THE CAPITAL REGIONAL DISTRICT 2024 GPC BASIC+ COMMUNITY GREENHOUSE GAS (GHG) EMISSIONS INVENTORY REPORT

Final Report

October 15, 2025

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Executive Summary

There is increasing evidence that global climate change resulting from emissions of carbon dioxide (CO_2) and other greenhouse gases (GHGs) is having a significant impact on the ecology of the planet. Delayed actions to respond to the effects of climate change are expected to have serious negative impacts on global economic growth and development.

Beyond the costs associated with delayed climate action, there are cost savings to be realized through efforts to improve energy efficiency, conserve energy, and reduce GHG emissions intensity. To make informed decisions on reducing energy use and GHG emissions at the community scale, community managers must have a good understanding of these sources, the activities that drive them, and their relative contribution to the total. This requires the completion of an energy and GHG emissions inventory. To allow for credible and meaningful reporting locally and internationally, the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (the GPC Protocol) was developed. The GPC Protocol has been adopted by the Global Covenant of Mayors—an agreement led by community networks to undertake a transparent and supportive approach to measure GHG emissions community-wide. The Global Covenant of Mayors and the Federation of Canadian Municipalities promotes the use of the GPC Protocol as a standardized way for municipalities to collect and report their actions on climate change.

This project set out to compile a detailed GHG inventory for the Capital Regional District (CRD) for the 2007 base year and the 2024 reporting year using the GPC Protocol. The CRD has historically relied on the Provincial 2007, 2010 and 2012 Community Energy and Emissions Inventories (CEEI) to baseline and track community GHG emissions. However, there have been some limitations to the CEEI which has resulted in the CRD preparing a GPC BASIC+ inventory. Following the requirements of the GPC Protocol, the GHG inventories considered emissions from all reporting Sectors, including Stationary Energy, Transportation, Waste, Industrial Process and Product Use (IPPU), and Agriculture, Forestry and Other Land Use (AFOLU). The purpose of this document is to describe the quantification methodologies used to calculate GHG emissions for the 2024 reporting year, and to present the CRD's 2024 community GHG emissions.

In 2024, the CRD's BASIC+ GHG emissions totaled 1,783,513 tonnes of carbon dioxide equivalent (tCO_2e). On an absolute basis, this is an 11% decrease from the 2007 base year GHG emissions and a decline of 30.0% on a per capita basis. Due to limitations in how to quantify GHG emissions resulting from land use change (e.g., residential development) and ecosystem sequestration, these GHG emissions have been disclosed but excluded from the CRD's GHG emissions inventory, until a more robust measurement methodology can be developed.

A summary of the 2024 GHG emissions is presented in Table E-1 and Figure E-1.

Table E-1 BASIC+ 2007 Base & 2024 Reporting Year GHG Emissions

Sector	Sub-Sector	2007 GHG Emissions (tCO_2e)	2024 GHG Emissions (tCO_2e)
Stationary Energy	Residential Buildings	422,256	230,418
	Commercial & Institutional Buildings	270,524	349,497
	Manufacturing Industries & Construction	0	0
	Energy Industries	418	5,518
	Agriculture, Forestry & Fishing Activities	89,497	123,176
	Fugitive Emissions	1,003	1,622
Transportation	In-Boundary On-road Transportation	864,570	678,140
	Trans-Boundary On-road Transportation	13,256	6,159
	Waterborne Navigation	48,218	56,498
	Aviation	26,097	20,250
	Off-road Transportation	60,629	79,596
Waste	Solid Waste	110,955	104,017
	Biological Treatment of Waste	73	6,387
	Wastewater Treatment & Discharge	18,998	4,414
IPPU	IPPU	70,418	114,034
AFOLU	Land-Use: Emissions Sequestered (Disclosure Only - Not Included In Total)	-396,487	-401,842
	Land-Use: Emissions Released (Disclosure Only - Not Included In Total)	151,516	89,610
	Livestock	6,867	3,449
	Non-CO2 Land Emission Sources	849	338
GHG Emissions from Reporting year		**2,004,628**	**1,783,513**
Change in GHG Emissions from 2007 Reporting year			**-11.0%**
GHG Emissions Per Capita		**5.6**	**3.9**
Change in Per Capita GHG Emissions from 2007 Reporting year			**-30.0%**

Data in the table above is depicted in Figure E-1.

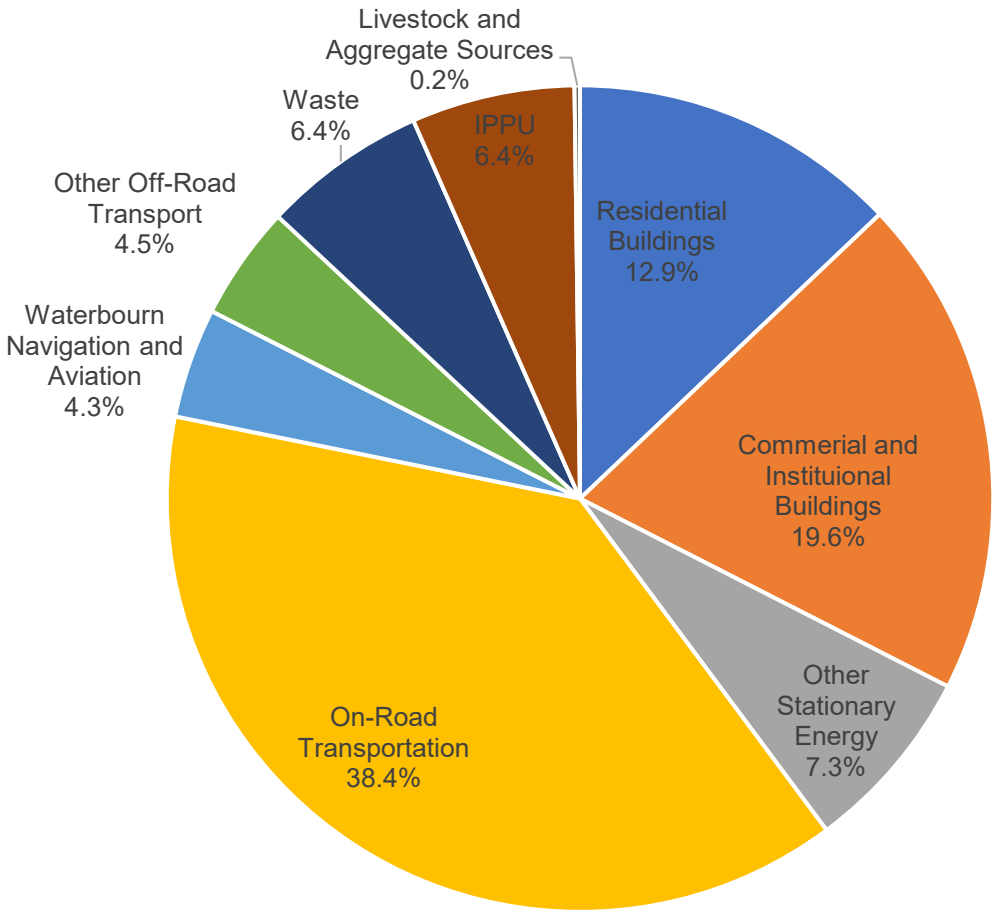

Figure E-1 CRD's 2024 BASIC+ GHG Emissions Profile (Excluding Land-Use)

Abbreviations

ACI	Annual Crop Inventory
AFOLU	Agriculture, Forestry, and Other Land Use
BC	British Columbia
C40	C40 Cities Climate Leadership Group
CH_4	Methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CEEI	Community Energy and Emissions Inventories
CRD	Capital Regional District
eMWh	megawatt hours equivalents
FCM	Federation of Canadian Municipalities
GDP	gross domestic product
GHG	greenhouse gas
GJ	Gigajoules
GPC	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
GWP	global warming potentials
HDV	Heavy Duty Vehicle
HFC	Hydrofluorocarbons

ICBC	Insurance Corporation of BC
ICLEI	International Council for Local Environmental Initiatives
IE	included elsewhere
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Process and Product Use
ISO	International Organization for Standardization
kg	Kilograms
kW	Kilowatt
kWh	kilowatt hours
L	Litres
LDT	Light Duty Truck
LDV	Light Duty Vehicle
MWh	megawatt hours
N_2O	nitrous oxides
NE	not estimated
NIR	National Inventory Report
NPRI	National Pollutant Release Inventory
NO	not occurring
ORVE	Off-Road Vehicle and Equipment
PCP	Partnership for Climate Protection

PFC	Perfluorocarbons
SC	Other Scope 3
SF_6	sulfur hexafluoride
T	Tonnes
VIA	Victoria International Airport
WIP	waste-in-place
WRI	World Resources Institute

Glossary

Air pollution	The presence of toxic chemicals or materials in the air, at levels that pose a human health risk.
Reporting year	This is the reference or starting year to which targets and GHG emissions projections are based.
BASIC	An inventory reporting level that includes all Scope 1 sources except from energy generation, imported waste, IPPU, and AFOLU, as well as all Scope 2 sources (GPC, 2014).
BASIC+	An inventory reporting level that covers all GPC BASIC sources, plus Scope 1 AFOLU and IPPU, and Scope 3 in the Stationary Energy and Transportation Sectors (GPC, 2014).
Biogenic emissions	Emissions produced by living organisms or biological processes, but not fossilized or from fossil sources (GPC, 2014).
Carbon dioxide equivalent (CO_2e)	The amount of carbon dioxide (CO_2) emissions that would cause the same integrated radiative forcing, over a given time horizon, as an emitted amount of a greenhouse gas (GHG) or a mixture of GHGs. The CO_2e emission is obtained by multiplying the emission of a GHG by its Global Warming Potential (GWP) for the given time horizon. For a mix of GHGs, it is obtained by summing the CO_2e emissions of each gas (IPCC 2014).
Climate change	Climate change refers to a change in the state of the climate that can be identified by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2014).
Emission	The release of GHGs into the atmosphere (GPC, 2014).
Emission factor(s)	A factor that converts activity data into GHG emissions data (GPC, 2014).
Flaring	The burning of natural gas that cannot be used.
Fossil fuels	A hydrocarbon deposit derived from the accumulated remains of ancient plants and animals which is used as an energy source.
Fugitive emission	Emissions that are released during extraction, transformation, and transportation of primary fossil fuels. These GHG emissions are not combusted for energy.
Geographic boundary	A geographic boundary that identifies the spatial dimensions of the inventory's assessment boundary. This geographic boundary defines the physical perimeter separating in-boundary emissions from out-of-boundary and transboundary emissions (GPC, 2014).

Gigajoule (GJ)	A gigajoule (GJ), one billion joules, is a measure of energy. One GJ is about the same energy as: • Natural gas for 3-4 days of household use • The electricity used by a typical house in 10 days
Global warming	A gradual increase in the Earth's temperature which is attributed to the greenhouse effect caused by the release of greenhouse gas (GHG) emissions into the atmosphere.
Global warming potential (GWP)	An index measuring the radiative forcing following an emission of a unit mass of a given substance, accumulated over a chosen time horizon, relative to that of the reference substance, carbon dioxide (CO_2). The GWP thus represents the combined effect of the differing times these substances remain in the atmosphere and their effectiveness in causing radiative forcing. The Kyoto Protocol is based on global warming potentials over a 100-year period (IPCC 2014).
Greenhouse gas (GHG)	GHGs are the seven gases covered by the UNFCCC: carbon dioxide (CO_2); methane (CH_4); nitrous oxide (N_2O); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); sulphur hexafluoride (SF_6); and nitrogen trifluoride (NF_3) (GPC, 2014).
GHG intensity	The annual rate to which GHG emissions are released in the atmosphere, relative to a specific intensity.
Gross domestic product (GDP)	An economic measure of all goods and services produced in an economy.
In-boundary	Occurring within the established geographic boundary (GPC, 2014).
Reporting year	The year for which emissions are reported (GPC, 2014).
Scope 1	Emissions that physically occur within a community.
Scope 2	Emissions that occur from the use of electricity, steam, and/or heating/cooling supplied by grids which may or may not cross Community boundaries.
Scope 3	Emissions that occur outside a community but are driven by activities taking place within a community's boundaries.
Tonne of CO_2e	A tonne of greenhouse gases (GHGs) is the amount created when we consume: • 385 litres of gasoline (about 10 fill-ups) • Enough electricity for three homes for a year (38,000 kWh)
Transboundary GHG emissions	Emissions from sources that cross the geographic boundary (GPC, 2014). These include GHG emissions from on-road trips where the vehicle crosses municipal boundaries. For example, if travelling from Comox to Nanaimo, the on-road transportation GHG emissions in Nanaimo would be considered transboundary as the origin of the trip occurred in Comox.

1 Introduction

Climate Change & Greenhouse Gas (GHG) Emissions

Since the industrial revolution, human activities such as burning fossil fuels, deforestation, agricultural practices, and other land use changes have resulted in the release of unnaturally large volumes of greenhouse gas (GHG) emissions into the Earth's atmosphere causing global climate systems to change. In its sixth assessment report, the Intergovernmental Panel on Climate Change (IPCC) concluded that "the scale of recent changes across the climate system as a whole and the present state of many aspects of the climate system are unprecedented over many centuries to many thousands of years."[1] To substantially reduce the risks and effects of climate change, and limit global warming to 1.5°C, scientists and policy makers have come to the agreement that global society must dramatically reduce greenhouse gas (GHG) emissions 50–60% by 2030, 80% by 2040, more than 90% by 2050 with the remaining emissions being offset or neutralized (e.g., direct air capture, reforestation, etc.) and be net negative in the second half of the century. Recognizing the importance and benefits to addressing climate change, many governments – including the Government of Canada and Province of British Columbia, and the CRD as well as publicly traded organizations representing more than $23 trillion in market capitalization have now committed to these GHG reduction targets.[2]

Communities & GHG Emissions

Communities are centers of communication, commerce, and culture. They are, however, also a significant and growing source of energy consumption and GHG emissions. On a global scale, communities are major players in GHG emissions. They are responsible for more than 70% of global energy-related carbon dioxide emissions and thus represent the single greatest opportunity for tackling climate change.

[1] https://www.ipcc.ch/assessment-report/ar6/
[2] sciencebasedtargets.org/news/more-than-1000-companies-commit-to-science-based-emissions-reductions-in-line-with-1-5-c-climate-ambition

For a community to act on mitigating climate change and monitor its progress, it is crucial to have good quality GHG emissions data to build a GHG inventory. Such an inventory enables cities to understand the breakdown of their emissions and plan for effective climate action. The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC Protocol) seeks to support exactly that, by giving cities the standards and tools that are needed to measure the emissions, build more effective emissions reduction strategies, set measurable and more ambitious emission reduction goals, and to track their progress more accurately and comprehensively.

Until recently there has been no internationally recognized way to measure community-level emissions. Inventory methods that community managers have used to date around the globe vary significantly. This inconsistency has made comparisons between cities and over the years difficult. The GPC Protocol offers an internationally accepted, credible emissions accounting and reporting practice that will help communities to develop comparable GHG inventories.

Variance from Community Energy & Emissions Inventories (CEEI)

The CRD has historically relied on annual Provincial Community Energy and Emissions Inventories (CEEI) to track community GHG emissions. Because the current CEEI does not fully meet the requirements of the GPC Protocol BASIC+ reporting requirements, the CRD has prepared its own GHG emissions inventory which relies on the CEEI data as well as external data sources. A high-level summary of the differences between the CEEI and GPC Protocol inventories are presented in Table 1.

Table 1 Summary of GHG Inventory Scope Differences

Reporting Sector	CEEI	GPC BASIC	GPC BASIC+
Residential Buildings	✓	✓	✓
Commercial And Institutional Buildings And Facilities	✓	✓	✓
Manufacturing Industries And Construction	✓	✓	✓
Energy Industries		✓	✓
Energy Generation Supplied To The Grid		✓	✓
Agriculture, Forestry And Fishing Activities		✓	✓
Non-Specified Sources		✓	✓

Reporting Sector	CEEI	GPC BASIC	GPC BASIC+
Fugitive Emissions From Mining, Processing, Storage, And Transportation Of Coal		✓	✓
Fugitive Emissions From Oil And Natural Gas Systems		✓	✓
On-Road Transportation	✓	✓	✓
Railways		✓	✓
Waterborne Navigation		✓	✓
Aviation		✓	✓
Off-Road Transportation	✓	✓	✓
Solid Waste	✓	✓	✓
Biological Waste	✓	✓	✓
Incinerated And Burned Waste		✓	✓
Wastewater		✓	✓
Emissions From Industrial Processes			✓
Emissions From Product Use			✓
Emissions From Livestock	✓		✓
Emissions From Land			✓
Emissions From Aggregate Sources And Non-CO_2 Emission Sources On Land	✓		✓

Report Purpose

The purpose of this document is to describe the quantification methodologies used by the CRD to calculate its BASIC+ GHG emissions for the 2007 base and 2024 reporting years. The focus of this report is on the 2024 reporting year. The CRD has elected to prepare a BASIC+ GHG emissions inventory to align with global best practices in community GHG emissions and to provide its members with the more comprehensive GHG emissions inventory database.

This document also supports the preparation of future community GHG emissions inventories, by:

- Defining GHG emissions data sources to be used for future inventory work
- Establishing quantification methods and assumptions.
- Evaluating the quality of the data sources and emission factors.
- Supporting consistent quantification of the inventory results over time.

2 Global Protocol For Community (GPC) Scale Emission Inventories Protocol

Overview

The GPC Protocol is the result of a collaborative effort between the GHG Protocol at the World Resources Institute (WRI), C40 Cities Climate Leadership Group (C40), and ICLEI—Local Governments for Sustainability (ICLEI). The GPC Protocol is recognized as one of the first set of standardized global rules for cities to measure and publicly report city-wide GHG emissions. It sets out requirements and provides guidance for calculating and reporting city-wide GHG emissions, consistent with the 2006 IPCC guidelines on how to estimate GHG emissions (IPCC, 2014). Specifically, the GPC Protocol seeks to:

- Help cities develop a comprehensive and robust GHG inventory to support climate action planning.
- Help cities establish a base year GHG emissions inventory, set GHG reduction targets, and track performance.
- Ensure consistent and transparent measurement and reporting of GHG emissions between cities, following internationally recognized GHG accounting and reporting principles.
- Enable city-wide GHG inventories to be aggregated at subnational and national levels.
- Demonstrate the important role that cities play in tackling climate change and facilitate insight through benchmarking—and aggregation—of comparable GHG data.

GPC Protocol Structure

The GPC Protocol sets several assessment boundaries which identify the restrictions for gases, emission sources, geographic area, and time span covered by a GHG inventory:

- The GHG inventory is required to include all seven Kyoto Protocol GHGs occurring within the geographic boundary of a city. These include:
  - Carbon dioxide (CO_2)
  - Methane (CH_4)
  - Nitrous oxide (N_2O)
  - Hydrofluorocarbons (HFCs)
  - Perfluorocarbons (PFCs)
  - Sulfur hexafluoride (SF_6)
  - Nitrogen trifluoride (NF_3)
- The GHG emissions from city-wide activities must be organized and reporting under the following five sectors, based on the selected reporting level:
  - Stationary Energy
  - Transportation
  - Waste
  - Industrial Processes and Product Use (IPPU)
  - Agriculture, Forestry, and Other Land Use (AFOLU)
  - Other Scope 3 (Optional)

The GPC Protocol also requires that a city define an inventory boundary, identifying the geographic area, time span, gases, and emission sources.

Under the GPC Protocol, the CRD has the option of reporting GHG emissions under three different levels:

- Territorial - The CRD reports only on GHG emissions that occur within its geographic boundaries.
- Community-Induced – The CRD accounts for all GHG emissions resulting from activities occurring within the region. Under the Community-Induced framework, there are two levels of reporting available to cities - BASIC and BASIC+
  - BASIC—This level covers stationary energy and transportation GHG emissions that physically occur within a community (Scope 1) and those that occur from the use of electricity, steam, and/or heating/cooling supplied by grids which may or may not cross

city boundaries (Scope 2). The BASIC level also includes waste GHG emissions that may occur outside of a community but are driven by activities taking place within a community's boundaries (Scope 3). The BASIC level aligns with the current GHG reporting requirements of most voluntary reporting programs for local governments.

- BASIC+—This level covers the same scopes as BASIC and includes more in-depth and data dependent methodologies. Specifically, it expands the reporting scope to include Scope 1 emissions from Industrial Process and Product Use (IPPU), Agriculture, Forestry, and Other Land-Use (AFOLU), and Scope 3 GHG emissions from transboundary transportation. The sources covered in BASIC+ also align with sources required for national reporting in IPCC guidelines.

Activities taking place within the CRD can generate GHG emissions that occur inside its geographic boundary as well as outside of it. To distinguish between these, the GPC Protocol groups emissions into three categories based on where they occur: Scope 1, Scope 2, or Scope 3 emissions. The GPC Protocol distinguishes between emissions that physically occur within the CRD (Scope 1), from those that occur outside the region but are driven by activities taking place within its boundaries (Scope 3), and from those that arise from the use of electricity, steam, and/or heating/cooling supplied by grids that may or may not cross regional boundaries (Scope 2). Scope 1 emissions may also be termed "territorial" emissions, because they are produced solely within the territory defined by the geographic boundary (see Figure 1).

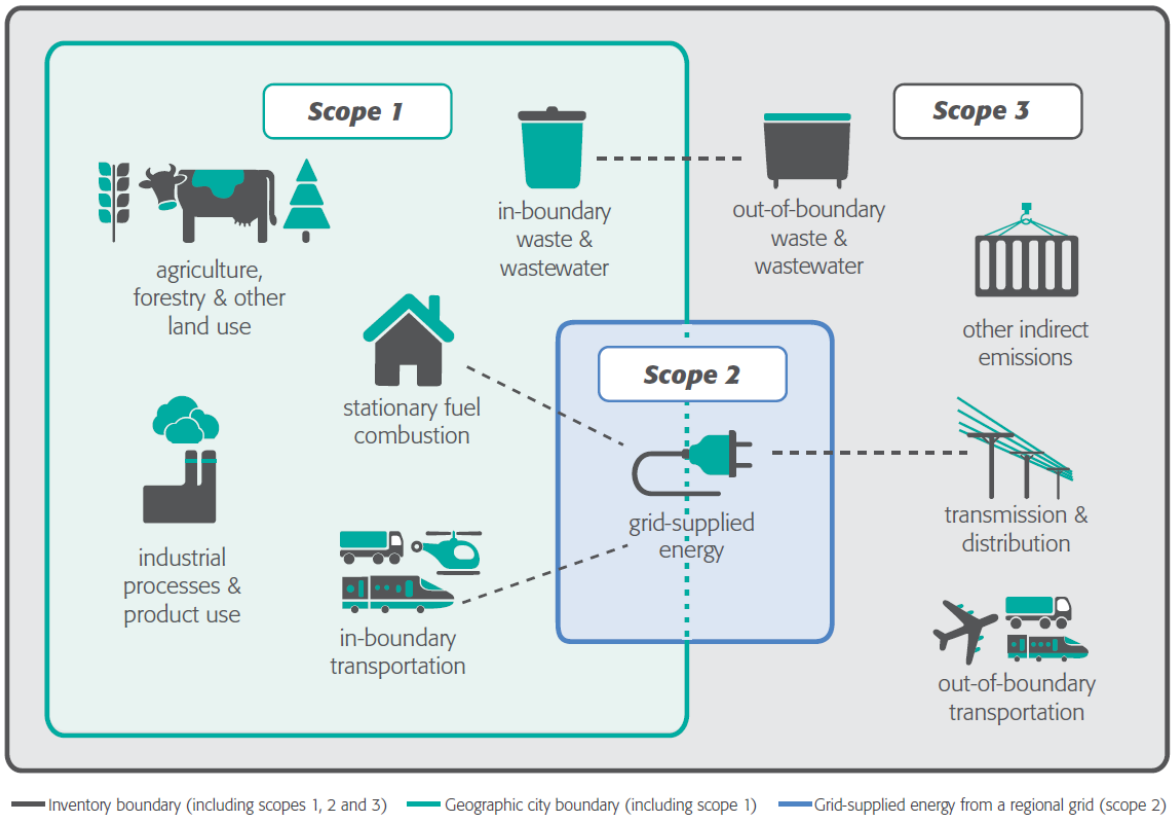

Figure 1 Sources and Boundaries of a City's GHG Emissions (GPC 2014)

GHG Emission Categories

As noted previously, the GPC Protocol requires that different emission sources to be categorized into a total of five reporting sectors. These high-level categories are described in more detail below. More information on how GHG emissions are captured within the GPC Protocol is available on the Greenhouse Gas Protocol website.

Stationary Energy

Stationary energy sources are typically one of the largest contributors to a city's GHG emissions. In general, these emissions come from fuel combustion and fugitive emissions. They include the emissions from energy to heat and cool residential, commercial, and industrial buildings, as well as the activities that occur within these residences and facilities. Emissions associated with distribution losses from grid-supplied electricity/steam/heating/cooling are also included, as are some fugitive emissions from sources such as coal piles, natural gas pipelines, and related Off-road Transportation GHG emission sources.

The Stationary Energy sector includes the following sub-sectors:

- Residential buildings
- Commercial and institutional buildings and facilities
- Manufacturing industries and construction
- Energy industries
- Energy generation supplied to the grid*
- Agriculture, forestry, and fishing activities
- Non-specific sources
- Fugitive emissions from mining, processing, storage, and transportation of coal
- Fugitive emissions from oil and natural gas systems

* Emissions related with electricity generation activities occurring within a community's boundaries are to be reported; however, the GHG emissions from these sources are not reported separately as they are accounted for elsewhere and to prevent double counting (GPC 2014).

Under the GPC Protocol, cities are to report off-road GHG emissions under the Off-road Transportation Sub-Sector if and only if the GHG emissions are occurring at transportation facilities (e.g., airports, harbors, bus terminals, train stations, etc.). Other off-road transportation GHG emissions that occur on industrial premises, construction sites, agriculture farms, forests, aquaculture farms, and military premises, etc., are to be reported under the most relevant Stationary Energy Sub-Sector (GPC, 2014). For example, GHG emissions from commercial building off-road construction equipment would be included in the Commercial And Institutional Buildings And Facilities Sub-Sector, whereas GHG emissions from residential lawn mowers would be reported under the Residential Buildings Sub-Sector.

Transportation

The GHGs released to the atmosphere to be reported in the Transportation sector are those from combustion of fuels in journeys by on-road, railways, waterborne navigation, aviation, and off-road. GHG emissions are produced directly by the combustion of fuel and indirectly using grid-supplied electricity.

Unlike the Stationary Energy sector, transit is mobile and can pose challenges in both accurately calculating GHG emissions and allocating them to a specific sub-sector. This is particularly true when it comes to transboundary transportation, which includes GHG emissions from trips that either start or finish within a city's boundaries (e.g., departing flight emissions from an airport outside the community boundaries) (GPC, 2014). Transboundary GHG emissions are only required for GPC BASIC+ GHG reporting.

The Transportation sector includes the following sub-sectors:

- On-road
- Railways
- Waterborne
- Aviation
- Off-road

As noted previously, cities are to report off-road GHG emissions under the Off-road Transportation sub-sector if and only if the GHG emissions are occurring at transportation facilities (e.g., airports, harbors, bus terminals, train stations, etc.). For example, off-road railway maintenance support equipment GHG emissions are reported under the Off-Road Transportation Sub-Sector.

Waste

Cities produce GHG emissions that arise from activities related to the disposal and management of solid waste. Waste does not directly consume energy, but releases GHG emissions because of decomposition, burning, incineration, and other management methods.

The Waste sector includes the following sub-sectors:

- Solid waste disposal
- Incineration and open burning
- Biological treatment of waste
- Wastewater treatment and discharge

Under the GPC Protocol, the Waste sector includes all GHG emissions that result from the treatment or decomposition of waste regardless of the source of the waste (e.g., another community's waste in the local landfill). However, the GHG emissions that are associated with waste from outside a City's boundary that is treated or decomposes within the community boundary are deemed to be "reporting only" emissions and do not contribute to the GHG inventory (GPC 2014).

Any GHG emissions that result from the combustion of waste or waste related gases to generate energy, such as a methane capture and energy generation system at a landfill, are reported under Stationary Energy Generation Supplied to The Grid Sub-Sector (GPC, 2014). Any waste related GHG emissions that

are combusted but not related to energy generation are reported in the appropriate Waste Sub-Sector. Lastly, any waste GHG emissions that are released to the atmosphere are also captured in the appropriate Waste Sub-Sector.

Industrial Processes & Product Use (IPPU)

Emissions from this sector are only required for BASIC+ GHG reporting under the GPC Protocol. This sector encompasses GHG emissions produced from industrial processes that chemically or physically transform materials and using products by industry and end-consumers (e.g., refrigerants, foams, aerosol cans) (GPC, 2014).

The IPPU sector includes the following sub-sectors:

- Industrial processes
- Product use

Any GHG emissions associated with energy use for industrial processes are not reported in the IPPU Sector; rather, they are reported under the appropriated Stationary Energy sub-category.

Agriculture, Forestry & Other Land Use (AFOLU)

Emissions from the AFOLU sector are only required for BASIC+ GHG reporting. AFOLU GHG emissions are those that are captured or released because of land-management activities. These activities can range from the preservation of forested lands to the development of crop land. Specifically, this sector includes GHG emissions from land-use change, manure management, livestock, and the direct and indirect release of nitrous oxides (N_2O) from soil management, rice cultivation, biomass burning, urea application, fertilizer, and manure application (GPC, 2014).

The AFOLU sector includes the following sub-sectors:

- Livestock
- Land
- Aggregate sources and non-CO_2 emission sources on land

Other Scope 3 Emissions

Communities, by their size and connectivity, inevitably give rise to GHG emissions beyond their boundaries – often referred to as Other Scope 3 GHG emissions under the GPC Protocol. In the community context, Other Scope 3 GHG emissions include upstream GHG emissions, such as fuel extraction, production, and transportation GHG emissions, as well as cradle to-gate GHG emissions associated with the consumption of goods and services like food and drink, water, construction materials,

and other goods and services that are estimated to make a material contribution to a community's GHG inventory. The GPC Protocol already includes the following Scope 3 emissions in other Sectors:

- On-road, waterborne, and aviation transboundary transportation
- Transmission and distribution losses associated with grid-supplied energy
- Solid waste disposal
- Biological treatment of solid waste
- Wastewater treatment and discharge

Cities may voluntarily report on Other Scope 3 emissions as they are estimated. In the case of the CRD, no other Scope 3 GHG emissions, other than those listed above, have been estimated.

Accounting & Reporting Principles

All GHG inventories following the GPC Protocol are required to meet GHG accounting principles. Specifically, these inventories should be relevant, consistent from year to year, accurate and transparent about methodologies, assumptions, and data sources. The transparency of inventories is fundamental to the success of replication and assessment of the inventory by interested parties.

The GHG inventories must also properly account for key energy and GHG emission sinks, sources, and reservoirs (SSR) that are occurring within municipal boundaries. The SSRs are a convenient way to identify and categorize all the GHG emissions to determine if they should be included or excluded from a GHG inventory. A "Source" is something that releases GHG emissions to the atmosphere, such as a diesel generator. A "Sink" is a process or item that removes GHGs from the atmosphere, such as photosynthesis and tree growth. Finally, a "Reservoir" is a process or item with the capability to store or accumulate a GHG removed from the atmosphere by a GHG sink, such as a wetland or a peat bog. By assessing and reporting on the applicable SSRs, users of the GHG inventory can have confidence that the inventory is complete and representative of the types and quantities of the GHGs being released within community limits.

Base Year & Reporting Year Recalculations

As cities grow and expand, significant changes to the GHG emissions profile of a community can alter materially thus making it difficult to meaningfully assess GHG emission trends and changes over time. The

GPC Protocol has requirements on how to treat changes in a community's GHG profile—this is summarized in Table 2.

Table 2 GPC Protocol Recalculation Thresholds

Threshold	Example Change	Recalculation Needed	No Recalculation Needed
Changes in the assessment boundary	A community is annexed in or removed from a city's administrative boundary	X	
	Change in protocol reporting method (e.g., from BASIC to BASIC+, addition of GHGs reported, etc.)	X	
	Shut down of a power plant		X
	Building a new cement factory		X
Changes in calculation methodology or improvements in data accuracy	Change in calculation methodology for landfilled municipal solid waste (MSW)	X	
	Adoption of a more accurate local emission factor, instead of a national average emission factor.	X	
	Change in electricity emission factor due to energy efficiency improvement and growth of renewable energy utilization		X
Discovery of significant errors	Discovery of mistake in unit conversion in formula used	X	

Data Quality

Data collection and the assessment of its quality is an integral component of compiling any GHG inventory. Like the IPCC, the GPC Protocol requires users to establish first whether a source exists and then assess the data availability and quality. To support GHG reporting, the following notation keys are used.

- If the GHG sink, source or reservoir does not exist, a "NO" is used to indicate it is "not occurring".
- If the GHG sink, source or reservoir does occur, and data is available, then the emissions are estimated. However, if the data is also included in another emissions source category or cannot be disaggregated, the notation key "IE" would be used to indicate "included elsewhere" to avoid double counting.

- When GHG emissions are occurring in the CRD, but data is not available, then the notation key “NE” would be used to indicate “not estimated”.

For GHG data that does exist, in accordance with the GPC Protocol, an assessment of quality is also made on emission factors and GHG estimation methodologies deployed. The GPC Protocol data quality assessment notation keys are summarized in Table 3.

Table 3 GPC Protocol Data Quality Assessment Notation Keys

Data Quality	Activity Data	Emission Factor
High (H)	Detailed activity data	Site-specific emission factors
Medium (M)	Modeled activity data using robust assumptions	More general emission factors
Low (L)	Highly modeled or uncertain activity data	Default emission factors

3 GHG Assessment Boundaries

This section sets out the reporting boundaries of the CRD's GHG inventory.

Spatial Boundaries

This GHG inventory is defined geographically by the capital region of British Columbia jurisdictional boundaries. As shown in Figure 2, this region consists of 13 municipalities and 3 electoral areas. For the purposes of this report, only the CRD GHG emissions are presented. A breakdown of GHG emissions by each CRD municipality and electoral area has been presented in a separate report.

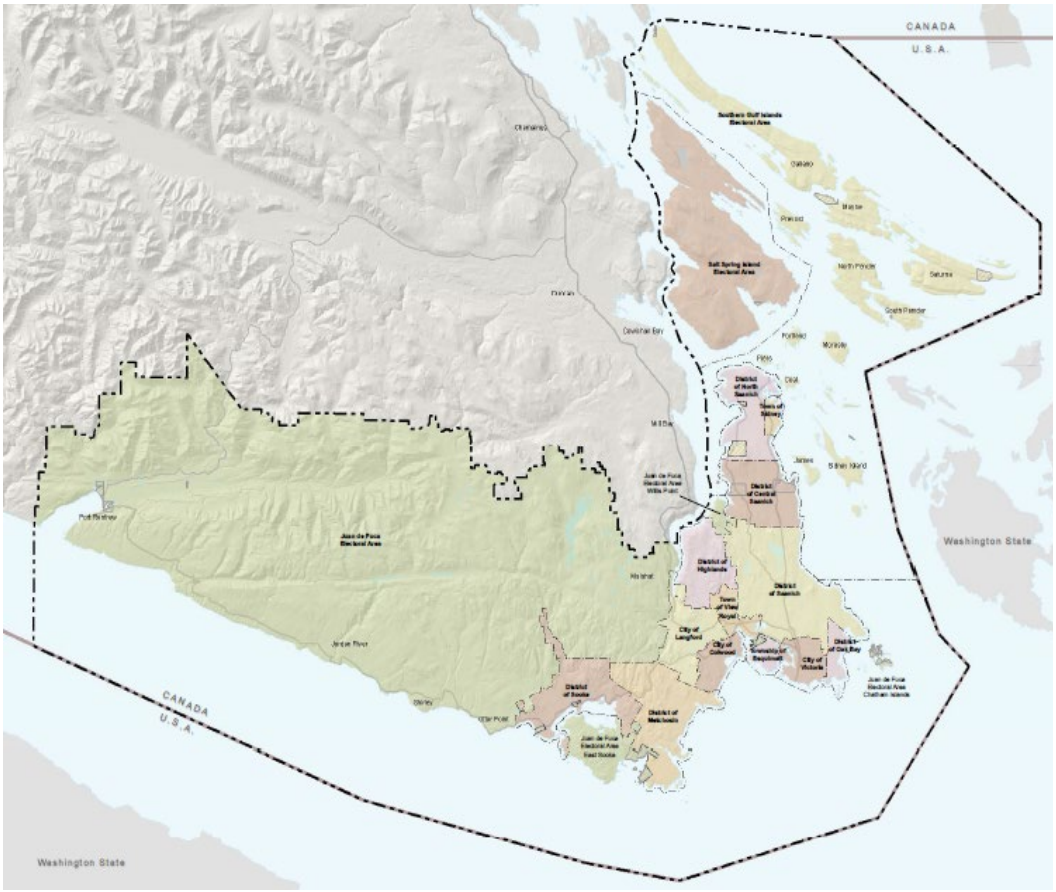

Figure 2 GHG Boundary

Additional GHG inventory related information is presented in Table 4.

Table 4 Inventory Information

Inventory Boundary	Additional Information
Name of Community / District	Capital Regional District
Municipality / Electoral Area	• District of Central Saanich • City of Colwood • Township of Esquimalt • District of Highlands • Juan de Fuca Electoral Area • City of Langford • District of Metchosin • District of North Saanich • District of Oak Bay • District of Saanich • Salt Spring Island Electoral Area • Town of Sidney • District of Sooke • City of Victoria • Town of View Royal • Southern Gulf Islands Electoral Area
Country	Canada
Inventory Year	2024
Geographic Boundary	See Figure 2
Land Area (hectares)	2,310.18
Resident population	452,069
GDP (CAN$)	Unknown at time of reporting
Composition of Economy	Government

Temporal Boundaries

Federal and provincial initiatives and legislation have been implemented to support local governments in acting to advance energy efficiency, promote energy conservation, and reduce GHG emissions. The CRD and its local governments have already been working to address sustainability and climate change through several initiatives for many years. The CRD's Regional Growth Strategy set an absolute regional GHG reduction target of 61% by 2038 (below 2007 levels).

To maintain consistency with the current reporting year, and as required by the GPC Protocol, the CRD has updated its 2007 GHG base year GHG emissions profile to be consistent with the GPC Protocol BASIC+ reporting level. Between the current reporting year and the 2007 base year, there were no boundary changes (e.g., annexes) and thus no additional modifications were made. All methods and assumptions, adjusted for the 2007 reporting year, are the same.

Due to limitations in how to quantify GHG emissions resulting from land use change (e.g., residential development) and sequestration, these GHG emissions have been excluded from the CRD's 2007 and 2024 GHG emissions inventories, but have been disclosed, until a more robust measurement methodology can be developed.

Table 5 presents the prior 2007 and the updated 2007 base year GHG emissions reported as tonnes of carbon dioxide equivalent (tCO_2e).

Table 5 Original And Updated BASIC+ Base Year

Aspect	Quantification Protocol	2007 GHG Base Year (tCO_2e)
Original Base Year	CEEI Protocol	1,563,000
Updated Base Year	GPC Protocol BASIC+	2,004,628

GHG Reduction Target

Recognizing the role that the CRD plays in achieving a significant and immediate reduction in global GHG emissions, the CRD has set a regional GHG reduction target of 61% (from 2007 levels) by 2038. With the CRD's 2007 base year GHG emissions being 2,004,628 tCO_2e, a 61% reduction would require a reduction of approximately 1,222,823 tCO_2e. On a per capita basis, this amounts to reducing emissions from approximately 3.9 tCO_2e per person in 2024 to 2.4 tCO2e per person by 2038.

In February 2019, the CRD declared a climate emergency and committed to regional carbon neutrality.

2024 GHG Boundary

This inventory covers all in-scope GHG emissions for the 2024 reporting year. Where 2024 data was not available, the most recent year's data have been used, and the timescale noted accordingly. These are as follows:

- Global Warming Potentials (GWP). The BC government has communicated that is adopting GWPs from the fifth IPCC report. On this basis, the CRD is applying GWPs from the fifth IPCC report.
- Stationary Energy: Residential, Commercial and Institutional Buildings. Propane, and wood GHG emissions were estimated using linear regression methods. The data used in the estimates included historical propane and wood energy data published in the 2007-2021 CEEIs, and heating degree days (HDD) published by Environment and Climate Change Canada.
- Stationary Energy: Residential, Commercial and Institutional Buildings. The CRD used real-estate sales data between 2021 and 2025 to estimate the number of heating oil tanks and average household consumption for the 2024 reporting year.
- Stationary Energy: Other Off-Road. The ECCC 2025 NIR prepared for the Province of BC for the 2023 reporting year was used to estimate GHG emissions for:
    - Off-road agriculture and forestry GHG emissions
    - Off-road commercial and institutional GHG emissions
    - Off-road manufacturing, mining, and construction GHG emissions
    - Off-road residential GHG emissions

  These GHG emissions were assigned to the CRD on a per capita basis.
- Stationary Energy: Fugitives. Fortis BC provided total fugitive emissions for the 2020 reporting year at the CRD level. Since no historical numbers were provided, the 2020 value was used to estimate the 2024 emissions.
- Transportation: On-Road. The on-road transportation emissions are based on the total estimated fuel sales in the CRD, and the number of registered vehicles. Insurance Corporation of BC (ICBC) compiles data on an January 1 to December 31 basis, and thus the current on-road GHG emission estimate is based on the number of registrations from January 1, 2024 – December 31, 2024.
- Transportation: Aviation. 2024 aviation GHG emissions were estimated using 2015 aircraft flight profiles (the last available data), and the total number of aircraft movements reported in 2024.

- Transportation: Waterborne Recreational Watercraft. GHG emissions from recreational watercraft and US/Canada ferries were estimated based on a publicly available year 2000 study for the Victoria, Vancouver, and Washington harbors.
- Transportation: Cruise Ships. The Greater Victoria Harbour Authority (GVHA) reported on cruise ship emissions for the 2018 reporting year but did not provide an estimate for 2024. As a result, the 2018 GHG emissions estimate and number of cruise ship visits to Ogden Point was used to create a proxy to estimate 2024 cruise ship emissions.
- Waste: Solid Waste. To quantify GHG emissions from the Hartland Landfill, the CRD utilized the waste-in-place (WIP) method which is accepted under the GPC Protocol. The WIP assigns landfill emissions based on total waste deposited during that year. It counts GHGs emitted that year, regardless of when the waste was disposed. Except for the City of Victoria, who claims 31% of the CRD's landfill GHG emissions, the remaining landfill GHG emissions were allocated to each local government on a per capita basis. Using this allocation method, the CRD members may over, or underestimate associated solid waste GHG emissions as the current year landfill GHG emissions are based upon cumulative waste over time, and each member may have contributed more waste in past years than the current year (and vice versa).
- AFOLU: Aggregate Sources And Non-CO_2 Emission Sources On Land. These emissions are based on the 2025 NIR as prepared by ECCC and the total area of farmland BC in 2021 as reported by Statistics Canada. These GHG emissions were assigned to each local government on a per hectare (ha) of cropland basis.
- AFOLU: Land-Use. The land cover change analysis requires a consistent land-use category attribution and spatial data. For parts of the CRD, spatial data was available for the 2007, 2011 and 2019 reporting years. Differences between these data sets in terms of resolution and their timing of collection increase the uncertainty as to the accuracy of the land-use classifications. For example, the 2007 and 2011 land use data was collected at different times of the year and may not accurately reflect tree cover. Furthermore, no land use spatial data was collected for the Juan de Fuca, Salt Spring Island and Gulf Islands and thus Annual Crop Inventory (ACI) settlement data collected by Agriculture Canada was used to inform the analysis. The challenge in utilizing this data is that it is provided in a 30m resolution. Furthermore, since annual data is not available, the change between land cover data years (2007-2011, 2011-2019) for all areas was averaged and may not represent actual changes in each year. Since no data was available for 2024, the 2019 estimates were applied.

Due to limitations in how to quantify GHG emissions resulting from land use change (e.g., residential development), these GHG emissions have been excluded from the CRD's GHG emissions inventory, but have been disclosed, until a more robust measurement methodology can be developed.

GHG Emission Sources & Scopes

Table 6 summarizes the CRD's emissions by source and GHG emission scope.

Table 6 Summary of Emissions Scope and GPC Protocol Reporting Sector

GHG Emissions Scope	GPC Protocol Reporting Sector
Scope 1	The GHG emissions occurring from sources located within the CRD's limits: • Stationary fuel combustion: – Residential buildings – Commercial and institutional buildings and facilities – Manufacturing industries and construction – Energy industries – Energy generation supplied to the grid. – Agriculture, forestry and fishing activities – Fugitive emissions from oil and natural gas systems • Transportation: – On-road transportation – Railways – Waterborne navigation – Aviation – Off-road transportation • Waste: – Solid waste generated in the CRD. – Biological waste generated in the CRD. – Incinerated and burned waste generated in the CRD. – Wastewater generated in the CRD. – Solid waste generated outside the CRD. • Industrial processes and product use (IPPU): – Emissions from industrial processes occurring in the CRD boundary. • Agriculture, Forestry, and Other Land Use (AFOLU): – Land-use: emissions sequestered (*reported, but not included in the tota*l) – Livestock – Aggregate sources and non-CO_2 emission sources on land
Scope 2	The GHG emissions occurring from using grid-supplied electricity, heating and/or cooling within the CRD's boundary: • Stationary fuel combustion: – Residential buildings – Commercial and institutional buildings and facilities • Transportation: – On-road

GHG Emissions Scope	GPC Protocol Reporting Sector
Scope 3	Other GHG emissions occurring outside of the CRD's limits as a result of the CRD's activities: • Stationary Energy: – Residential buildings – Commercial and institutional buildings and facilities • Transportation: – On-Road: Transboundary

GHG Reporting

Both the GPC Protocol and the PCP outline principles and rules for compiling community GHG emissions inventories, but neither require tools or software to be used to produce emissions data. Where relevant, the GPC Protocol and PCP recommend using methodologies aligned with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

The GHG inventory is required to include all seven Kyoto Protocol GHGs occurring within the geographic boundary of the CRD. These include:

- Carbon Dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur hexafluoride (SF_6)
- Nitrogen trifluoride (NF_3)

Each GHG listed above has a different global warming potential (GWP) due to its ability to absorb and re-emit infrared radiation. This chemical property is recognized by the GWP set out by the IPCC Fourth Assessment Report. A larger GWP value means the substance has a greater affinity to absorb and re-emit infrared radiation. The GWP of these GHGs are CO_2 = 1.0, CH_4 = 28, N_2O = 265 (IPCC, 2014).

No GHG emissions from HFCs, PFCs, SF_6 or, NF_3 ere estimated due to the lack of available data.

Total GHG emissions are normally reported as CO_2e, whereby emissions of each of the GHGs are multiplied by their GWP and are reported as tonnes of CO_2e.

The GHG inventory results following the GPC Protocol reporting table format are presented in Appendix A. The GPC Protocol reporting format is presented in Table 7 below which also indicates the reporting level (BASIC / BASIC+) for each source.

Table 7 GPC Protocol Summary Table

GPC Protocol Reference Number	Reporting Level	Emissions Scope	GHG Emissions Source
I	Stationary Energy Sources		
I.1	Residential Buildings		
I.1.1	BASIC	1	Emissions from in-boundary fuel combustion
I.1.2	BASIC	2	Emissions from consumption of grid-supplied energy
I.1.3	BASIC+	3	Transmission and distribution losses from grid-supplied energy
I.2	Commercial and Institutional Buildings/Facilities		
I.2.1	BASIC	1	Emissions from in-boundary fuel combustion
I.2.2	BASIC	2	Emissions from consumption of grid-supplied energy
I.2.3	BASIC+	3	Transmission and distribution losses from grid-supplied energy
I.3	Manufacturing Industry and Construction		
I.3.1	BASIC	1	Emissions from in-boundary fuel combustion
I.3.2	BASIC	2	Emissions from consumption of grid-supplied energy
I.3.3	BASIC+	3	Transmission and distribution losses from grid-supplied energy
I.4	Energy Industries		
I.4.1	BASIC	1	Emissions from in-boundary production of energy used in auxiliary operations
I.4.3	BASIC+	3	Transmission and distribution losses from grid-supplied energy
I.5	Agriculture, Forestry, and Fishing Activities		

GPC Protocol Reference Number	Reporting Level	Emissions Scope	GHG Emissions Source
I.5.1	BASIC	1	Emissions from in-boundary fuel combustion
I.5.2	BASIC	2	Emissions from consumption of grid-supplied energy
I.5.3	BASIC+	3	Transmission and distribution losses from grid-supplied energy
I.7	Fugitive Emissions from Mining, Processing, Storage, And Transportation of Coal		
I.7.1	BASIC	1	In-boundary fugitive emissions
I.8	Fugitive Emissions from Oil and Natural Gas Systems		
I.8.1	BASIC	1	In-boundary fugitive emissions
II	Transportation		
II.1	On-road Transportation		
II.1.1	BASIC	1	Emissions from in-boundary transport
II.1.2	BASIC	2	Emissions from consumption of grid-supplied energy
II.1.3	BASIC+	3	Emissions from transboundary journeys
II.2	Railways		
II.2.1	BASIC	1	Emissions from in-boundary transport
II.2.2	BASIC	2	Emissions from consumption of grid-supplied energy
II.2.3	BASIC+	3	Emissions from transboundary journeys
II.3	Water-borne Navigation		
II.3.1	BASIC	1	Emissions from in-boundary transport
II.3.2	BASIC	2	Emissions from consumption of grid-supplied energy
II.3.3	BASIC	3	Emissions from transboundary journeys
II.4	Aviation		
II.4.1	BASIC	1	Emissions from in-boundary transport
II.4.2	BASIC	2	Emissions from consumption of grid-supplied energy

GPC Protocol Reference Number	Reporting Level	Emissions Scope	GHG Emissions Source
II.4.3	BASIC+	3	Emissions from transboundary journeys
II.5	Off-road		
II.5.1	BASIC	1	Emissions from in-boundary transport
II.5.2	BASIC	2	Emissions from consumption of grid-supplied energy
III	Waste		
III.1	Solid Waste Disposal		
III.1.1	BASIC	1	Emissions from waste generated and treated within the CRD
III.1.2	BASIC	3	Emissions from waste generated within but treated outside of the CRD
III.2	Biological Treatment of Waste		
III.2.1	BASIC	1	Emissions from waste generated and treated within the CRD
III.2.2	BASIC	3	Emissions from waste generated within but treated outside of the CRD
III.3	Incineration and Open Burning		
III.3.1	BASIC	1	Emissions from waste generated and treated within the CRD
III.3.2	BASIC	3	Emissions from waste generated within but treated outside of the CRD
III.4	Wastewater Treatment and Discharge		
III.4.1	BASIC	1	Emissions from wastewater generated and treated within the CRD
III.4.2	BASIC	3	Emissions from wastewater generated within but treated outside of the CRD
IV	Industrial Processes and Product Use (IPPU)		
IV.1	BASIC+	1	In-boundary emissions from industrial processes
IV.2	BASIC+	1	In-boundary emissions from product use
V	Agriculture, Forestry, and Other Land Use (AFOLU)		
V.1	BASIC+	1	In-boundary emissions from livestock

GPC Protocol Reference Number	Reporting Level	Emissions Scope	GHG Emissions Source
V.1	BASIC+	1	In-boundary emissions from land
V.1	BASIC+	1	In-boundary emissions from other agriculture
VI	Other Scope 3 Emissions		
VI.1	BASIC / BASIC+	3	Other indirect emissions

4 GHG Methodologies

The following sections describe the reporting source category, assumptions, activity data applied, and the quantification methodology.

Stationary Energy

Stationary energy sources are one of the largest contributors to the CRD's GHG emissions. For the CRD, the Stationary Energy Sector encompasses the following GHG emissions scopes and sub-sectors:

- Scope 1 Emissions:
  - Residential buildings
  - Commercial and institutional buildings and facilities
  - Manufacturing industries and construction
  - Energy industries
  - Energy generation supplied to the grid
  - Agriculture, forestry and fishing activities
  - Fugitive emissions from oil and natural gas systems
- Scope 2 Emissions:
  - Emissions from the consumption of grid-supplied electricity, steam, heating, and cooling.
- Scope 3 Emissions:
  - Transmission and distribution losses of electricity, steam, heating, and cooling.

There are GHG emissions from construction of buildings and infrastructure as the capital region grows and changes. However, these GHG emissions have not been quantified due to a lack of available data. ECCC does estimate BC GHG emissions for manufacturing industries, mining and construction, but these GHG emission sources are not disaggregated and cannot reasonably be applied to the CRD (there is no mining and limited manufacturing activities). As a result, the notation "Not Estimated (NE)" is reported.

Activity Data

BC Hydro and Fortis BC provided the Province of BC 2024 electricity and natural gas consumption data itemized by community in MWh and GJ, respectively. Based on the utility provider descriptions of the data, each is categorized as follows:

- Residential Buildings based on the BC Hydro and Fortis BC descriptor: “Residential”
- Commercial and Institutional Buildings/Facilities based on BC Hydro and Fortis BC descriptor: “Commercial”

Fortis BC also provided the number of natural gas connections.

The Province developed 2007-2021 residential, propane and wood GHG energy use estimates from the number and type of dwellings and the average dwelling consumption by authority and region from the BC Hydro Conservation Potential Review. In conjunction with heating degree days data, this provincial data was used to estimate the 2024 reporting year propane and wood GHG emissions for all CRD members.

The CRD provided 2024 heating oil consumption estimates for all member municipalities.

Fugitive emissions from the natural gas distribution network within the CRD is based on the Fortis fugitive emission factor for the 2020 reporting year for the Capital Regional District. This factor was used to estimate 2007-2024 fugitive emissions for residential natural gas use in the CRD and assumes a direct change with the number of reported natural gas connections (as reported by Fortis BC).

The CRD provided landfill gas data from the Hartland landfill.

Off-road GHG emissions associated with residential, commercial, and institutional buildings—such as those from residential lawn mowers—are included in the Stationary Energy sector and are based on the 2025 NIR prepared by ECCC. These emissions are allocated to the CRD on a per capita basis.

Off-road GHG emissions from agriculture, forestry, fishing, manufacturing, and construction sectors, also included in the Stationary Energy sector, are likewise based on the 2025 NIR. These emissions are distributed to the CRD according to employment figures for each sector, using data from Statistics Canada.

Assumptions & Disclosures

The following assumptions were made in the calculation of the 2024 GHG emissions:

- The natural gas and electricity energy data was provided to the CRD in draft form and may be subject to change.
- BC Hydro estimates that the combined energy losses- transmission and distribution- to be approximately 6.28%. This value was used to calculate the Scope 3 emissions for each Stationary Energy Sub-Sector. It is assumed that this is accurate.

- Fugitive emissions from the natural gas distribution network within the CRD is based on the Fortis fugitive emission factor for the 2020 reporting year. This factor was used to estimate 2024 fugitive emissions for residential natural gas use in the CRD and assumes a direct change with the number of reported natural gas connections (as reported by Fortis BC). This value is assumed to be stable and has been applied to the 2024 reporting year.
- Propane and wood GHG emissions were estimated using linear regression methods. The data used in the estimate included historical propane and wood energy data published in the 2007-2021 CEEIs by the Province of BC, and heating degree days (HDD) as published by Environment and Climate Change Canada.
- The CRD fuel oil estimates are based on the percentage of homes sold (relative to the total number of homes in each municipality) with heating oil systems between 2018 and 2025. Using this year average, and BC assessment data, the CRD estimated the size and number of homes with heating oil for each member municipality for the 2024 reporting year. The guiding assumption is that oil systems are not increasing overtime; they are stable or decreasing in number.

Data Quality Assessment

Table 8 presents the activity data quality assessment for the stationary energy sources.

Table 8 Stationary Energy Data Source Quality Assessment

Data	Quality Assessment Rating
Residential, Commercial and Industrial Electricity	Medium for Source Category; Low for Distribution between CRD Members
Residential, Commercial and Industrial Natural Gas	Medium for Source Category; Low for Distribution between CRD Members
Residential Heating Oil, Wood and Propane Energy Use	Medium
Agriculture, Forestry & Fishing Activity GHG Emissions	Low
Manufacturing Industries & Construction GHG Emissions	Low
Fugitive Emissions	Medium
Transmission, Distribution & Line Losses	Medium
Off-Road Transportation Emissions	Low
Landfill Gas Volumes Utilized / Flared	High

Residential & Commercial Buildings GHG Emissions Calculation Methodology

The Province of BC developed residential propane and wood GHG energy use estimates using heating degree days (HDD), the number and type of dwellings and the average dwelling consumption by authority and region contained in the BC Hydro Conservation Potential Review. To estimate the 2024 propane and wood energy use, historical 2021 values and the number of heating degree days (HDD) were linearly regressed to estimate future propane and wood energy use using reporting year HDD values. These values were prorated to each local government.

The CRD provided 2024 fuel oil estimates for all member municipalities based on the percentage of homes sold (relative to the total number of homes in each municipality) with heating oil systems between 2018 and 2025.

To calculate GHG emissions from electricity, natural gas, heating oil, propane, and wood, the total net annual energy values (where applicable, less transmission, distribution, and line losses of 6.28%) were multiplied by applicable emissions factors. These values were then multiplied by the pollutant's GWP to give total CO_2e emissions in tonnes. These values were then multiplied by the pollutant's GWP to give total CO_2e emissions in tonnes.

These quantification methods are captured as follows:

$$Energy_{\text{Stationary Energy – Electricity}} = Electricity * (1 - Line\ Loss\ (\%))$$

$$Energy_{\text{Stationary Energy – Transmission, Distribution, and line Losses}} = Electricity * Line\ Loss\ (\%)$$

$$Emissions_{\text{Stationary Energy – Electricity}} = Fuel\ (MWh) * EF_{tCO2e}$$

$$Emissions_{\text{Stationary Energy – Natural Gas}} = (Fuel\ (GJ) * EF_{CO2}) + (Fuel\ (GJ) * EF_{CH4} * GWP_{CH4}) + (Fuel\ (GJ) * EF_{N2O} * GWP_{N2O})$$

$$Emissions_{\text{Stationary Energy – Propane}} = (Fuel\ (GJ) * EF_{CO2}) + (Fuel\ (GJ) * EF_{CH4} * GWP_{CH4}) + (Fuel\ (GJ) * EF_{N2O} * GWP_{N2O})$$

$$Emissions_{\text{Stationary Energy – Wood}} = (Fuel\ (GJ) * EF_{CO2}) + (Fuel\ (GJ) * EF_{CH4} * GWP_{CH4}) + (Fuel\ (GJ) * EF_{N2O} * GWP_{N2O})$$

$$Emissions_{\text{Stationary Energy – Heating Oil}} = (Fuel\ (GJ) * EF_{CO2}) + (Fuel\ (GJ) * EF_{CH4} * GWP_{CH4}) + (Fuel\ (GJ) * EF_{N2O} * GWP_{N2O})$$

The emission factors used in the 2024 reporting year are summarized in Table 9.

Table 9 Residential & Commercial Buildings Stationary Energy GHG Emission Factors

Emission Factor	Units	tCO_2e	Quality Assessment Rating
Electricity (BC Hydro)	tCO_2e / MWh	0.0099000	Medium
Natural Gas	tonne CO_2e / m^3	0.0019570	Medium
Propane	tonne CO_2e / L	0.0015443	Medium
Heating Oil	tonne CO_2e / GJ	0.0683456	Medium
Wood	tonne CO2e / kg	0.0003930	Medium

Flaring GHG Emissions Calculation Methodology

In 2024, the Hartland Landfill captured fugitive landfill methane and flared it. These GHG emissions are reported under the Solid Waste category. To quantify GHG emissions related to landfill fugitive gas combustion, the following methodology is deployed.

*$Emissions_{Fugitive\ Landfill\ Gas}$ = $LFG\ Volume_{m3}$ * $LFG\ Methane\ Content_{Percent}$ * Density of methane at 25°C and 1.0 Atmosphere * Combustion Efficiency (99.7%) * GWP_{CH4}*

Transportation

Transportation covers all GHG emissions from combustion of fuels in journeys by on-road, railways, waterborne navigation, aviation, and off-road. GHG emissions are produced directly by the combustion of fuel and indirectly using grid-supplied electricity. For the CRD, the Transportation Sector encompasses the following GHG emissions scopes and Sub-Sectors:

- Scope 1 Emissions:
  - On-road: In Boundary
  - Waterborne
  - Aviation
  - Off-road
- Scope 2 Emissions:

  - Emissions from the consumption of grid-supplied electricity.
- Scope 3 Emissions:
  - On-road: Transboundary
  - Waterborne
  - Aviation
  - Off-road

Activity Data

ICBC provided 2024 vehicle registration data to the CRD.

The Province of BC provided clear gasoline and diesel fuel sold data for the Victoria Transit Region.

BC Transit provided total diesel and gasoline fuel use. This data was used to estimate GHG emissions from busses serving the CRD.

The 2022 CRD Origin Destination Travel Survey was used to estimate on-road in-boundary and transboundary split for registered vehicles and busses. The CRD Origin Destination Travel Survey is based on travel patterns observed in the Capital Regional District (CRD) level. The City of Victoria and District of Saanich provided an estimate of vehicle kilometer travelled (VKT) data for light duty and heavy vehicles. This data is based on survey's completed in prior years.

Transport Canada provided total domestic and international itinerant movements, by type of operation, airports with NAV CANADA flight service stations for the Victoria International Airport and the Victoria Harbour. The Victoria International Airport provided 2015 GHG emissions estimates; this was used to estimate the 2024 emissions data.

Marine watercraft GHG emissions were estimated using published BC Ferries 2022 GHG emissions estimates. GHG emissions from the Coho Ferry, the Victoria Clipper Ferry, personal and commercial watercraft, were estimated based on a Study entitled "Marine Vessel Air Emissions in BC and Washington State Outside of the GVRD and FVRD for the Year 2000". The Transport Canada Vessel Registration System provided the total number of registered waterborne vehicles for the reporting year. The Greater Victoria Harbor Authority provided 2018 GHG emissions estimates per cruise ship and the number of 2024 cruise ships docked in Victoria Harbor.

Other off-road transportation emissions are based on the 2025 NIR.

Assumptions & Disclosures

The following assumptions were made in the calculation of the Transportation Sector GHG emissions:

- The on-road transportation emissions are based on the total estimated fuel sales in the CRD, and the number of registered vehicles. Insurance Corporation of BC (ICBC) compiles data on an January 1 to December 31 basis, and thus the current on-road GHG emission estimate is based on the number of registrations from Janurary 1, 2024 – December 31, 2024.
- Vehicle fuel consumption rates and Vehicle Kilometer Travelled (VKT) were taken from the activity data summary for British Columbia on-road transportation from the 2025 NIR. Based on the clear diesel and clear gasoline consumption values reported by the Province of BC for the Victoria region, the VKT and fuel efficiency values are reasonable and result in a similar estimate of fuel consumption for the Region.
- Gasoline and diesel GHG emissions from BC Transit busses are pro-rated to the CRD based on the proportion of population in each municipality within the CRD. A more accurate estimation method would be to prorate fuel use based on total bus service kilometers in the CRD. However, this data is not available, and thus the method applied provides the best estimate at the time of reporting.
- It is assumed that the 2015 aircraft flight profiles at the Victoria International Airport are representative of the 2024 reporting year.
- Victoria harbour aviation GHG emissions were estimated using Victoria harbor aircraft movement statistics, estimated taxi times, and estimated fuel use for the DHC-6 Twin Otter type of plane.
- All aviation GHG emissions are prorated based on the total Victoria population relative to the CRD population.
- As there is currently no publicly available energy or GHG related information on the operation of the Coho and the Victoria Clipper Ferries, it was assumed that the GHG emissions for these ferries calculated in the Study entitled “Marine Vessel Air Emissions in BC and Washington State Outside of the Greater Victoria Regional District (GVRD) and FVRD for the Year 2000”.
- Cruise ship emissions were based on the Greater Victoria Harbor Authority’s 2018 GHG emissions estimates per cruise ship and the number of 2024 cruise ships reported to dock in Victoria Harbor.
- BC Ferries did not disclose its total reported fuel use for 2024 but did publish 2022 GHG emissions by Scope. Fuel consumption was back calculated using passenger numbers and emissions factors.
- The Transport Canada Vessel Registration System provided the total number of registered waterborne vehicles for the reporting year; however, it does not provide any detail on the type, size, use, and owner of the watercraft. It was therefore assumed that the watercraft would have been similar to those in the referenced study.
- All marine emissions are prorated to each member municipality relative to population with the exception of the GHG emissions associated with the Coho Ferry and Cruise ships, which are apportioned to the City of Victoria.
- No railway GHG emissions are occurring in the CRD.

- The off-road transportation emissions are based on the 2025 NIR. This is deemed to be the best available data.

Data Quality Assessment

Table 10 presents the activity data quality assessment for the transportation data sources.

Table 10 Transportation Data Quality Assessment

Data	Quality Assessment Rating
Split Between In-Boundary and Transboundary Traffic	Medium-High
Vehicle Registry Data	High
Vehicle Kilometers Travelled (VKT) Data	Medium-Low
Aviation GHG Data	Medium-Low
Waterborne GHG Data	Low
Other Off-Road Transportation GHG Data	Low

On-Road Calculation Methodology

The GPC Protocol identifies several methods for determining on-road emissions. The vehicle kilometers travelled (VKT) methodology and fuel sales methods were utilized to estimate the GHG emissions from on-road transportation (Scope 1) and transboundary transportation (Scope 3). The VKT uses the number and type of vehicles registered in a geopolitical boundary, the estimated fuel consumption rate of individual vehicles, and an estimate of the annual vehicle kilometres traveled (VKT) by various vehicle classes. ICBC provided the number of registered vehicles in the CRD by style and by fuel type for 2025. To estimate the split between on-road in-boundary and transboundary traffic, data from the 2022 CRD Origin Destination Survey was applied.

Results for the CRD are shown in Table 11.

Table 11 CRD On-Road In-Boundary/Transboundary Split

Aspect	CRD
Estimated proportion of on-road in-boundary travel	99.3%
Estimated proportion of on-road transboundary travel	0.7%

To quantify the 2007 and 2024 reporting year on-road and transboundary GHG emissions, the following steps were taken:

1. Sort the ICBC vehicle registration data by postal code.
2. Review each vehicle model and fuel type and assign it to one of 4 classes (for each fuel type): LDV, LDT, HDV, ORVE
3. Assign estimated NRCan vehicle fuel consumption rates and estimated VKT to each vehicle class.
4. Estimate total fuel use by vehicle classification.
5. Summate and allocate estimated fuel use, by vehicle class using the applicable in-boundary and transboundary split.
6. Pro-rate the gasoline and diesel fuel use from busses.
7. Summate and allocate estimated bus fuel use using the applicable in-boundary and transboundary split.
8. Compare fuel estimated fuel volumes to the regional fuel sales volumes reported by the CRD. Adjust the VKTs as needed to make sure that the fuel estimate is at least above the fuel sales volumes reported in the region.

The GHG quantification method is captured, for all fuel types, is as follows:

$$Emissions_{On\text{-}road} = In\text{-}Boundary\ Split\ \% * ((Vol.\ Fuel * EF_{CO2}) + (Vol.\ Fuel * EF_{CH4} * GWP_{CH4}) + (Vol.\ Fuel * EF_{N2O} * GWP_{N2O}))$$

$$Emissions_{Transboundary} = Transboundary\ Split\ \% * ((Vol.\ Fuel * EF_{CO2}) + (Vol.\ Fuel * EF_{CH4} * GWP_{CH4}) + (Vol.\ Fuel * EF_{N2O} * GWP_{N2O}))$$

The emission factors used in the reporting year GHG inventory are from the Province of BC.[3] These are summarized in Table 12.

Table 12 Vehicle GHG Emission Factors

Vehicle Class	Units	tCO_2e	Quality Assessment Rating
Gasoline-LDV	tonne CO_2e / L	0.00220168	Medium
Gasoline-LDT	tonne CO_2e / L	0.00220168	Medium
Gasoline-HDV	tonne CO_2e / L	0.00224684	Medium
Gasoline-ORVE	tonne CO_2e / L	0.00235126	Medium
Gasoline-Hybrid-LDV	tonne CO_2e / L	0.00220168	Medium

[3] Data methods for the Community Energy and Emissions Inventory - Province of British Columbia

Vehicle Class	Units	tCO_2e	Quality Assessment Rating
Gasoline-Hybrid-LDT	tonne CO_2e / L	0.00220168	Medium
Gasoline-Hybrid-HDV	tonne CO_2e / L	0.00224684	Medium
Gasoline-Hybrid-ORVE	tonne CO_2e / L	0.00235126	Medium
Electric-LDV	tonne CO_2e / kWh	0.00000990	Medium
Electric-LDT	tonne CO_2e / kWh	0.00000990	Medium
Electric-HDV	tonne CO_2e / kWh	0.00000990	Medium
Electric-ORVE	tonne CO_2e / kWh	0.00000990	Medium
Diesel-LDV	tonne CO_2e / L	0.00263301	Medium
Diesel-LDT	tonne CO_2e / L	0.00263348	Medium
Diesel-HDV	tonne CO_2e / L	0.00261638	Medium
Diesel-ORVE	tonne CO_2e / L	0.00263538	Medium
Hydrogen-Hybrid-LDV	tonne CO_2e / L	-	Medium
Hydrogen-LDV	tonne CO_2e / L	-	Medium
Hydrogen-LDT	tonne CO_2e / L	-	Medium
Natural Gas-LDV	tonne CO_2e / kg	0.00000312	Medium
Natural Gas-LDT	tonne CO_2e / kg	0.00000312	Medium
Natural Gas-HDV	tonne CO_2e / kg	0.00000312	Medium
Natural Gas-ORVE	tonne CO_2e / kg	0.00000312	Medium
Propane-LDV	tonne CO_2e / L	0.00154034	Medium
Propane-LDT	tonne CO_2e / L	0.00154034	Medium
Propane-HDV	tonne CO_2e / L	0.00154034	Medium
Propane-ORVE	tonne CO_2e / L	0.00154034	Medium
Propane-Hybrid-LDV	tonne CO_2e / L	0.00154034	Medium
Motorcycle - Non catalyst	tonne CO_2e / L	0.00222439	Medium

Vehicle Class	Units	tCO_2e	Quality Assessment Rating
Motorcycle - Electric	tonne CO_2e / L	0.00000990	Medium

Aviation

Victoria International Airport

The Victoria International Airport (VIA) estimated its 2015 airplane GHG emissions following the ACI ACERT standard. This includes GHG emissions from aircraft and GHG emissions from auxiliary power units (APU). APUs provides electricity to the aircraft prior to the engine start up. Within the ACERT model, it is assumed all aircraft have APUs and the duration of the APU operation (of five minutes per aircraft) was generically applied to every landing take-off (LTO) cycles. It should also be noted that the EIA has quantified aircraft GHG emissions from planes up to 3,000 ft. to avoid double counting with other airports and cities. This is consistent with the ACERT standard.

The CRD's 2024 aviation emissions estimate is based on the 2015 aircraft flight profiles, which included the estimated landing and takeoff (LTO) and auxiliary power unit (APU) fuel use, and an estimated percentage allocation of total flights to the following aviation class groupings (Table 13). The total reported flight movements for the reporting year and the aircraft flight profile data was used to estimate aviation GHG emissions for the reporting year at the VIA.

Table 13 Aircraft Type, Estimated Percentage of Total Reported Movements, And Estimated Fuel Use

Aviation Class	Aircraft Type	Estimated Percentage of Annual Movements	Estimated LTO Fuel Use by Aircraft Type (kg)	Estimated APU Fuel Use by Aircraft Type (kg/min)
Jet	Large: 2-aisle, long-haul	0.01%	1,853	4.00
	Medium: 2-aisle, medium-haul	0.01%	1,321	4.00
	Small: 1-aisle, small/medium haul	7.95%	565	1.78
	Regional: 1-aisle, short-haul	0.01%	315	1.78
	Business: 2-eng business jets	0.01%	41	1.78
Turboprop	Turboprop (all engines)	22.29%	46	1.78
Piston	Piston (all engines)	66.30%	41	0.00

Aviation Class	Aircraft Type	Estimated Percentage of Annual Movements	Estimated LTO Fuel Use by Aircraft Type (kg)	Estimated APU Fuel Use by Aircraft Type (kg/min)
Helicopter	Helicopter small (1 engine/turbine)	1.72%	13	0.00
	Helicopter large (2 engine/turbine)	1.72%	8	0.00

Calculating fuel use for each aviation class applied the following equation:

Fuel Use $_{Per\ Aviation\ Class}$ *= Number of Aircraft Movements * (LTO Fuel Use + (APU Fuel Use * 15 minutes))*

The GHG quantification method, that was applied to each aviation class, is as follows:

Emissions $_{Per\ Aviation\ Class}$ *= (Vol. Fuel * Aviation Class* EF_{CO2}*) + (Vol. Fuel * Aviation Class* EF_{CH4} ** GWP*$_{CH4}$*) + (Vol. Fuel * Aviation Class* EF_{N2O} ** GWP*$_{N2O}$*))*

The ACERT GHG calculator used by the VIA utilized emission factors from the 2025 NIR. Actual airplane emission factors are from the International Civil Aviation Organization (ICAO) GHG database. These are summarized in Table 14.

These GHG emissions were reported in the Scope 3 category as directed by the GPC Protocol.

Table 14 Aviation GHG Emission Factors

Airplane Type	Units	tCO_2e	Quality Assessment Rating
Jet	tCO_2e/kg fuel	0.0032254	Medium-Low
Turbo Propeller	tCO_2e/kg fuel	0.0032254	Medium-Low
Piston	tCO_2e/kg fuel	0.0034154	Medium-Low
Helicopter	tCO_2e/kg fuel	0.0032254	Medium-Low

Aviation

Victoria Harbour

Victoria harbor aviation emissions were estimated using 2024 NAV Canada airplane movement statistics, estimated taxi times, and estimated fuel use for the DHC-6 Twin Otter type of plane (Table 15).

Table 15 Aircraft Type, Estimated Percentage of Total Reported Movements, And Estimated Fuel Use

Aviation Class	Aircraft Type	Estimated Percentage of Annual Movements	Estimated LTO Fuel Use by Aircraft Type (kg)	Estimated APU Fuel Use by Aircraft Type (kg/min)
Turboprop	DHC-6 Twin Otter	100%	56	0.00

Calculating aviation fuel use in the Victoria harbor for applied the following equation:

$$Fuel\ Use_{\ Per\ Aviation\ Class} = Number\ of\ Aircraft\ Movements * (LTO\ Fuel\ Use + (APU\ Fuel\ Use * 15\ minutes))$$

The GHG quantification method is as follows:

$$Emissions_{\ Per\ Aviation\ Class} = CRD\ Population * ((Vol.\ Fuel * Aviation\ Class\ EF_{CO2}) + (Vol.\ Fuel * Aviation\ Class\ EF_{CH4} * GWP_{CH4}) + (Vol.\ Fuel * Aviation\ Class\ EF_{N2O} * GWP_{N2O}))$$

The airplane emission factors are from the International Civil Aviation Organization (ICAO) GHG database. These are summarized in Table 16.

Table 16 Marine Aviation GHG Emission Factors

Units	tCO_2e	Quality Assessment Rating
Turbo Propeller	0.0032163	Medium-Low

As there is no publicly available origin traveler data for harbor flights, the aviation GHG emissions were prorated based on the local government populations relative to the CRD population. These were reported in the Scope 3 category.

Waterborne Transportation GHG Emissions Calculation Methodology

BC Ferries

Marine waterborne transportation emissions encompass GHG emissions from the use of the BC Ferries. BC Ferries reported their 2022 GHG emissions which were pro-rated based on total service populations. The GHG emissions reported by BC Ferries are based on provincially derived GHG emissions factors (Table 17).

Table 17 BC Ferries GHG Emission Factors

Aspect	Units	tCO2e	Quality Assessment Rating
Ferry: Diesel	tonne CO_2e / L	0.0028777	Medium
Ferry: Natural Gas	tonne CO_2e / L	0.0014140	Medium

As BC Ferries operate outside of the CRD's boundary, the GHG emissions were allocated to Scope 3 based on the proportion of the CRD population relative to the total Vancouver Island and Mainland / Southwest populations. The GHG quantification method, that was applied to the BC Ferries and other watercraft was as follows:

$$Emissions_{Waterborne} = (CRD\ Population / Vancouver\ Island;\ Mainland;\ Southwest\ Population) * ((Vol.\ Fuel * EF_{CO2}) + (Vol.\ Fuel * EF_{CH4} * GWP_{CH4}) + (Vol.\ Fuel * EF_{N2O} * GWP_{N2O}))$$

Cruise Ships

Cruise ship GHG emissions were estimated by the Greater Victoria Harbour Authority.[4] The Greater Victoria Harbour Authority (GVHA) reported on cruise ship emissions for the 2018 reporting year but did not derive an estimate for 2024. As a result, the 2018 GHG emissions estimate and number of cruise ship visits to Ogden Point in 2024 was used to create a proxy to estimate 2024 cruise ship emissions.

The GHG quantification method to estimate 2024 GHG emissions from the Odgen Point cruise ship terminal was as follows:

$$\mathbf{Emissions}_{\mathbf{Waterborne}} = (GVHA\ Reported\ Emissions_{2018} / Cruise\ Ship\ Visits_{2018}) * Cruise\ Ship\ Visits_{2022}$$

[4] https://gvha.ca/wp-content/uploads/2019/10/EmissionsInventory-2019.pdf

Personal Watercraft

The Transport Canada Vessel Registration System provided the total number of registered waterborne vehicles; however, the registration system does not provide any detail on the type, size, use, and owner of the watercraft. It was therefore assumed that 50% of the boats are sail (60% diesel; 40% gas) and 50% are power (25% diesel, 75% gas). To estimate the GHG emissions, the estimated annual fuel consumption rates from the Victoria Harbour Study "Marine Vessel Air Emissions in BC and Washington State Outside of the GVRD and FVRD for the Year 2000" and BC based emission factors were applied (Table 18).

Table 18 Personal Watercraft GHG Emission Factors

Aspect	Units	tCO_2e	Quality Assessment Rating
Marine Gasoline	tonne CO_2e / L	0.0022539	Medium-Low
Marine Diesel	tonne CO_2e / L	0.0026083	Medium-Low

The GHG quantification method, that was applied to personal watercraft was as follows:

$$Emissions_{Waterborne} = Total\ Boats * Fuel_{Percent} * ((Vol.\ Fuel * EF_{CO2}) + (Vol.\ Fuel * EF_{CH4} * GWP_{CH4}) + (Vol.\ Fuel * EF_{N2O} * GWP_{N2O}))$$

Off-Road Transportation GHG Emissions Calculation Methodology

Currently, there is limited data available to estimate off-road GHG emissions. As such, a GHG emissions estimate for each off-road category was developed using Provincial emissions data from the 2025 NIR, and population and employment statistics from Statistics Canada.

Residential, commercial, and institutional building related off-road GHG emissions are based on the 2025 NIR estimates for BC and were pro-rated to the CRD on a per capita basis.

Agriculture, forestry and fishing related off-road GHG emissions are based on the 2025 NIR estimates for BC and were pro-rated to the CRD on a per hectare of agricultural land basis.

Manufacturing industries and construction, and manufacturing, mining and construction related off-road GHG emissions are based on the 2025 NIR estimates for BC and were pro-rated to the CRD based on the number of employees in each of the reported sectors.

Other off-road GHG emissions are based on the 2025 NIR estimates for BC and were pro-rated to the CRD on a per capita basis. These GHG emissions were reported in the Transportation Other Off-Road Sub-Sector.

The GHG quantification method is presented below:

$$Emissions_{Off\text{-}Road} = (NIR\ Off\text{-}Road\ GHG\ Emissions_{BC} / BC\ Population_{BC}) * Current\ Reporting\ Year\ Population_{CRD}$$

$$Emissions_{Agriculture,\ Forestry\ And\ Fishing} = (NIR\ Off\text{-}Road\ GHG\ Emissions_{BC} / BC\ Lands\ in\ Agriculture_{HA}) * CRD\ Lands\ in\ Agriculture_{HA}$$

$$Emissions_{Manufacturing\ Industries\ And\ Construction\ \&\ Manufacturing,\ Mining\ and\ Construction\ Off\text{-}Road} = (NIR\ Off\text{-}Road\ GHG\ Emissions_{BC} / BC\ Employment\ Statistics_{BC}) * Current\ Reporting\ Year\ Employment\ Statistics_{CRD}$$

$$Emissions_{Other\ Off\text{-}Road} = (NIR\ Off\text{-}Road\ GHG\ Emissions_{BC} / BC\ Population_{BC}) * Current\ Reporting\ Year\ Population_{CRD}$$

Waste

Cities produce GHG emissions because of the disposal and management of solid waste, incineration and open burning of waste, the biological treatment of waste, and through wastewater treatment and discharge. Waste does not directly consume energy, but releases GHG emissions because of decomposition, burning, incineration, and other management methods.

For the CRD, the Waste Sector encompasses the following GHG emissions scopes and Sub-Sectors:

- Scope 3: Emissions:
  - Solid waste disposal
  - Biological treatment of waste
  - Wastewater treatment and discharge

Some GHG emissions from incineration and open burning are likely to be occurring in the CRD but cannot readily be estimated. This the notation key for “Not Estimated” has been used to indicate this.

Activity Data

The CRD provided landfill gas volumes, energy and GHG related data for the Hartland landfill (fugitives and flaring), total CRD wastewater volumes, average biological oxygen demand (BOD) and Total Kjeldal Nitrogen (TKN) annual average values (mg/L) from the wastewater for all relevant outfalls. The wastewater volumes are based on total budgeted sewer costs.

Assumptions & Disclosures

The following assumptions were made in the calculation of the 2024 GHG emissions:

- To quantify GHG emissions from the Hartland Landfill, the CRD utilized the waste-in-place method which is accepted under the GPC Protocol. The Waste-in-place (WIP) assigns landfill emissions based on total waste deposited during that year. It counts GHGs emitted that year, regardless of when the waste was disposed. GHG emissions from the Hartland Landfill for the reporting year are allocated based upon the percentage of Community waste, relative to total waste received at to the Hartland Landfill. It is assumed that the GHG emissions data provided is reasonably accurate and the method deployed correct.
- It is assumed that the landfill gas has a constant higher heating value (HHV) of 0.01865 (GJ/m^3).
- Composting GHG emissions are estimated based on the total tonnage estimated by the CRD. It is assumed that all compost is treated aerobically.

Data Quality Assessment

Table 19 presents the activity data quality assessment for the waste data sources.

Table 19 Waste Data Quality Assessment

Data	Quality Assessment Rating
Landfill fugitive methane and flaring data	Medium-High
Landfill tonnages sent to landfill by CRD member data	Medium-Low
Wastewater volume data	High
Wastewater BOD and TKN data	High
Composting waste data (compost and biosolids)	Medium

Solid Waste GHG Emissions Calculation Methodology

The Hartland Landfill has a landfill gas (LFG) collection and destruction system at the Hartland Landfill opperating specifically for 2024 only to which the LFG is combusted in a flare. The GHG emissions associated with energy generation are reported as a reporting only GHG emission under Stationary Energy: Energy Industries Reporting Only and are not included in the total GHG emissions estimate. The GHG emissions associated with flaring of the landfill gas are reported under Stationary Energy: Energy Industries Scope 1.

The GHG quantification method for Stationary Energy: Energy Industries is as follows:

$$Emissions_{\text{Stationary Energy: Energy Industries}} = (LFG\ Consumed_{m3} * HHV_{LFG} * EF_{RNG\ CH4} * GWP_{CH4}) + (LFG\ Consumed_{m3} * HHV_{LFG} * EF_{RNG\ N2O} * GWP_{N2O})$$

The fugitive landfill GHG emissions estimates were generated by the CRD using the waste-in-place (WIP) method which is accepted under the GPC Protocol. The WIP assigns landfill emissions based on emissions during that year. It counts GHGs emitted that year, regardless of when the waste was disposed.

Biological Treatment of Solid Waste GHG Emissions Calculation Methodology

The CRD provided composting data which is assumed to be treated aerobically. The composting emission factors used in the estimation of GHG emissions was derived from the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 5, Chapter 4: Biological Treatment of Solid Waste) (Table 20).

Table 20 Composting Emission Factors

Emission Factor	Units	tCO_2e	Quality Rating Assessment
Composting: Anerobic	tCO_2e / kg waste	0.00019150	Low
Composting: Aerobic	tCO_2e / kg waste	0.00002800	Low

To quantify GHG emissions from the biological treatment of solid waste, the following GHG quantification methods was deployed:

$$Emissions_{\text{Anaerobic Waste}} = Compost\ Waste_{\text{Total}} * EF_{CH4} * GWP_{CH4}$$

Wastewater Treatment And Discharge: Treatment Systems GHG Emissions Calculation Methodology

Wastewater is currently treated prior to discharge. To estimate GHG emissions, the total wastewater volumes (m^3), the average BOD and the average Total Kjeldal Nitrogen TKN in treated wastewater area used. IPCC default wastewater methane (CH_4) producing capacity (0.6 kg CH_4/kg BOD) and methane correction factor (MCF) (0.1 – unitless) were used to estimate CH_4 from the wastewater. To estimate N_2O from the wastewater, the Total Kjeldal Nitrogen (TKN) annual average in conjunction with the total wastewater volumes to calculate the total TKN in the wastewater. The IPCC default conversion value of 0.01 kg N_2O-N/kg sewage-N was used to estimate N_2O from the wastewater. These factors used are for treated wastewater being deposited into deep or moving waters. It is likely that ocean sequesters more CH_4 than what has been estimated.

To quantify GHG emissions from the wastewater treatment, the following GHG quantification method is deployed:

$$Emissions_{Wastewater\ CH4} = ((Wastewater_{m3} * (BOD_{ml/L} / 1000) * (0.018_{kg\ CH4/kg\ BOD} * 0.01)) / 1000) * GWP_{CH4}$$

$$Emissions_{Wastewater\ N2O} = ((Wastewater_{m3} * (TKN_{ml/L} / 1000) * 0.01_{kg\ N2O\text{-}N/kg\ sewage\text{-}N}) / 1000) * GWP_{N2O}$$

Industrial Processes and Product Use (IPPU)

Emissions from the IPPU Sector are only required for BASIC+ GHG reporting under the GPC Protocol. This Sector encompasses GHG emissions produced from industrial processes that chemically or physically transform materials and using products by industry and end-consumers (e.g., refrigerants, foams, and aerosol cans) (GPC, 2014).

For the CRD, the IPPU encompasses the following GHG emissions scopes and Sub-Sectors:

- Scope 1 Emissions:
  - Product use

No significant GHG emissions from Industrial Processes, like the release of chemicals and refrigerants because of manufacturing or processing of materials, are reported to be occurring and thus the notation key for “Not Occurring” has been used to indicate this. It should be noted that the reporting threshold for the BC government is 10,000 tCO_2e so it is possible that there are small industrial GHG emissions sources occurring within the CRD, but there is no data to support a conclusion.

Activity Data

The IPPU data was derived from the 2025 NIR.

Data Quality Assessment

Table 21 presents the activity data quality assessment for the IPPU data sources.

Table 21 IPPU Data Quality Assessment

Data	Quality Assessment Rating
Industrial process emissions data	Low

Data	Quality Assessment Rating
Industrial product use emissions data	Low

Assumptions & Disclosures

The following assumptions were made in the calculation of the 2024 GHG emissions:

- The product use emissions are based on the 2025 NIR product use GHG emissions as prepared by ECCC. These are applied to the CRD on a per capita basis.
- The NIR uses the Tier 1 methodology to estimate these emissions and thus uncertainty around their accuracy remains quite high.

Product Use Emissions GHG Emissions Calculation Methodology

For the 2024 reporting year, only the emissions estimated were production and consumption of halocarbons, SF_6 and NF_3 were estimated for the province. To estimate product use GHG emissions for the CRD, a per capita estimate was developed using the Provincial emissions data from the 2025 NIR, and BC's NIR reporting year population from Statistics Canada. This value was applied to the 2024 reporting year CRD population to estimate the total product use emissions.

The GHG quantification method is presented below:

$$Emissions_{Product\ Use} = (NIR\ Product\ Use\ GHG\ Emissions_{BC} / NIR\ Population_{BC}) * Current\ Reporting\ Year\ Population$$

Agriculture, Forestry, and Other Land Use (AFOLU)

The AFOLU Sector includes emissions from livestock, land-use, and all other agricultural activities occurring within a community's boundaries. For the CRD, the AFOLU encompasses the following GHG emissions scopes and Sub-Sectors:

- Scope 1 Emissions:
  - Land (*reported, but not included in the GHG totals*)
  - Livestock
  - Aggregate Sources and Non-CO_2 Emissions Sources On Land

Activity Data

The CRD provided remotely sensed imagery to estimate land-cover change. This data included:

- Habitat Acquisition Trust (HAT) Land Cover Mapping (2007 and 2011)
- Annual Crop Inventory (ACI), Agriculture Canada
- Satellite Imagery interpretation (2011 and 2019), CRD
- Vegetation Resources Inventory (VRI), British Columbia Government.
- Earth Observation for Sustainable Development of Forests (EOSD) Land Cover Classification, Service Natural Resources Canada

Livestock and aggregate sources and non-CO_2 emissions sources on land were estimated using GHG emissions data from the 2025 NIR, and land-use data from the 2021 Statistics Canada Census of Agriculture, to create a GHG emissions per hectare value.

Assumptions & Disclosures

The following assumptions were made in the calculation of the 2024 GHG emissions:

- It is conservatively assumed that all cropland is used for livestock and agricultural purposes.
- Infrequent and small source open burning may be occurring, but there is no data to estimate this emissions source.
- The land cover change analysis requires a consistent land-use category attribution and spatial data. For parts of the CRD, spatial data was available for the 2007, 2011 and 2019 reporting years. Differences between these data sets in terms of resolution and their timing of collection increase the uncertainty as to the accuracy of the land-use classifications. For example, the 2007 and 2011 land use data was collected at different times of the year and may not accurately reflect tree cover. Furthermore, no land use spatial data was collected for the Juan de Fuca, Salt Spring Island or Gulf Islands and thus Annual Crop Inventory (ACI) settlement data collected by Agriculture Canada was used to inform the analysis. The challenge in utilizing this data is that it is provided in a 30m resolution. Furthermore, since annual data is not available, the change between land cover data years (2007-2011, 2011-2019) for all areas was averaged and may not represent actual changes in each year. Lastly, due to limitations in how to quantify GHG emissions resulting from land use change (e.g., residential development), these GHG emissions have been excluded from the CRD's GHG emissions inventory, but have been disclosed, until a more robust measurement methodology can be developed. Since no data was available for 2024, the 2019 estimates were applied.

Data Quality Assessment

Table 22 presents the activity data quality assessment for the AFOLU data sources.

Table 22 AFOLU Data Quality Assessment

Data	Quality Assessment
Land-use data	Medium
Urea application GHG data	Low
Direct, indirect, and manure nitrous oxide (N_2O) GHG data	Low
Livestock data	Medium

Land Use GHG Emissions Calculation Methodology

Remotely sensed imagery was used to estimate land-cover changes during the 2007-2019 reporting periods. Using the remotely sensed imagery an annual average land-use change between land classes (e.g. cropland forestland, etc.) was determined and applied to BC-based emission factors to estimate GHG emissions resulting from changes between land-uses for the reporting year.

The following table identifies the data sources used for the reporting years for each of the study area's geographies.

Table 23 Spatial Data Sources Representing Land Cover For The CRD Study Area

		CRD Study Area Geography		
		CRD Core	**Gulf Islands**	**Juan de Fuca Region**
Reporting Year	**2007**	2005 HAT Land Cover Mapping	2001 EOSD Land Cover Classification	2011 HAT Land Cover Mapping[2]
	2011	2011 HAT Land Cover Mapping	2001 EOSD Land Cover Classification + 2011 ACI 'Settlement'	2011 HAT Land Cover Mapping[2] + 2011 ACI 'Settlement'
	2022	2019 HAT Land Cover Mapping + 'Settlement' satellite image interpretation[1]	2001 EOSD Land Cover Classification + 2019 ACI 'Settlement'	2011 HAT Land Cover Mapping[2] + 2019 ACI 'Settlement'

	CRD Study Area Geography		
	CRD Core	**Gulf Islands**	**Juan de Fuca Region**

Notes:

[1] Settlements land cover category is a combination of i) municipality provided building footprint as acquired mostly from digitizing roofline from satellite and orthoimagery, ii) new roads (ParcelMap BC parcel with parcel start dates > 2011 and parcel class = 'road') and iii) and theoretical building footprints (average building footprint areas as buffered centroids of new ParcelMap BC parcel with start dates > 2011 with a residential parcel class)

[2] The 2011 land cover classification was interpreted mostly from 2005 imagery in the Juan de Fuca region making it more suitable for the 2007 reporting year.

The spatial data sources representing land cover in this analysis include more categories than the 6 IPCC land-use categories. To align with the IPCC land classification definitions (as required by the GPC Protocol), the following data categories were re-assigned to the most appropriate IPCC land class.

Table 24 IPCC Land Use Classification Cross-References

IPCC Land Cover	EOSD Land Cover	HAT Land Cover	Annual Crop Inventory
Cropland	Annual Cropland, Perennial Cropland And Pasture	Agricultural Fields	-
Forest	Broadleaf Dense, Broadleaf Open, Coniferous Dense, Coniferous Open, Coniferous Sparse	Tree	-
Grassland	Grassland, Herb, Shrub Low	Grass, Herb	-
Settlement	Developed	Pavement/Building	Developed
Wetland	Wetland - Herb, Wetland - Shrub, Wetland - Treed	Riparian Tree, Riparian Herb, Pond	-
Other	Water, Exposed Land	Shadow, Ocean, Lake, River, Sand/Gravel Shoreline, Bedrock Shoreline, Exposed Soil, Exposed Bedrock	-

The analysis resulted in an estimate of an annual average change in hectares' value for each land class. Once the land use change values were determined for the reporting year, BC-based and IPCC emission factors were applied to estimate reported and disclosed (not-reported) GHG emissions from land use (Table 25).

Table 25 Land-Use Change Emission Factors

Land-Use Classification	Emission Factor	Units	Quality Assessment Rating
Forestland	224.1	tCO_2e / ha	Low
Shrubland/Scrubland	112.0	tCO_2e / ha	Low
Grasslands	205.7	tCO_2e / ha	Low
Wetlands	471.5	tCO_2e / ha	Low
Cropland	237.8	tCO_2e / ha	Low
Settlements	0	tCO_2e / ha	Low
Other	0	tCO_2e / ha	Low
Forestland	1.8	tCO_2e / ha / year	Low
Shrubland/Scrubland	0.1	tCO_2e / ha / year	Low
Grasslands	2.6	tCO_2e / ha / year	Low
Wetlands	3.3	tCO_2e / ha / year	Low
Croplands	0.4	tCO_2e / ha / year	Low
Settlements	0	tCO_2e / ha / year	Low
Other	0	tCO_2e / ha / year	Low

The GHG quantification methods for land use change is presented below:

$$Emissions_{Lands\ Not\ Converted} = Land\ Type_{ha} * EF_{Sequester}$$

$$Emissions_{Lands\ Converted} = Land\ Type_{ha} * (EF_{Release} / (Current\ Land\ Reporting_{Year} - Last\ Land\ Reporting_{Year} + 1))$$

Aggregate Sources and Non-CO2 Emission Sources on Land GHG Emissions Calculation Methodology

Emissions from Aggregate Sources and Non-CO_2 Emission Sources on Land includes direct N_2O emissions from agricultural soil management and indirect N_2O emissions from applied nitrogen. To estimate these GHG emissions, the total area of farmland for BC is used in conjunction with 2024 NIR data to develop a tCO_2e / ha value. This is then be applied to the total crop land in hectares to derive a GHG emissions estimate.

The GHG quantification method is presented below:

$$Emissions_{Direct\ \&\ Indirect\ N2O} = ((BC_{Direct\ N2O\ Emissions} + BC_{Indirect\ N2O\ Emissions} + BC_{Indirect\ N2O\ Manure\ Management\ Emissions}) / BC_{Land\ In\ Crops\ ha}) * CRD\ Cropland_{ha}$$

$$Emissions_{Urea\ Application} = CRD\ Cropland_{ha} * 0.06\ tCO_2e / ha$$

5 2024 GHG Reporting Year Results

This section presents the 2024 reporting year GHG emissions for the CRD.

GPC GHG Emissions Summary

Total BASIC, and BASIC+ emissions for the CRD for the 2024 reporting year are presented in Figure 3 below.

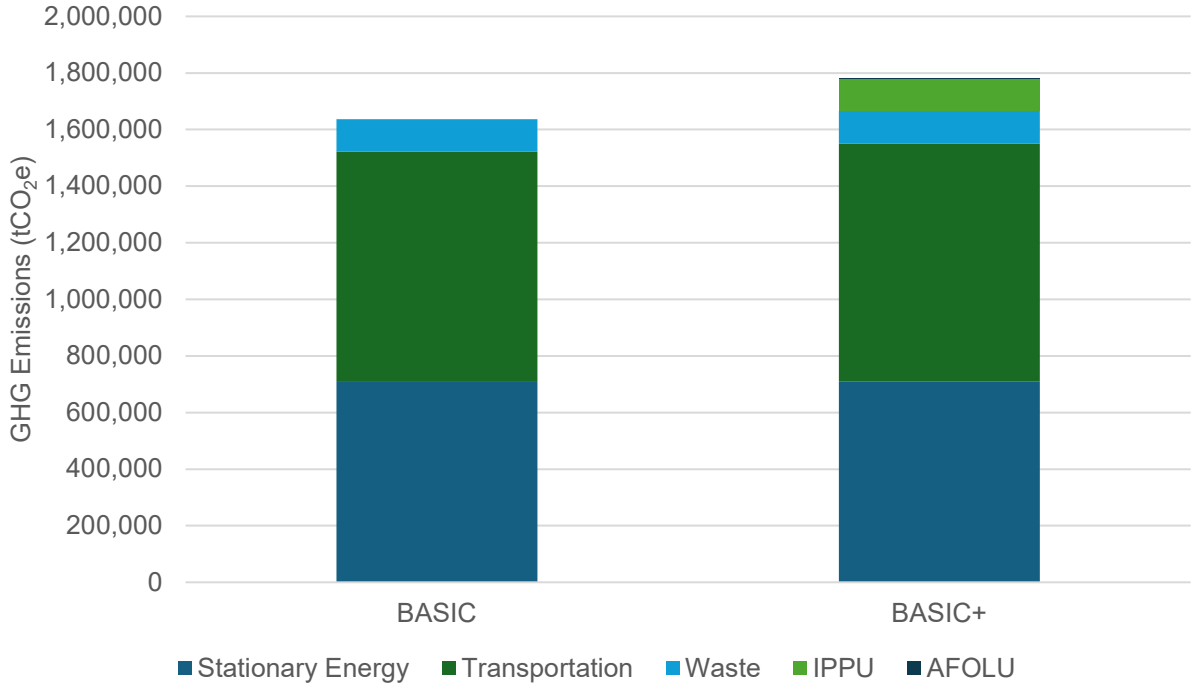

Figure 3 2024 GHG Emissions Summary by GPC Reporting Level

Emissions by reporting level are presented in Table 26 below which shows a difference in GHG emissions under the GPC Protocol's BASIC, and BASIC+ reporting levels. This is due to the inclusion of additional sources in BASIC+ which are very significant for almost any growing community. These additional emissions include transboundary emissions, industrial and product use emissions, and emissions from land-use change. Under the GPC Protocol, emissions included within each higher reporting level are cumulative from lower levels.

Table 26 Breakdown of the CRD's 2024 GHG Emissions in GPC Reporting Format

GHG Emissions Source (by Sector)		Total GHGs (metric tonnes CO_2e)					
		Scope 1	Scope 2	Scope 3	BASIC	BASIC+	BASIC+ S3
Stationary Energy	Energy use (all emissions except I.4.4)	676,532	31,582	2,116	708,115	710,231	710,231
	Energy generation supplied to the grid (I.4.4)	8,340					
Transportation	(all II emissions)	813,966	271	26,407	814,236	840,643	840,643
Waste	Waste generated in the Community (III.X.1 and III.X.2)	114,818		0	114,818	114,818	114,818
	Waste generated outside community (III.X.3)	NO					
IPPU	(all IV emissions)	114,034				114,034	114,034
AFOLU	(all V emissions)	3,786				3,786	3,786
Other Scope 3 (S3)	(all VI emissions)			NE			NE
TOTAL		**1,723,137**	**31,853**	**28,523**	**1,637,170**	**1,783,513**	**1,783,513**

Notation Keys: IE = Included Elsewhere; NE = Not Estimated; NO = Not Occurring.

Cells in green are required for BASIC reporting; Cells in green and blue are required for BASIC+ reporting; Cells in purple are for disclosure purposes only but are not included in the summary totals as required by the GPC Protocol; Cells in orange are not required for BASIC or BASIC+ reporting.

Table 27 presents the breakdown of the CRD's BASIC+ GHG emissions by Sector and Sub-Sector.

Table 27 Breakdown of the CRD's 2024 BASIC+ GHG Emissions in the GPC Protocol Reporting Format

GPC ref No.	GHG Emissions Source (by Sector and Sub-Sector)	Total GHGs (metric tonnes CO_2e)			
		Scope 1	Scope 2	Scope 3	Total
I	Stationary Energy				
I.1	Residential buildings	208,152	20,868	1,398	230,418
I.2	Commercial and institutional buildings and facilities	338,064	10,715	718	349,497
I.3	Manufacturing industries and construction	NE	NE	NE	NE
I.4.1/2/3	Energy industries	5,518	NO	NO	5,518
I.4.4	Energy generation supplied to the grid	8,340			
I.5	Agriculture, forestry, and fishing activities	123,176	IE	IE	123,176
I.6	Non-specified sources	IE	IE	IE	IE
I.7	Fugitive emissions from mining, processing, storage, and transportation of coal	NO			NO
I.8	Fugitive emissions from oil and natural gas systems	1,622			1,622
Sub-Total	(community induced framework only)	**676,532**	**31,582**	**2,116**	**710,231**
II	Transportation				
II.1	On-road transportation	677,872	271	6,156	684,299
II.2	Railways	NO	NO	NO	NO
II.3	Waterborne navigation	56,498	IE	IE	56,498
II.4	Aviation	IE	IE	20,250	20,250
II.5	Off-road transportation	79,596	IE	IE	79,596
Sub-total	(community induced framework only)	**813,966**	**271**	**26,407**	**840,643**
III	Waste				
III.1.1/2	Solid waste generated in the Community	104,017		NO	104,017
III.2.1/2	Biological waste generated in the Community	6,387		NO	6,387

GPC ref No.	GHG Emissions Source (by Sector and Sub-Sector)	Total GHGs (metric tonnes CO_2e)			
		Scope 1	Scope 2	Scope 3	Total
III.3.1/2	Incinerated and burned waste generated in the Community	NO		NO	NO
III.4.1/2	Wastewater generated in the Community	4,414		IE	4,414
III.1.3	Solid waste generated outside the Community	NO			
III.2.3	Biological waste generated outside the Community	NO			
III.3.3	Incinerated and burned waste generated outside community	NO			
III.4.3	Wastewater generated outside the Community	NO			
Sub-total	(community induced framework only)	**114,818**		**0**	**114,818**
IV	Industrial Processes and Product Uses				
IV.1	Emissions from industrial processes occurring in the Community boundary	NE			NE
IV.2	Emissions from product use occurring within the Community boundary	114,034			114,034
Sub-Total	(community induced framework only)	**114,034**			**114,034**
V	Agriculture, Forestry, and Other Land Use				
V.1	Emissions from livestock	3,449			3,449
V.2	Emissions from land (not included in total)	-312,232			-312,232
V.3	Emissions from aggregate sources and non-CO_2 emission sources on land	338			338
Sub-Total	(community induced framework only)	**3,786**			**3,786**
VI	Other Scope 3				
VI.1	Other Scope 3			NE	NE
Total	**(community induced framework only)**	**1,723,137**	**31,853**	**28,523**	**1,783,513**

NOTES:
Cells in green are required for BASIC reporting.
Cells in green and blue are required for BASIC+ reporting.
Cells in purple are for disclosure purposes only but are not included in the summary totals as required by the GPC Protocol.
Cells in orange are not required for BASIC or BASIC+ reporting

Breakdown of Energy & GHG Emissions

Under the BASIC+ method, the CRD's GHG emissions totaled 1,783,243 tCO_2e. On a per capita basis, this works out to 3.9 tCO_2e per person (Table 28).

Table 28 Total Energy and GHG Emissions Per Person by Sector

Sector	Sub-Sector	Energy (GJ)	GHG Emissions (tCO_2e)	GJ Per Capita	tCO_2e Per Capita
Stationary Energy	Residential Buildings	12,632,670	230,418	34	0.5
	Commercial & Institutional Buildings	10,427,644	349,497	28	0.8
	Manufacturing Industries & Construction	-	-	-	-
	Agriculture, Forestry & Fishing activities	-	5,518	-	0.0
	Non-Specified Sources	1,940,981	123,176	5	0.3
	Fugitive Emissions	-	1,622	-	0.0
Transportation	In-Boundary On-road Transportation	11,451,687	678,140	31	1.5
	Trans-Boundary On-road Transportation	104,001	6,159	0	0.0
	Waterborne Navigation	772,682	56,498	2	0.1
	Aviation	272,462	20,250	1	0.0
	Off-road Transportation	1,254,247	79,596	3	0.2
Waste	Solid Waste		104,017		0.2
	Biological Treatment of Waste		13		0.0
	Wastewater Treatment & Discharge		4,414		0.0
IPPU	Product Use		114,034		0.3

Sector	Sub-Sector	Energy (GJ)	GHG Emissions (tCO_2e)	GJ Per Capita	tCO_2e Per Capita
AFOLU	Land-Use: Emissions Sequestered		(401,842)		(0.9)
	Land-Use: Emissions Release		89,610		0.2
	Livestock		3,449		0.0
	Non-CO_2 Land Emission Sources		338		0.0
Total		**38,856,375**	**1,783,513**	**104.4**	**3.9**

Total GHG emissions for 2024 are 1,783,513 tCO_2e and have decreased 11.0% from the 2007 reporting year. Scope 1 and 2 Emissions are 96.6% and 1.8% of the total GHG inventory. Scope 1 emissions are the GHG emissions that result from the combustion of fuel in sources within the CRD's boundaries, primarily from Stationary Energy and Transportation. Scope 1 GHG emissions also include IPPU and some AFOLU GHG emissions. Scope 2 emissions result from the use of electricity supplied to the CRD which includes emissions associated with the generation of electricity and other forms of energy (e.g., heat and steam). Scope 2 emissions are low compared to other geographies, due to the predominance of hydroelectric generation technologies in BC. Scope 3 emissions are emissions from electricity line losses, transboundary traffic, and emissions associated with the CRD that are occurring outside of the CRD's boundaries. For 2024, Scope 3 GHG emissions make up 1.6% of the GHG inventory. This breakdown by emission scope is depicted in Figure 4.

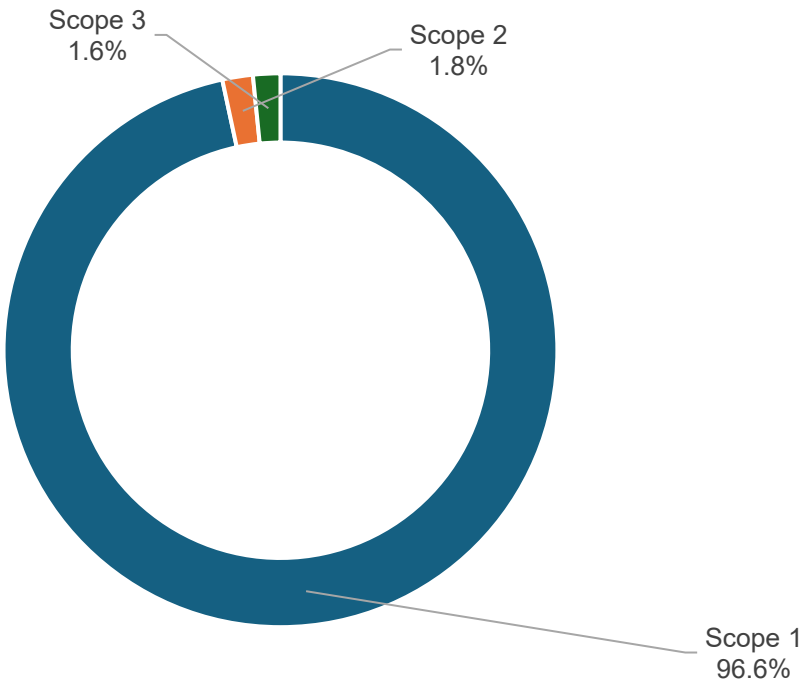

Figure 4 CRD BASIC+ GHG Emissions by Emissions Scope

A breakdown of GHG emissions by reporting scope for the 2007 and 2024 reporting years are presented in Table 29.

Table 29 Change in GHG Emissions Between 2007 & 2024 Reporting Years

Emissions Scope	2007 GHG Emissions (tCO_2e)	2024 GHG Emissions (tCO_2e)	Change
Scope 1	1,841,365	1,723,137	-6.4%
Scope 2	116,129	31,853	-72.6%
Scope 3	47,134	28,523	-39.5%
Total	**2,004,628**	**1,783,513**	**-11.0%**

Sectoral GHG Emissions Analysis

The following sections present an overview of the GHG emissions within each of the GPC sectors.

Stationary Energy

Stationary energy sources are one of the largest contributors to the CRD's GHG emissions. In 2024, excluding sequestered GHG emissions, it contributed 39.8% of the community's GHG emissions. In general, stationary energy emissions include the energy to run manufacturing processes and other industrial activities (e.g., compressor stations), energy to heat and cool residential, commercial, and industrial buildings, as well as the activities that occur within these residences and facilities. Fugitive methane emissions from natural gas pipelines and other distribution facilities, and related off-road GHG emissions, are also reported in this Sector. The table below shows the breakdown of energy use in the stationary energy reporting category.

Table 30 summarizes the energy and GHG emissions for the 2024 reporting year.

Table 30 2024 Energy and GHG Emissions by Stationary Energy Sector

Sector	Electricity (tCO_2e)	Natural Gas (tCO_2e)	Heating Oil (tCO_2e)	Propane (tCO_2e)	Wood (tCO_2e)	Other Sources (tCO_2e)	Total GHG Emissions (tCO_2e)	Total Energy (GJ)
Residential Buildings	22,266	132,703	18,804	24,914	23,905	7,826	**230,418**	**12,632,670**
Commercial & Institutional Buildings	11,433	230,930	1,880			105,254	**349,497**	**10,427,644**
Energy Industries						5,518	**5,518**	
Agriculture, Forestry & Fishing activities						123,176	**123,176**	**1,940,981**
Fugitive Emissions						1,622	**1,622**	
Total GHG Emissions (tCO_2e)	**33,699**	**363,633**	**20,684**	**24,914**	**23,905**	**243,397**	**710,231**	
Total Energy (GJ)	**12,253,985**	**7,218,582**	**302,639**	**408,321**	**1,094,904**	**3,722,864**		**25,001,295**

It can be seen in Figure 5 that natural gas use contributed 51.2% of the CRD's total Stationary Energy GHG emissions.

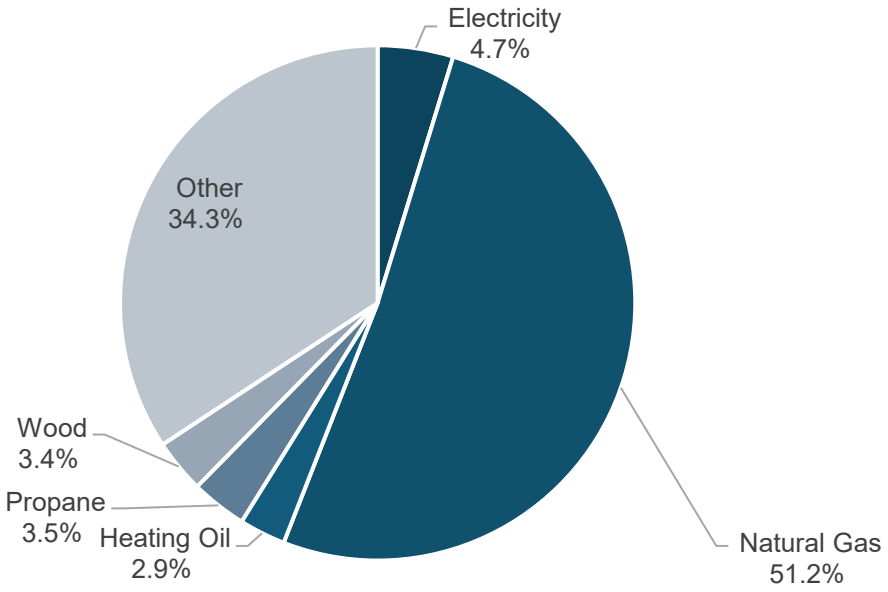

Figure 5 Stationary Energy GHG Emissions Contribution to the GHG Inventory

Figure 6 shows that the stationary GHG emissions largely arise from the operation of residential and commercial buildings.

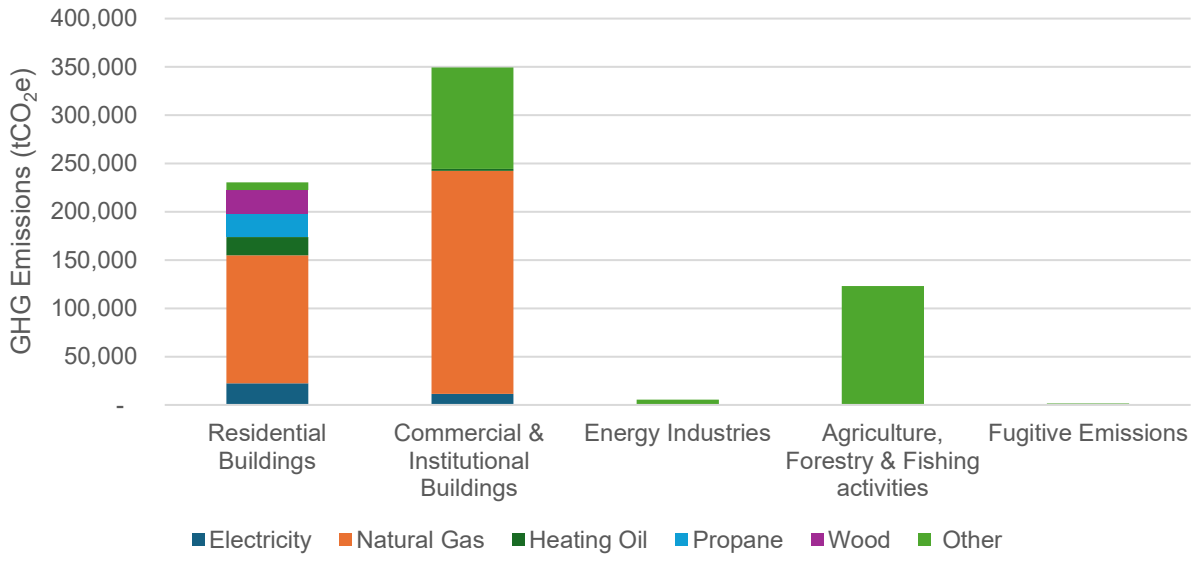

Figure 6 Total Stationary Energy Use By Sub-Sector

Stationary energy GHG emissions have decreased 9.4% as compared to the 2007 base year and 4.4% as compared to the 2023 reporting year (Table 31).

Table 31 Stationary Energy—Energy and GHG Emissions Trends

Sector	Change in tCO_2e: 2007 & 2024	Change in tCO_2e: 2023 & 2024
Residential Buildings	-45.4%	-8.9%
Commercial & Institutional Buildings	29.2%	-1.4%
Energy Industries	1220.1%	-42.4%
Agriculture, Forestry & Fishing activities	37.6%	-0.7%
Fugitives	61.8%	2.7%
Total	**-9.4%**	**-4.4%**

Transportation

Transportation covers all emissions from combustion of fuels in journeys by road, rail, water, and air, including inter-community and international travel. For the 2024 reporting year, transportation GHG emissions accounted for 47.1% of the CRD GHG inventory with the bulk of transportation GHG emissions resulting from the on-road transportation sub-sector (81.4%). The transportation GHG emissions are produced directly by the combustion of fuel or indirectly because of the use of grid-supplied electricity. Unlike stationary emission sectors, transit is mobile and can pose challenges in both accurately calculating emissions and allocating them to the cities linked to the transit activity. The following sections summarize energy and GHG emissions by on-road transportation, which is then followed by off-road transportation (marine, aviation, and other).

Table 32 summarizes the on-road energy and GHG emissions for the 2024 reporting year.

Table 32 2024 On-Road Transportation Energy And GHG Emissions by Fuel Type

Fuel Type	Number of Registered Vehicles	Total Fuel Use	Fuel Use Units	Energy (GJ)	GHG Emissions (tCO_2e)
Electricity	13,999	27,351,645	kWh	98,465	271
Gasoline	276,769	277,027,960	Liters (L)	9,601,789	565,689
Diesel	16,304	47,586,774	Liters (L)	1,840,656	117,501

Fuel Type	Number of Registered Vehicles	Total Fuel Use	Fuel Use Units	Energy (GJ)	GHG Emissions (tCO_2e)
Propane	256	577,033	Liters (L)	14,732	836
Hydrogen	4	-	Liters (L)	-	-
Natural Gas	78	843,497	Kilograms (kg)	45	2
Total	**307,410**	**N/A**	**N/A**	**11,555,688**	**684,299**

Overall, GHG emissions from on-road transportation has decreased by 22.1% compared to the 2007 reporting year. Figure 7 provides a breakdown of GHG emisisons by vehicle classification. More than 80% of the on-road GHG emissions come from light duty vehciles, motorcyles and and trucks.

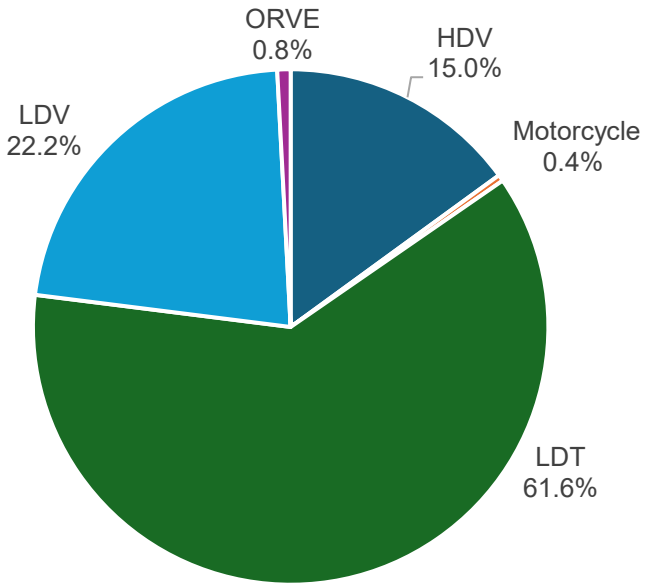

Figure 7 Breakdown of On-Road GHG Emissions by Vehicle Type

Table 33 summarizes the waterborne, and off-road transportation energy and emissions by fuel type. These GHG emissions contribute to 18.6% of the total transportation GHG emissions and 8.8% to the total inventory, after excluding for land use sequestration (Figure 8).

Table 33 2024 Aviation, Waterborne, and Off-Road Transportation Energy and Emissions by Fuel Type

Fuel Type	Total	Units	Energy (GJ)	GHG Emissions (tCO_2e)
Marine Gasoline	6,844	Liters (L)	237	15
Marine Diesel	18,505,126	Liters (L)	715,778	53,252
Marine Natural Gas	1,458,596	Liters (L)	56,666	3,230
Aviation Jet Fuel	7,851,934	Liters (L)	272,462	20,250
Other Off-Road Transportation Diesel	32,426,249	Liters (L)	1,254,247	79,596
Total	**N/A**	**N/A**	**2,299,392**	**156,344**

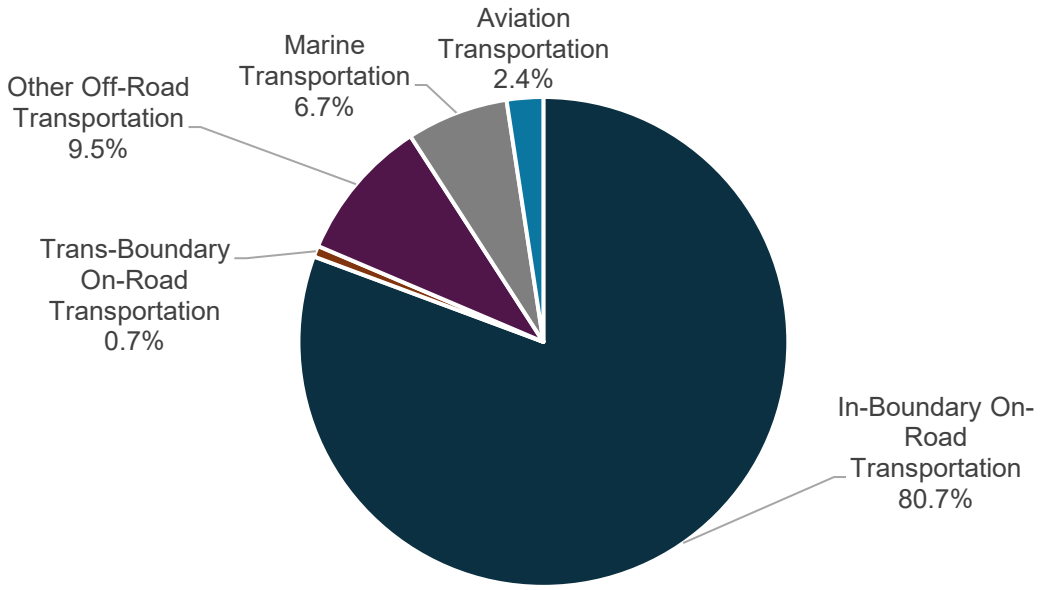

Figure 8 Summary of Transportation GHG Emissions by Sub-Sector

Waste

Communities produce solid waste, compost, and wastewater. Waste does not directly consume energy, but when deposited into landfills, or left exposed to the atmosphere, it decomposes and releases methane (CH_4) gas which is a potent GHG. The GHG emissions from the solid waste, composting, and wastewater

facilities for the reporting year is summarized in the following table. For the 2024 reporting year, waste emissions contributed 6.4% to the GHG inventory after excluding sequestration GHG emissions. A breakdown of the Waste Sub-Sector GHG emissions is presented in Table 34.

Table 34 Summary of Waste Sub-Sector GHG Emissions

Sector	2024 GHG Emissions (tCO_2e)	GHG Emissions Per Capita (tCO_2e / Capita)	Change from Reporting year (2007)
Wastewater Treatment & Discharge	4,414	0.01	-76.8%
Biological Treatment of Solid Waste	6,387	0.01	8631%
Solid Waste	104,017	0.23	-6.3%
Total	**114,818**	**0.25**	**-11.7%**

For the 2024 reporting year, in scope GHG emissions from waste have decreased by 11.7% compared to the 2007 reporting year. Fluctuations in waste will occur over the reporting periods as waste is driven by both the population, as well as economic prosperity in the region. In 2024 waste emission increase because of shift in operations at Hartland landfill. The Solid Waste Sub-Sector contributes just over 90% of total waste GHG emissions (Figure 6).

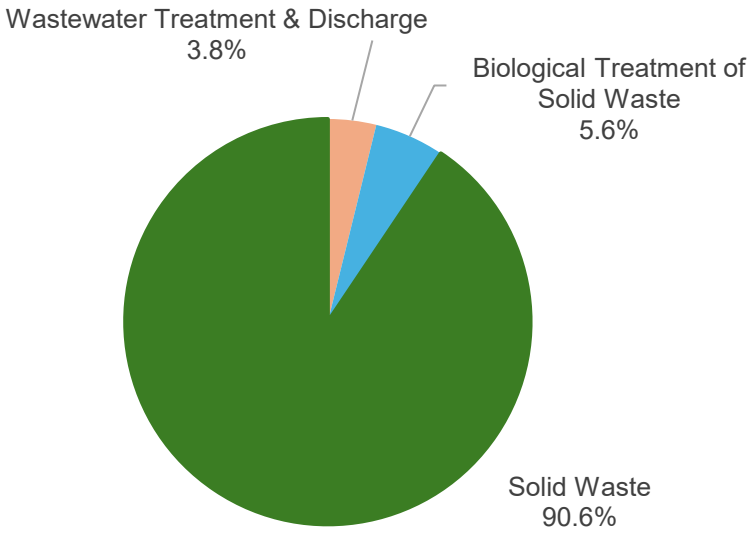

Figure 6 2024 GHG Emissions from Waste

Industrial Processes & Product Use (IPPU)

Reporting on IPPU GHG emissions is required for BASIC+ reporting only. Industrial GHG emissions are produced from a wide variety of non-energy related industrial activities which are typically released from industrial processes that chemically or physically transform materials. During these processes, many different GHGs can be produced. It is not clear if there are industrial GHG emissions occurring within the CRD's boundaries and thus a "Not Estimated" notation is used in the GPC tables.

Also included in the IPPU Sector is Product Use GHG emissions. Certain products used by industry and end-consumers, such as refrigerants, foams, or aerosol cans, also contain GHGs which can be released during use and disposal and thus, as with best-practice, must be accounted for. For the reporting year, only the emissions estimated were production and consumption of halocarbons, SF_6 and NF_3 were estimated for the CRD on the basis that other GHG emissions sources identified in the NIR are not likely to be occurring in the CRD. The sources of these GHG emissions are typically fridges, heat pumps, and air conditioners.

Between the 2007 and 2024 reporting years, IPPU GHG emissions have increased by 61.9% (Table 35). The increase in GHG emissions is largely related to ECCC's estimate of GHG emissions for BC which is allocated to the CRD on a per capita basis.

Table 35 Product Use GHG Emissions for the 2007 and 2024 Reporting Years

Sub-Sector	2007 GHG Emissions (tCO_2e)	2024 GHG Emissions (tCO_2e)	Change
Product Use Emissions	70,418	114,034	61.9%

Agriculture, Forestry, & Other Land Use (AFOLU)

The AFOLU Sector includes GHG emissions from livestock, land use, and all other agricultural activities occurring within the CRD's boundaries.

The following information is provided for disclosure purposes only. Using remotely sensed imagery, land cover data was used to estimate land use changes between the reporting years. In 2024, the CRD's greenspace is estimated to have sequestered and stored 401,842 tCO_2e (Table 36) and released 89,610 tCO_2e for a net effect of 312,232 tCO_2e. Upon review, the result was deemed to contradict expectations relative known trends of development in the region. Therefore, it was excluded from the total inventory calculations.

Table 36 Summary of Land Area & GHG Emissions By Land Use Sector

Land Type	Total Hectares (Ha)	GHG Emissions Sequestered (tCO_2e)	GHG Emissions Released (tCO_2e)
Forest Land	171,008.8	(312,121.9)	-
Cropland	6,347.2	(2,714.9)	-
Grassland	15,864.1	(43,300.6)	-
Wetlands	12,511.1	(43,704.2)	-
Settlements	11,821.8	-	46,066.8
Other Land	13,439.6	-	43,542.9
Total	**230,992.6**	**(401,841.6)**	**89,609.7**

In addition to land use change, GHG emissions from the AFOLU Sector are produced through a variety of non-land use pathways, including livestock (enteric fermentation and manure management), and aggregate sources and non-CO_2 emission sources on land (e.g., fertilizer application). Under this Sector, the CRD reports on GHG emissions from the following sources, and Sub-Sectors:

- Scope 1 GHG Emissions:
  - Livestock:
  - Methane (CH_4) Emissions from Enteric Fermentation
  - Methane (CH_4) Emissions from Manure Management
  - Direct Nitrous Oxide (N_2O) GHG Emissions
  - Aggregate Sources and Non-CO_2 Emissions Sources on Land
  - Direct Nitrous Oxide (N_2O) Emissions from Agricultural Soil Management
  - Indirect Nitrous Oxide (N_2O) Emissions from Applied Nitrogen

The GHG emissions from this source is presented in Table 37. Compared to the 2007 base year, these GHG emissions have decreased 50.9%.

Table 37 Summary of Livestock and Aggregate Sources and Non-CO2 Emissions Sources On Land Change GHG Emissions Between 2007 and 2024

Land Type	2007 GHG Emissions (tCO_2e)	2024 GHG Emissions (tCO_2e)	Change From 2007
Livestock	6,867	3,449	-49.8%

Land Type	2007 GHG Emissions (tCO_2e)	2024 GHG Emissions (tCO_2e)	Change From 2007
Aggregate Sources and Non-CO_2 Emissions Sources On Land	849	338	-60.2%
Total	**7,716**	**3,786**	**-50.9%**

6 Quality Assurance & Quality Control

Quality Assurance and Quality Control (QA/QC) procedures are applied to add confidence that all measurements and calculations have been made correctly and to reduce uncertainty in data. Examples include:

- Checking the validity of all data before it is processed, including emission factors.
- Performing recalculations to reduce the possibility of mathematical errors.
- Recording and explaining any adjustments made to the raw data.
- Documenting quantification methods, assumptions, emission factors and data quality

With respect to the GHG inventory, the data was subject to various quality assurance and quality control checks throughout the collection, analysis, and reporting phases. Specifically, the following procedures were followed:

- Upon receipt of data from the CRD, the data was checked for completeness (e.g., all months of data are present), relevancy (e.g., the correct calendar year is presented), and reasonableness (e.g., comparing similar transportation data sets). Incorrect or incomplete datasets were queried directly with the data provider.
- Where estimates were used (e.g., fuel oil consumption), all possible data sources were considered for their accuracy and relevance to the community before a final method and data source was selected.
- All manual data transfers were double-checked for data transfer accuracy.
- The inventory was compared to other third-party inventories (e.g., CEEI) to assess for reasonableness of the estimates.
- The inventory underwent internal CRD reviews to confirm assumptions, data and reasonableness of the estimates.

7 Recommendations

To remain accurate and reflective of the current community conditions, the CRD should revise and improve its GHG emissions inventory either annually or in line with capital planning cycles (i.e., every 3-4 years), focusing on these general aspects:

- Improving activity data collection and management, including Sector and Sub-Sector allocations.
- Performing recalculations, where applicable, and tracking GHG emissions over time.
- Reviewing methodologies and data to assess for opportunities to improve the estimates.
- Assessing changes to boundaries, methodologies, assumptions, or data that may be material and require a reporting year restatement.

The next section provides a summary of specific GHG inventory improvement recommendations.

Inventory Assumptions, Assessment, & Recommendations

In the preparation of the 2024 GHG emissions inventory, there are several assumptions were made in the analysis that will have some influence on accuracy of the CRD's estimate of GHG emissions. Most emission sources have been calculated with a high level of confidence, due to the presence of utility records, and direct energy and emissions data being provided by stakeholders. Data sources and assumptions with medium to high uncertainty are presented in Table 38 which summarizes the main assumptions, possible impacts on the data, and recommended improvement. It is recommended that the CRD prioritize improvements that are likely to have a material (>5%) influence on the GHG inventory estimate.

Table 38 Summary of GHG Inventory Assumptions, Estimated Impacts, and Recommended Improvements

Sector	Issue / Assumption	Possible Impact on The GHG Inventory	Recommended Improvements
Stationary Energy	Fortis BC provides energy in lump sum amounts for: residential, commercial, and industrial. As such, other sectors, like agricultural	No impact on the GHG inventory. The change would only happen between emission sub-sectors.	Work with the Province and FortisBC to get a more detailed breakdown of energy use by sub-sector.

Sector	Issue / Assumption	Possible Impact on The GHG Inventory	Recommended Improvements
	buildings, could not be split out. A related accuracy issue is the assignment of mixed-use buildings without separate metering.		
Stationary Energy	Propane and wood GHG emissions were estimated by the Province to which the accuracy of the estimates remain unknown.	Immaterial impact on the GHG inventory (<5%)	Consider completing a residential energy labelling program. With such a program, an energy and fuel profile for buildings could be developed so that a reasonable estimate of other fuel use be determined.
Stationary Energy	The CRD estimated heating oil consumption for the member municipalities (except for Saanich and Victoria) using real-estate sales data and an estimated consumption factor.	Immaterial impact on the GHG inventory (<5%)	Consider completing a residential energy labelling program. With such a program, an energy and fuel profile for buildings could be developed so that a reasonable estimate of other fuel use be determined.
Stationary Energy	FortisBC provided a total estimate of fugitive emissions for the CRD region for 2024; however, this did not include upstream fugitive emissions as suggested as best practice by the GPC Protocol.	Immaterial impact on the GHG inventory (<1%)	Work with FortisBC to refine this estimate.
Transportation	The CRD is relying on ECCC data and models applied at a Provincial level to estimate off-road fuel consumption (e.g., construction, etc.). These emissions are assigned on a per capita basis. It is likely that this approach is over-estimating and possibly double counting GHG emissions.	Possibly material (>10%) impact to the GHG inventory.	Work with member municipalities to estimate infrastructure and building construction GHG emissions for different project types. Use this information with building and infrastructure construction data to estimate these GHG emissions.
Transportation	The Victoria International Airport does not report on GHG emissions from tenants or aircraft. Keeping in line with the GPC Protocol, only	Immaterial impact on the GHG inventory (<5%)	The Victoria International Airport will not be collecting or reporting on GHG emissions from tenants or

Sector	Issue / Assumption	Possible Impact on The GHG Inventory	Recommended Improvements
	the aircraft GHG emissions were estimated using NAV Canada airplane movement statistics, estimated taxi times, and estimated fuel use. The fuel use only accounts for departing and arriving planes up to 3,000ft to avoid double counting with other cities.		aircraft. This is the best available data at this point.
Transportation	The GHG emissions from recreational watercraft and US/Can ferries were estimated based on a publicly available year 2000 study for the Victoria, Vancouver, and Washington harbors.	Immaterial impact on the GHG inventory (<5%)	Work with the Victoria Harbor Master as they begin to deploy a database tracking the types and number of boats entering the Victoria harbor.
Transportation	The GHG emissions from marine aviation are estimated based on Victoria Harbor NAV Canada air traffic movements and an estimate of fuel consumption for a typical plane.	Immaterial impact on the GHG inventory (<5%)	Work with Harbour Air and other marine aircraft companies to provide fuel consumption volumes.
Transportation	The GHG inventory does not include refrigerant losses from vehicles. Derive a method to estimate these GHG emissions.	Immaterial impact on the GHG inventory (<5%)	Develop a method to estimate these GHG emissions.
Waste	There is tracking to the origin of solid waste but is based on reported origin which may or may not be accurate. For example, some haulers will identify that they are hauling waste from Victoria when in fact the waste is originating from Saanich.	There is no impact to the GHG Inventory for the CRD but will have impacts to the CRD member inventories.	Work with waste haulers to devise a better system to track waste origination.
Waste	The inventory does not estimate the fugitive emissions from septic tanks.	Immaterial impact on the GHG inventory (<1%)	Work with member municipalities to inventory the number of homes on septic systems so that an estimate can be derived.

Sector	Issue / Assumption	Possible Impact on The GHG Inventory	Recommended Improvements
Waste	The inventory does estimate open burning GHG emissions.	Immaterial impact on the GHG inventory (<1%)	Work with member municipalities to estimate the likely occurrence of open burning in their jurisdictions so that an estimate can be derived.
IPPU	Product use emissions were estimated on a per capita basis using the 2025 NIR estimates. The product use emissions were estimated by the NIR using an IPCC Tier 1 approach and thus will have high uncertainty. There are many emission sources in this category, but the largest one is likely from building air conditioner and heat pump units.	Immaterial impact on the GHG inventory (<5%)	Explore the use of using LIDAR to estimate the number of air conditioners on buildings, and other means to collection information on how many residential buildings have heat pumps and air conditioners. Use this information to estimate refrigerant losses.
AFOLU	GHG estimates for land use change are based on a period of years (2011-2019) and thus were averaged for each period. As there was no current data, land use change for the reporting year was estimated using the average value between the data years.	Immaterial impact on the GHG inventory (<5%)	Work with the planning department to track land-use change annually so that a more refined estimate can be made.
AFOLU	The land-use sequestration and storage GHG emission factors are taken from the literature, for BC ecozones, and may not reflect the productivity, or lack thereof, of land uses in the CRD. The land-change emission factors for changes between land types were derived by the Province. These are average values by ecozone and are based on a 20-year horizon. Since land-use change in the CRD is typically related to development, it was assumed that the loss of emissions is	Possibly a material impact on the GHG inventory (>10%)	Work with the Province and the post-secondary institutions to derive refined sequestration emission factors.

Sector	Issue / Assumption	Possible Impact on The GHG Inventory	Recommended Improvements
	immediate which may overestimate GHG emission losses. In both emission factor applications, the use of non-site emission factors may result in an over or underestimate of GHG emissions.		

8 References

Environment and Climate Change Canada. 2025. National Inventory Report 1990 to 2023: Greenhouse Gas Sources and Sinks in Canada. Part 1-3. April 2025. Available at: https://unfccc.int/national_reports/annex_i_ghg_inventories/national_inventories_submissions/items/8812.php

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