Town of Parry Sound

Corporate Milestone 1

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1. Methodology

1.1 Greenhouse Gas (GHG) Inventory

A greenhouse gas inventory brings together data on community and municipal sources of greenhouse gas emissions to estimate emissions for a given year. Two separate GHG inventories and forecasts have been created for the Town of Parry Sound: one for municipal corporate operations and one for community sources. As per the PCP protocol, the inventories consist of the following sources of GHG emissions.

Corporate	*Community*
-Buildings	-Residential
-Streetlights	-Commercial and institutional
-Water and sewage treatment	-Industrial
-Municipal fleet	-Transportation
-Solid Waste	-Solid Waste

1.2 Scope

This document will focus solely on ***corporate*** emissions.

1.3 Baseline Year

A baseline year of 2016 was selected because it is the year in which the most recent publicly available municipal greenhouse gas emissions data could be retrieved. 2016 also happens to be the most recent Statistics Canada Census year, providing the most recent data on population statistics. Additional data was gathered from other years as well, where relevant, and was referred to throughout the data analysis process. In the event that actual data could not be collected for the baseline year, assumptions were applied from prior, or successive years where relevant. Establishing a baseline is a useful tool to identify areas for improvement, inform development of a GHG reduction action plan, estimate cost savings from reductions, and serve as a reference point to track improvements.

1.4 Data Collection

Energy and emissions quantities were collected for the Town of Parry Sound and compiled into an internal database for analysis and calculation.

1.5 Data Sources

Corporate energy usage, emissions, and yearly expenditures were calculated for 2016 and reported by sector (buildings and facilities, fleet vehicles, streetlight, water and wastewater, and corporate solid waste) as well as by emissions source (electricity, natural gas, propane, fuel oil, gasoline, diesel, waste, and wastewater). In some cases, data sources varied depending on the type of expenditure required to calculate emissions. The majority of corporate data was obtained from the Government of Ontario's open data catalogue, 'Energy use and greenhouse gas

emissions for the Broader Public Sector[1],' as reported by each municipality under *O. Reg 397/11*[2]. If the data was unavailable on BPS 2016, Parry Sound staff provided the missing data. For a detailed summary of corporate data sources, please refer to Table 1.

Table 1: Corporate Data Sources

Emission Sector	Municipality	Source	Quality of Data	Notes
Building/ Facilities	Parry Sound	BPS, 2016	High	Actual energy consumption per source, per building.
Streetlights	Parry Sound	BPS 2016	High	Actual energy consumption in kWh.
Fleet	Parry Sound	Municipality	Medium	Actual fuel consumption for 2017 and 2018 retroacted for 2016.
Water/ Wastewater	Parry Sound	BPS 2016	High	Actual energy consumption per source, per facility related to water and wastewater operations.
Solid Waste	Parry Sound	Municipality	Low	Calculation based primarily on assumptions.

Legend for data quality:

-High: Actual usage data covering the period of the inventory year, from a credible data collector/ provider
-Medium: Actual usage data provided, with some assumptions from within or around the geographic boundary, inventory year, or otherwise to fill in data gaps
-Low: Usage data provided, but mainly based on assumptions.

1.5.1 Buildings and Facilities

Actual energy consumption data by each emission source for each municipal building and facility was obtained from the Government of Ontario's open data catalogue, 'Energy use and greenhouse gas emissions for the Broader Public Sector[3],' as reported by each municipality under *O.Reg 397/11*.

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[1] https://www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector
[2] https://www.ontario.ca/laws/regulation/110397
[3] https://www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector

1.5.2 Water and Wastewater

Actual energy consumption data by each emission source for each facility related to water and wastewater treatment/ processing was obtained from the Government of Ontario's open data catalogue, 'Energy use and greenhouse gas emissions for the Broader Public Sector[4],' as reported by each municipality under *O.Reg 397/11.*

1.5.3 Streetlights

Actual energy consumption as an aggregate of kWh for all streetlights in the Town of Parry Sound was obtained from the Government of Ontario's open data catalogue, 'Energy use and greenhouse gas emissions for the Broader Public Sector[5],' as reported by each municipality under *O.Reg 397/11.*

1.5.4 Fleet Vehicles

Actual fuel consumption in litres for the years 2017 and 2018 was provided by Town of Parry Sound staff. Staff also provided a complete inventory of municipal vehicles and equipment organized by department to assist with developing assumptions for calculation.

1.5.5 Solid Waste

GHG emissions from solid waste is a unique emission source to be quantified by local governments. As a result, this presented difficult reporting and calculation challenges. These emissions reflect the impact of methane released through the decomposition of organic matter in landfills and can be calculated based on total waste deposited in a landfill. With waste generation data pertaining solely to corporate operations being unavailable, Georgian Bay Biosphere Reserve (GBBR) estimated the quantity of solid waste generated at corporate buildings and facilities based on approximations of the size of garbage bins used, their average fullness, and the frequency of their pickup per the PCP protocol. This was used in combination with actual tonnage of waste sent to the McDougall landfill from the MacFarlane St. Transfer Station in Parry Sound to disaggregate corporately generated solid waste from community generated solid waste.

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[4] https://www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector

[5] https://www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector

2. Calculation Process

2.1 Buildings and Facilities

There is only one formula for calculating building emissions from municipal operations. Fortunately, these emissions have already been calculated and made publicly available as per *O. Reg 397/11*. For reference, a simplified version of the formula for calculating building and facility emissions as per PCP protocol is as follows.

2.1.1 Formula

$$\sum (FC * Cef) + (FC * CHef * CHwp) + (FC * Nef * Nwp)$$

Where:

FC = Amount of fuel by type consumed

Cef = Emission factor for Carbon Dioxide (CO_2)

CHef = Emission factor for Methane (CH_4)

Nef = Emission factor for Nitrous Oxide (N_2O)

CHwp = Global warming potential of Methane

Nwp = Global warming potential of Nitrous Oxide

2.1.2 Assumptions

No assumptions were made in calculating GHG emissions produced by corporate buildings and facilities because actual consumption data was available.

2.1.3 Outcome

The Town of Parry Sound's buildings and facilities produced **205** tonnes of CO^2e in 2016. These emissions were produced by consuming **7,865** GJ of energy.
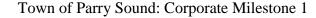
2.2 Water and Wastewater

The formula to calculate water and wastewater emissions is the same as the formula used to calculate building and facilities emissions. However, the formula is strictly used for the buildings and facilities involved in the processing and treatment of water and wastewater. For reference, a simplified version of the formula for calculating water and wastewater as per PCP protocol is as follows.

2.2.1 Formula

$$\sum (FC * Cef) + (FC * CHef * CHwp) + (FC * Nef * Nwp)$$

Where:

FC = Amount of fuel by type consumed

Cef = Emission factor for Carbon Dioxide (CO_2)

CHef = Emission factor for Methane (CH_4)

Nef = Emission factor for Nitrous Oxide (N_2O)

CHwp = Global warming potential of Methane

Nwp = Global warming potential of Nitrous Oxide

2.2.2 Assumptions

No assumptions were made in calculating GHG emissions produced by municipal water and wastewater infrastructure because actual consumption data was available.

2.2.3 Outcome

The Town of Parry Sound's water and wastewater infrastructure produced **236** tonnes of CO^2e in 2016. These emissions were produced by consuming **13,730** GJ of energy.

2.3 Streetlights

There are multiple formulas that can be used to calculate the emissions produced by streetlights. However, since actual consumption data was available through the Government of Ontario's open data catalogue, 'Energy use and greenhouse gas emissions for the Broader Public Sector[6], the formula corresponding to actual consumption data as per PCP protocol was used. For reference, a simplified version of the formula for calculating GHG emissions produced by streetlights as per PCP protocol is as follows.

2.3.1 Formula

$$\sum (FC * Cef) + (FC * CHef * CHwp) + (FC * Nef * Nwp)$$

Where:

FC = Amount of electricity consumed

Cef = Carbon Dioxide (CO_2) emission factor for electricity

CHef = Methane (CH_4) emission factor for electricity

Nef = Nitrous Oxide (N_2O) emission factor for electricity

CHwp = Global warming potential of Methane

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[6] https://www.ontario.ca/data/energy-use-and-greenhouse-gas-emissions-broader-public-sector

Nwp = Global warming potential of Nitrous Oxide

2.3.2 Assumptions

No assumptions were made in calculating GHG emissions produced by streetlights because actual consumption data was available.

2.4.2 Outcome

The Town of Parry Sound's streetlighting produced **12** tonnes of CO^2e in 2016. These emissions were produced by consuming **1,173** GJ of energy.

2.5 Fleet

There are multiple methods to calculating the amount of fuel consumed by the fleet. Once determined, a standard formula for calculating the GHG emissions produced by a corporate fleet can be applied. For reference, a simplified version of this formula, as per PCP protocol is as follows.

2.5.1 Formula

$$\sum (FC * VTC) + (FC * VTCHef * CHwp) + (FC * VTNef * Nwp)$$

Where:

FC = Amount of fuel by type consumed

VTC = Emission factor by vehicle type for Carbon Dioxide (CO_2)

VTCHef = Emission factor by vehicle type for Methane (CH_4)

VTNef = Emission factor by vehicle type for Nitrous Oxide (N_2O)

CHwp = Global warming potential of Methane

Nwp = Global warming potential of Nitrous Oxide

2.5.2 Assumptions

Actual fuel consumption data for the year 2016 was unavailable. However, actual fuel consumption data was available for the years 2017 and 2018. As a result, actual fuel consumption data from these years was used to estimate the amount of fuel for the year 2016. To estimate the amount of fuel consumed by the Parry Sound fleet in 2016, the growth rate of fuel consumption between 2017 and 2018 was first calculated using the following formula.

$$\frac{Present - Past}{Past}$$

Interestingly, aggregate fuel consumption witnessed a very small negative growth. Further breaking down the data revealed that the quantity of diesel consumed decreased, while the

quantity of gasoline consumed increased. Therefore, the negative growth rate of aggregate fuel consumption was attributed to a greater decline in the quantity of diesel consumed than the increase in the quantity of gasoline consumed. To further validate the negative growth rate of aggregate fuel consumption, Parry Sound's municipal operations have experienced a consistent downward trend in reported GHG emissions since 2011. This indicates that efforts to conserve energy have been extended, validating the negative growth rate.

It was assumed that growth rates remain relatively stable given the nature of municipal operations and the 2017 to 2018 growth rates can therefore be applied for the period 2016 to 2017. The outcome, using the following formula, yielded fuel consumption data that is credible given known fuel consumption data.

$$FV = PV \, (1 + g)^n$$

Where:

FV = Future value

PV = Present value

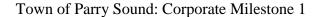g = Growth rate

n = Number of years apart

Rearranging the formula then creates the following formula.

$$PV = \frac{FV}{(1 + g)^n}$$

Unfortunately, disaggregated data on fuel consumption per vehicle or equipment does not exist. As a result, fuel consumption was allocated as follows. For vehicles and equipment consuming diesel an even allocation of fuel was given to each vehicle and equipment. Given the jurisdiction of the Township of Parry Sound, it was assumed that vehicles are driven shorter distances and to transport employees to and from a job site. However, while on the job site, they will then be using equipment. Fuel efficiency ranges between all vehicles and equipment. However, when contrasting subsectors (i.e. truck to truck, equipment to equipment, etc.) there is a relative consistency between emission technology and therefore the GHG coefficient associated with that technology. For example, the 2015 JCD Backhoe may have consumed more fuel than the 2012 MT6 Trackless – but given that they fall under the same category and receive the same emission factors, the GHG outcome would equate to the same amount.

A similar thought process was used for gasoline powered vehicles and equipment. To begin, the types of equipment that consume gasoline are fairly seasonal and consume small amounts of fuel (i.e. weed whackers, push lawn mowers, etc.). As a result, 5% of total gasoline was allocated to small equipment and split evenly between departments and engine type (2-stroke and 4-stroke) because there is no record of what constitutes small equipment for each department, and the quantity in which it exists. Each ATV and Gator was allocated 25L because of their infrequent use, however, this is likely to be underestimated. The remaining gasoline usage was then split

between gasoline powered vehicles for the same reason as diesel. Given the years and models of vehicles, there is a high degree of consistency in the emission technology within the vehicles, making emission factors the same, and in turn equating to a GHG outcome with minimal disparity.

2.5.3 Outcome

The Town of Parry Sound's fleet produced an estimated **274** tonnes of CO^2e in 2016. These emissions were produced by consuming **3,980** GJ of energy.

2.6 Solid Waste

Since actual data on corporately generated waste is not available, local governments can estimate the quantity of solid waste generated at corporate buildings and facilities, as well as community produced waste that is diverted as part of municipal operations (i.e. parks and sidewalk garbage receptacles). This estimate is determined on the size of garbage bins used, their average fullness at pickup, and the frequency of pickup (PCP Protocol, Approach #2, p.22)[7].

The type of landfill is another determinant of the formula used for estimating emissions from corporate solid waste. For reference, a simplified version of this formula, as per PCP protocol is as follows.

2.6.1 Formula

$$\sum 21 * (GBC * BF * PU * 2.136) * \left(\left(\frac{16}{12} \right) * MCF * DOC * DOCF * F \right) (1 - MR)(1 - OX)$$

Where:

GBC = garbage bin capacity (m^3)

BF = Approximately how full the bin is when it is emptied (%)

PU = Frequency of pickup (times per month)

MCF = Methane correction factor

DOC = Degradable organic content

DOCF = Fraction of DOC dissimilated

F = Fraction of methane in landfill gas

MR = Methane recovery at landfill (%)

OX = Oxidation Factor

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[7] https://data.fcm.ca/Documents/reports/PCP/PCP_Protocol_Canadian_Supplement_EN.pdf

2.6.2 Assumptions

Data on the actual corporate solid waste generated by the Town of Parry Sound in 2016 does not exist. Gaining an understanding of solid waste practices and policies can help to determine some of the factors and coefficients of the formula that are determinant on landfill management and operations.

When solid waste is generated, it is either sent to the transfer station or collected by Waste Connections Canada, who provides a waste pickup service for the Town of Parry Sound. If it is picked up by Waste Connections Canada it is disposed of at an undetermined landfill. If it is sent to the transfer station, it is placed into a large container where it will remain until the container's capacity has been reached and sent to the McDougall landfill. However, this waste is mixed in with community generated waste as part of the solid waste service the transfer station provides to citizens. As a result, the tonnage of solid waste from the transfer station reported by the McDougall landfill can only be used as a reference to determine the accuracy of the solid waste estimate. Given that only a minor amount of waste is diverted by Waste Connections Canada, for calculation purposes, it was assumed that all corporate solid waste was sent to the McDougall landfill.

Staff from the McDougall landfill informed GBBR that no emission capture technology exists. This is because a feasibility study was undertaken, which determined that it was economically unfeasible to purchase the technology and embark on installation. While this technology does not exist, the landfill is still being actively managed. Garbage is compacted daily to reduce its volume and then buried to allow for additional landfill space, and to deter wildlife. The landfill is also classified as engineered. The landfill is lined to capture leachate, which is then removed and sent to an offsite treatment facility for processing. These factors helped to determine assumptions on several of the values required by the formula.

Next was the process of determining the quantity of solid waste produced. It was assumed that buildings with a relatively small amount of daily occupants (Parry Sound Snowmobile District, Fire Hall, Town Office, Chamber of Commerce, Dog Pound, Transfer Station, Old CPR Train Station, Old Fire Hall, and Operations Building) had a single bin for garbage, sized at $0.08m^3$, and was removed weekly to eliminate any odours. Buildings that are heavily used by the public (Bobby Orr Community Centre and Stockey Centre) were assumed to have a 2-yard dumpster, or $1.52911m^3$, on site to facilitate the higher volume of generated waste. Municipal staff indicated that due to seasonal variability, the Bobby Orr Community Centre dumpster is approximately 40% full on average and emptied weekly by Waste Connections Canada. The Stockey Centre was assumed to be emptied less frequently because it receives high visitation at low frequencies, compared to the Bobby Orr Community Centre's high visitation at high frequencies.

When emptying the garbage bins at the various town parks, staff employees typically bring 4, 32 gallon garbage bins to transport waste from the park receptacle to the transfer stations for means of efficiency. Receptacles are emptied every day, but only during the summer months (June-September) are they in place. Therefore, when calculating how many times a month park bins are emptied, an average across all months was taken (30 times (daily)/ 4 months in place = 7.5 times

each month for the year). Given the quantity of parks, and the variability of park visitors throughout the parks, it was assumed that these bins are 85% full on average when they are emptied. The same logic was used for garbage receptacles along sidewalks. However, some of these bins are in place year round. To account for this difference, it was assumed that on average, sidewalk garbage receptacles were emptied every few days, or ten times a month, with a fullness of 60% to account for seasonality.

2.6.3 Outcome

The Town of Parry Sound's solid waste produced an estimated **33** tonnes of CO^2e in 2016.

2.7 Business as Usual

In calculating the business-as-usual (BAU) forecast, the year 2030 was chosen as the forecast year.

2.7.1 Assumptions

In their 2016 Population Census, Statistics Canada reported that the Town of Parry Sound experienced a 4% growth in population between the years 2011 and 2016. Given that BAU is determined by annual population growth, it was assumed that population grew by an even amount each year. As a result, the 4% growth rate was divided by the number of years over which the growth occurred (5) to estimate the annual population growth rate. After calculation, it was estimated that the Town of Parry Sound experiences 0.8% annual population growth. Following PCP protocol, this 0.8% growth rate was used to determine the forecasted emissions for the year 2030.

2.7.2 Outcome

Given a 0.8% population growth rate forecasted to the year 2030, the Town of Parry Sound is expected to produce 850 tonnes of CO_2e in 2030, representing a 12% increase from baseline levels, if business is to continue as usual.