Township of The Archipelago

Corporate Milestone 1

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Prepared by:

Organization: Georgian Bay Biosphere
Name: Benjamin John
Position: Climate Change & Energy Specialist
Contact: climate@gbbr.ca

Reviewed by:

Organization: Georgian Bay Biosphere
Name: David Bywater
Position: Conservation Program Manager
Contact: conservation@gbbr.ca

Approved by:

Organization: Township of The Archipelago

Name: Cale Henderson
Position: Manager of Development and Environmental Services
Contact: chenderson@thearchipelago.on.ca

Name: Alice Barton
Position: Councillor
Contact: alice.barton@gmail.com

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 Township of The Archipelago: 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 -Streetlights -Water and sewage treatment -Municipal fleet -Solid Waste	-Residential -Commercial and institutional -Industrial -Transportation -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 consumption 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 Township of The Archipelago and compiled into an internal database for analysis and calculation.

1.5 Data Sources

Corporate energy usage, and emissions 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, Archipelago staff provided the missing data. For a detailed summary of corporate data sources, please refer to Table 1.

Emission Sector	***Municipality***	***Source***	***Quality of Data***	***Notes***
Building/ Facilities	Archipelago	BPS, 2016	High	Actual energy consumption per source, per building.
Streetlights	Archipelago	Municipality, Hydro One	High	Actual energy consumption in kWh.
Fleet	Archipelago	Municipality	High	Actual billed fuel consumption for each fleet vehicle.
Water/ Wastewater	Archipelago	DNE	DNE	The Township of The Archipelago does not provide water or wastewater services.
Solid Waste	Archipelago	Municipality	Medium/ Low	Calculation based on actual waste generated data and 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
-DNE: Does not exist

1.5.1 Buildings and Facilities

Actual energy consumption data by each emission source for each municipal building and facilities 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*.

[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

The Township of The Archipelago is primarily a water-based municipality. This imposes limitations that make providing water and wastewater services economically unfeasible to the municipality's relatively small population.

1.5.3 Streetlights

Actual energy consumption in kWh was provided by the municipality for all streetlights in the Archipelago. This data was gathered by compiling energy consumption receipts billed to the Archipelago by Hydro One.

1.5.4 Fleet Vehicles

Actual fuel consumption in litres by vehicle was provided by Archipelago staff.

1.5.5 Solid Waste

GHG emissions from solid waste are unique emissions typically 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 Archipelago Township Office, and information gathered from municipal staff on waste management practices and policies. Waste sent to the McDougall landfill from the Archipelago's various transfer stations is mixed with community waste because no curbside waste collection program exists. This resulted in the tonnage reported to be an inaccurate representation of the Archipelago's waste generation.

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 Township of The Archipelago's buildings and facilities produced **41** tonnes of CO^2e in 2016. These emissions were produced by consuming **1,070** GJ of energy.

2.2 Water and Wastewater

The Township of The Archipelago does not provide water or wastewater services to its residents because of geographic and economic limitations. As a result, no GHG emissions are generated through this category and no calculation is warranted. However, for reference, a simplified version of the formula for calculating water and wastewater emissions as per the 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

2.3 Streetlights

There are multiple formulas that can be used to calculate the emissions produced by streetlights. However, since actual consumption data was provided by municipal staff from Hydro One, the formula corresponding to actual consumption data as per the PCP protocol was used. For reference, a simplified version of the formula for calculating GHG emissions produced by streetlights as per the 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

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 Township of The Archipelago's streetlighting produced **0** tonnes of CO^2e in 2016. These emissions were produced by consuming **43** GJ of energy.

2.5 Fleet

Actual fuel consumption data by vehicle was provided by municipal staff. 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

No assumptions were made in calculating the emissions produced by the corporate fleet. It should be noted that because the Archipelago is primarily a water-based municipality, reflecting the emissions produced by the Archipelago's boats was necessary. These boats are used for daily operations during the months when water access is available. Unfortunately, the PCP tool does not provide a listing specifically for boats, and were therefore categorized as offroad vehicles.

2.5.3 Outcome

The Township of The Archipelago's fleet produced an estimated **228** tonnes of CO^2e in 2016. These emissions were produced by consuming **3,241** 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)[4].

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 the 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

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

F = Fraction of methane in landfill gas

MR = Methane recovery at landfill (%)

OX = Oxidation Factor

2.6.2 Assumptions

Data on the actual corporate solid waste generated by the Township of The Archipelago 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 sent to the various transfer stations located throughout the municipality. Once transfer stations have reached capacity, solid waste is then diverted to the McDougall landfill. However, this waste is mixed in with community generated waste as part of the solid waste service the transfer stations provide to residents. As a result, the tonnage of solid waste from the transfer stations reported by the McDougall landfill can only be used as a reference to determine the accuracy of the solid waste estimate.

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. Municipal staff mentioned that beginning in 2019, waste from the Township Office was being sent directly to the McDougall landfill and weighed upon arrival. Municipal staff provided this data, but since 2019 is only partially over, an average of this year's waste per month was calculated and applied to the remaining months. While this is not 2016 data, it is the most accurate, and relevant data for this building that can be gathered at this time. Municipal staff also informed GBBR that historically, the Pointe au Baril Community Centre has only had two waste receptacles. These receptacles are continuously monitored and emptied when close to full. During July and August they are generally emptied weekly, and are emptied bi-weekly during May, June, September, and October. This information was then used to create a monthly average which could be applied across the entire year. A similar allocation was given to the Archipelago Works Garage. However, because the Township of The Archipelago has an expansive geographic jurisdiction with only a few waste receptacles, it was assumed that waste generated during daily operations must be held until returning to the works garage at the end of the day to be disposed of. As a result, a 2 cubic yard dumpster was allocated to the Archipelago Works Garage to account for this assumed accumulation of waste.

2.6.3 Outcome

The Township of The Archipelago's solid waste produced an estimated **11** 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 Township of The Archipelago experienced a 6.2% decline in population between the years 2011 and 2016. However, given that the BAU forecast is determined by annual population growth, it was determined that the reported decline in population would be unrepresentative of corporate operations and the projected BAU for the following reasons.

Geographically positioned on the Eastern shoreline of Georgian Bay and in the heart of cottage country, the Township of The Archipelago is a major tourist destination. In fact, the seasonal population in the warmer months raises the population from 531 permanent residents, to over 13,000 seasonal residents. Yet Statistics Canada only accounts for the 531 permanent residents in their 2016 Population Census. As a result, Statistics Canada's population decline is derived from permanent residents, failing to account for the major seasonal population influx. This is problematic and unrepresentative in producing a BAU forecast because the services and amenities provided by corporate operations are not restricted for permanent resident use only. Therefore, as seasonal population grows, so too will corporate operations, and the associated GHG emissions. Essentially, using Statistics Canada's population decline would demonstrate that there would be a natural decrease in GHG emissions as population shrinks, a situation which can logically be assumed to be untrue, given that municipal operations are conducted on behalf of all residents residing in the jurisdiction, not just the permanent ones. As a result, the following methodology and assumptions were considered in producing a growth statistic that would factor seasonal population in producing a BAU forecast.

Data was first retrieved from the Municipal Property Assessment Corporation (MPAC). This data was referenced because it classifies each property in Ontario according to its functional purposes. For example, data entries categorized as a 300 series property are classified as a residential property, including both permanent residences and seasonal residences.

It can be difficult to assume the number of people that are staying at a seasonal residence at any given time. For example, it is common for multiple families to rent a seasonal residence throughout the summer. This produces a high degree of variability in the population of any single seasonal residence, as one week could have 3 residents occupying the premises and the following week could have 8. From a calculation perspective, the most appropriate response would be to use a provincial statistic, such as number of residents per household. However, given that this statistic would have an incredibly low degree of variability between years, such as a matter of one-one hundredth of a person, the calculated growth rate would equate to the same value as if

just the growth rate of property numbers as determined by MPAC was used. Therefore, it was assumed that the growth rate of the number of residential properties and population would be the same, and that municipal operations would grow at a similar rate to match the added demand of municipal services. As a result, the annual growth rate of residential properties was used to determine the BAU forecast.

Given that the BAU forecast was determined by annual residential property growth, multiple years of growth data was used to eliminate the possibility of an outlier skewing the calculation result. With this consideration, the residential property growth rate was calculated for each year from 2011 to 2016, and then averaged. This resulted in an average annual residential property growth rate of 0.26%. Following PCP protocol, this 0.26% growth rate was used to determine the forecasted emissions for the year 2030.

2.7.2 Outcome

Given a 0.26% residential property growth rate forecasted to the year 2030, the Township of The Archipelago is expected to produce 291 tonnes of CO^2e in 2030, representing a 4% increase from baseline levels, if business is to continue as usual.