CITY OF BAINBRIDGE ISLAND

CLIMATE CHANGE
ADVISORY COMMITTEE
SPECIAL MEETING
MONDAY, NOVEMBER 18, 2019
6:30 – 8:30 PM
CITY HALL
COUNCIL CONFERENCE ROOM
280 MADISON AVENUE NORTH
BAINBRIDGE ISLAND, WA 98110

# AGENDA

| | | | |
|---|---|---|---|
| Members: | Jens Boemer | Lara Hansen | David McCaughey (Co-Chair) |
| | Derik Broekhoff | Gary Lagerloef | Nora Ferm Nickum |
| | Michael Cox (Co-Chair) | Julie Matthews | Deborah Rudnick |
| Liaison: | Joe Deets | | |

6:30: Call meeting to Order/Roll Call/Accept of Modify Agenda/Conflict of Interest Disclosure

6:35: Approve October 16th minutes

6:40: Public Comment

6:50: GHG Emissions Inventory Discussion

7:10: Updates/Report Outs/Discussion

- Climate Action Plan Development
- Community Workshops
- December 3rd City Council Study Session
- Green Building Code
- PSE

8:15: Other Business

8:30: Adjourn

## Materials

1. October minutes
2. GHG Emissions Inventory Report
3. GHG Emissions Inventory Factsheet
4. GHG Emissions Inventory Revisions
5. GHG Emissions Inventory Comments
6. Climate Action Plan Draft Goals
7. Community Workshop Overview

For special accommodations, please contact Roz Lassoff
206-780-8624 or at rlassoff@bainbridgewa.gov

**CLIMATE CHANGE ADVISORY COMMITTEE**

**Regular Meeting**

**Thursday, October 16, 2019, 6:30-8:30 PM**
**Bainbridge Island City Hall**

**MINUTES**

Present: Committee members Jens Boemer, Michael Cox, Gary Lagerloef, Julie Matthews, Nora Ferm Nickum, Deborah Rudnick; Council Liaison Joe Deets
On the phone: Committee member David McCaughey
Absent: Committee members Derik Broekhoff, Lara Hansen
Public/guests: James Rufo Hill, Rick Freeman, Heather Burger, Erin Hill, Gloria Saylor

1. The meeting was called to order at 6:31 pm.
    - Conflict of interest disclosures: None.

2. Minutes from the previous meeting (September 18, 2019) were approved.

3. Public comment
    - Gloria Saylor said that she has encouraged islanders to take the climate change survey via a post on the Quality Bainbridge Facebook page.

4. Friends of the Farm: Heather Burger, Executive Director, and Erin Hill, board member, came to talk about building a community food system:
    - They noted that there is a connection between industrial agriculture and climate change. It is responsible for 19% of greenhouse gas (GHG) emissions. Food purchased on conventional grocery store shelf travels on average 1,500 miles.
    - Creating a climate-positive food system means growing, processing, and selling as much local food as possible; making local food accessible and affordable; and keeping money in our community; among other things.
    - Bainbridge Island's Comprehensive Plan mentions farms 59 times.
    - How can we reduce our carbon footprint through the food we grow, process, consume?
        - Designate a local food system coordinator within COBI, map the existing food environment, set communitywide goals, and create a plan to implement goals with key performance indicators.
        - Enact policies that support a community food system (create an agricultural resource land zoning designation; facilitate more housing for farm interns; support programming).
        - Provide funding and incentives (e.g., grants or tax credits to support innovative energy systems; funding for local farm-to-school meals; encourage landscaping with edibles at places like city parks).

5. Discussion of Sea Level Rise analysis
    - James Rufo Hill, the principal author of and photographer for this report, came to present on the results. He began the effort while serving on this Committee.
    - Key findings:
        - Most of the City's assets are not exposed to sea level rise.

   - By the middle of this century, many private waterfront residences will face severe flooding, especially along Hedley Spit/Point Monroe, Manitou Beach, and Schel Chelb Estuary/Point White Drive.
   - Other vulnerable assets include the ferry terminal and maintenance facility, the Wyckoff Superfund site, Fay Bainbridge Park, and, to a lesser extent, the Winslow Wastewater Treatment Plant.
   - Accelerated bluff erosion is going to be an issue for houses and septic systems at the tops and bottoms of the bluffs.
   - Saltwater intrusion will push on the edges of the aquifer.
- Next steps: We will forward the report to the City and request a meeting to discuss it.

6. Discussion of draft Climate Action Plan sections
   - We discussed the early draft sections and adjustments to the template.
   - Timeline for next steps:
     - Lead authors will update their chapters by Oct. 23
     - Committee members send comments to chapter leads by Nov. 6
     - Lead authors update their chapters based on that feedback by Nov. 20

7. Updates
   - GHG Inventory Council study session on November 19
   - Community survey has been extended to October 28
   - Community Workshops – subgroup of Mike, Nora, Julie formed to organize
   - Next Climate and Energy Forum will be on November 9, 10-11:30 am, Eagle Harbor Church – topic is carbon offsets and Committee member Derik Broekhoff is a panelist
   - PSE issued their Request for Information for community solar projects
   - The November meeting of this Committee has been rescheduled for Nov. 21

8. The meeting was adjourned at 8:39 pm.

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Co-Chair 11/18/19

# CITY OF BAINBRIDGE ISLAND GREENHOUSE GAS EMISSIONS INVENTORY

FINAL FINDINGS REPORT

2019

CASCADIA CONSULTING GROUP, INC.

**Cascadia Consulting Group, Inc.**
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# Table of Contents

# Acronyms

| | |
|---|---|
| ACS | American Community Survey (from the U.S. Census Bureau) |
| BOD | Biochemical oxygen demand (a metric of the effectiveness of wastewater treatment plants) |
| EIA | United States Energy Information Association |
| EPA | United States Environmental Protection Agency |
| $CO_2e$ | Carbon dioxide equivalent |
| GHG | Greenhouse gas (limited to $CO_2$, $CH_4$, $N_2O$, and fugitive gases in this inventory) |
| GWP | Global Warming Potential |
| HFC | Hydrofluorocarbon |
| $MTCO_2e$ | Metric tons of carbon dioxide equivalent |
| MOVES | Motor Vehicle Emission Simulator model (developed by EPA to quantify emissions from mobile sources) |
| MPG | Miles per gallon |
| NONROAD | Part of MOVES model developed by EPA to quantify non-road mobile emissions |
| O&M | Operations and Maintenance |
| ODS | Ozone depleting substance |
| PFC | Perfluorocarbon |
| PSCAA | Puget Sound Clean Air Agency |
| PSE | Puget Sound Energy |
| PSRC | Puget Sound Regional Council |
| $SF_6$ | Sulfur hexafluoride |
| TCR | The Climate Registry |
| USDA | United States Department of Agriculture |
| WARM | Waste Reduction Model (model developed by EPA to quantify solid waste emissions) |
| WSDOT | Washington State Department of Transportation |
| WWTP | Wastewater Treatment Plant |
| VMT | Vehicle Miles Traveled |

# Executive Summary

Global climate change poses a growing threat and humanitarian climate emergency, and Bainbridge Island shares the responsibility to reduce greenhouse gas emissions (GHG) to stabilize the global climate while preparing for the effects of climate change. The City of Bainbridge Island recently completed a comprehensive greenhouse gas inventory as part of its commitment to reducing emissions and leading on climate action. Greenhouse gas emission inventories quantify the amount of climate pollution produced by an entity—in this case, from the Bainbridge Island community and municipal government operations. As the Bainbridge Island government and community continues to take action to reduce GHG emissions, these inventories will serve as tools for tracking progress and making improvements along the way.

## Inventory Approaches

This report describes findings from three distinct inventories:

- A **community inventory** that estimates GHG emissions produced by activities of the Bainbridge Island community, including residents and businesses. The community GHG inventory includes emissions due to energy used to power and heat homes and businesses; fuel used by vehicles running within Bainbridge Island; solid waste that is generated by the community; agriculture activities; fuel use by off-road equipment and vehicles; and others.
- A **municipal inventory** that accounts for the GHG emissions resulting from City of Bainbridge Island government operations. This inventory can help the City understand GHG emissions stemming from various activities associated with municipal operations, including from municipal building and facility operation, transportation, solid waste, wastewater, and refrigerant leakage.
- A **consumption-based inventory** that estimates GHG emissions associated with the *consumption* of food, goods, and services within the community, regardless of their origin. For example, this inventory would not include emissions from the production of locally-manufactured goods that are consumed entirely outside the community; however, it would include emissions associated with the production of goods manufactured in another community but consumed by Bainbridge Island residents, visitors, or businesses. This inventory can be examined in context with the community inventory to paint a more comprehensive picture of community emissions.

This report also presents findings from additional analyses:

- Municipal and communitywide **contribution analyses** that identify key drivers of observed emission trends. For example, analysis calculates the impact that a hotter summer or colder winter may have had on household energy use, and thus, emissions.
- A **carbon sequestration analysis** that estimates the amount of carbon dioxide that Bainbridge Island trees absorb—or sequester—from the atmosphere on an annual basis.

## Inventory Methodology

The GHG inventories summarized in this report account for human-caused emissions of the most prominent and typical greenhouse gases for communities: carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). To account for the differences in potency among these gases, all emissions are calculated and reported in units of metric tons of carbon dioxide equivalent ($MTCO_2e$). The inventories were conducted using widely accepted tools and protocols, including the *Local Government Operations Protocol* and *U.S. Community Protocol for Accounting and Reporting of Greenhous Gas Emissions*.

GHG emissions are inventoried by multiplying annual activity data (e.g. electricity consumption) by emission factors (greenhouse gas emissions produced per kWh of electricity). For the municipal operations inventory, we obtained most data from City staff and local documentation such as Puget Sound Energy's (PSE) billing records, records from local wastewater treatment facilities, and fleet vehicle fuel use records. For the communitywide inventory, key data sources included electricity consumption data from PSE, Puget Sound Regional Council (PSRC) modeling outputs for vehicle miles traveled by fuel type, Bainbridge Disposal tonnage records, and Kitsap County Conservation District estimates of agricultural landowners and acreage. Where local data were not available, we referenced and downscaled national data sources such as from the Federal Transit Administration, U.S. Census Bureau, and the U.S. Department of Agriculture.

## Inventory Boundaries

The activities and sectors included in GHG inventories are often classified into three “scopes,” which represent relative levels of control over an emissions source:

- **Scope 1** emission sources include those directly caused by an organization’s actions, such as from owned equipment and facilities.[1]
- **Scope 2** emissions are those indirectly associated with purchased electricity, steam, heating, or cooling.
- **Scope 3** includes all other indirect emissions that are not covered in Scope 2.

The communitywide and municipal inventories for Bainbridge Island included emissions sources from all three scopes: Scope 1, Scope 2, and Scope 3. The inventories included all sources required by the consulted protocols and additional sources, as relevant.

## Inventory Years

The inventories summarized in this report cover two representative years, **2014** and **2018**. To provide Bainbridge Island with the most comprehensive, consistent, and relevant information on their GHG emissions, we selected the most recent year available as an inventory year – 2018. For a comparison year, we selected 2014 because no major changes in organizational structure or infrastructure occurred after that year. Additionally, choosing a more recent comparison year increases the likelihood that all needed data are available and derived using consistent methodologies.

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[1] Except direct carbon dioxide emissions from biogenic sources.

# INVENTORY RESULTS

## Community Emissions

The Bainbridge Island community emitted an estimated 233,998 metric tons of carbon dioxide equivalent ($MTCO_2e$) in 2018, or 9.4 $MTCO_2e$ per Bainbridge Island resident. A high-level comparison suggests that this per-capita estimate is consistent with that of Kitsap County (9.9 $MTCO_2e$ per person), and lower than per-capita estimates for the U.S., Washington State, King County, and Bellevue. However, Bainbridge Island's estimated per-capita emissions are almost twice those of Seattle and Tacoma (Figure 6). The majority of Bainbridge Island community emissions stem from consumption of electricity in homes and commercial buildings (Figure 4).

**Figure 1. Bainbridge Island communitywide emissions in 2018 (total = 233,998 $MTCO_2e$).**

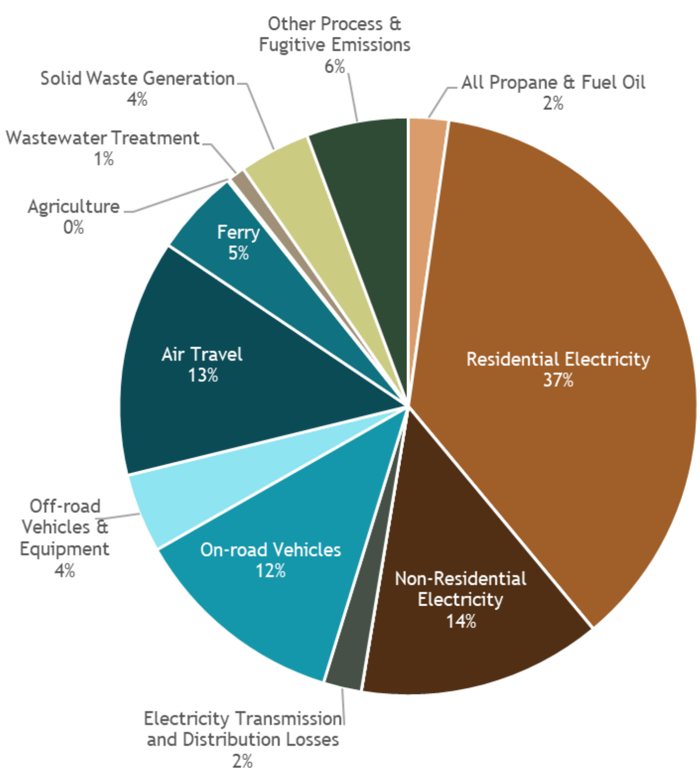
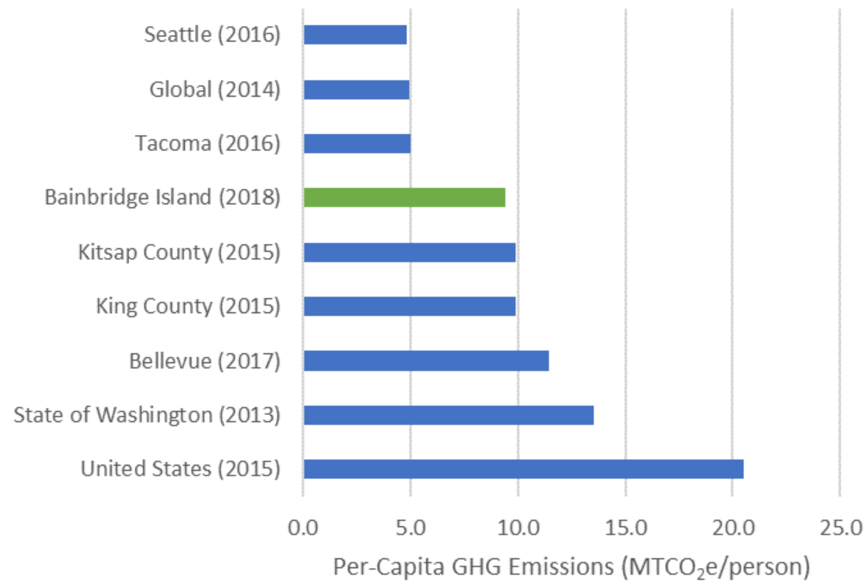
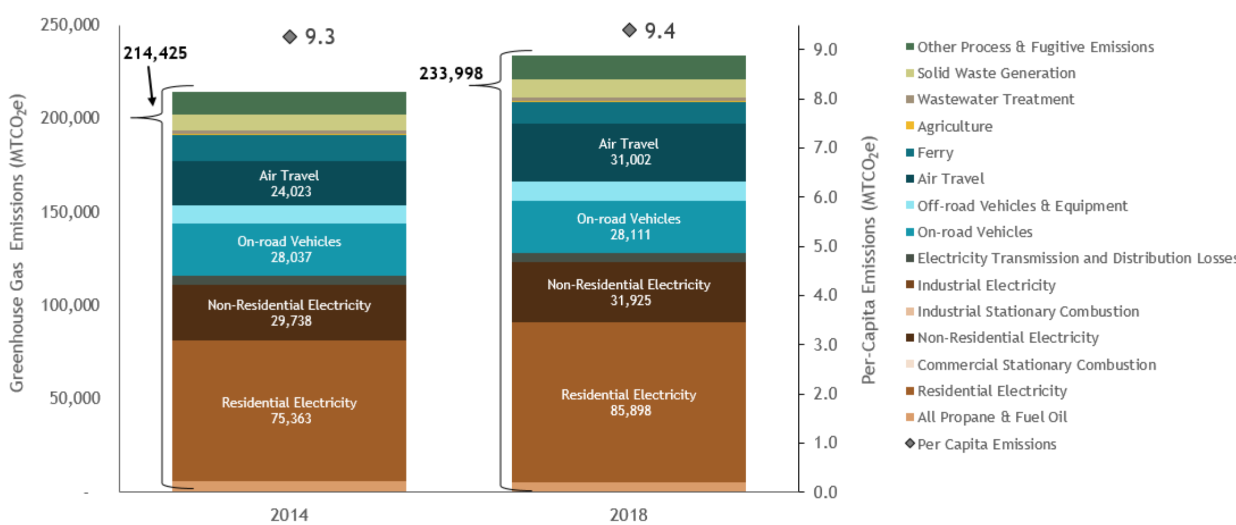


**Figure 2. Per-capita GHG emissions comparison.**[2]




Overall, communitywide emissions have increased by 9% since 2014 (Figure 5). Per-capita emissions, however, only increased 1% over that period, suggesting that population growth contributed to the observed trends. Changes in electricity fuel source (e.g., renewables versus coal) and growth in employment also pushed emissions upward, while improvements in vehicle fuel economy, reductions in the distance each person drives, and declining per-household and per-business energy consumption on Bainbridge Island softened the extent of those increases.

**Figure 3. Bainbridge Island community emissions trends, by year and source.**




[2] Other jurisdictions may use different data sets, methods, and years for their GHG emission inventories.

## City Government Emissions

Emissions from City of Bainbridge Island activities—which make up about 1% of the total community emissions—increased 11% from 2014 to 2018, totaling 2,291 $MTCO_2e$ in 2018 (Figure 7 and Figure 8). Major emissions sources included facility electricity consumption (60%) and on-road fleet vehicles (17%).

Emissions from municipal facility electricity and on-road fleet vehicles increased 14% and 7%, respectively. Just four facilities accounted for 80% of all facility electricity use in 2018: Bainbridge Island Waste Water Treatment Plant (WWTP), City Hall, Fletcher Bay: Well Field, and Bainbridge Island Public Works Operations and Maintenance Yard. Among the largest emissions decreases were from streetlights and traffic signals improvements.

**Figure 4. City operations GHG emissions in 2018 (total = 2,291 $MTCO_2e$).**

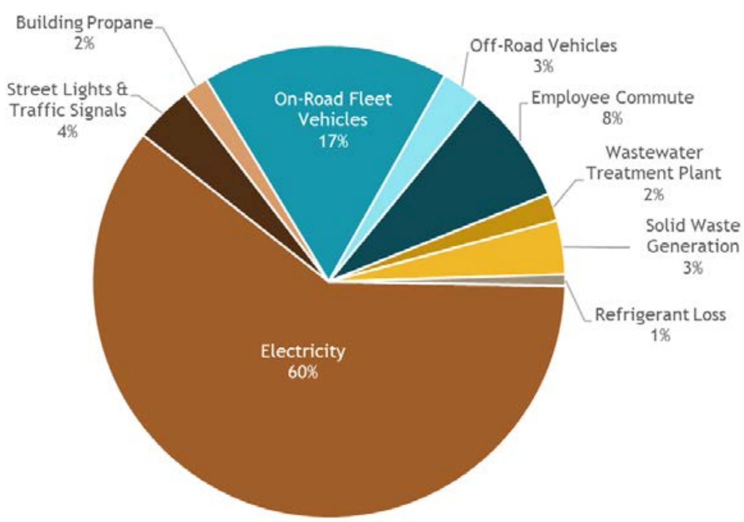
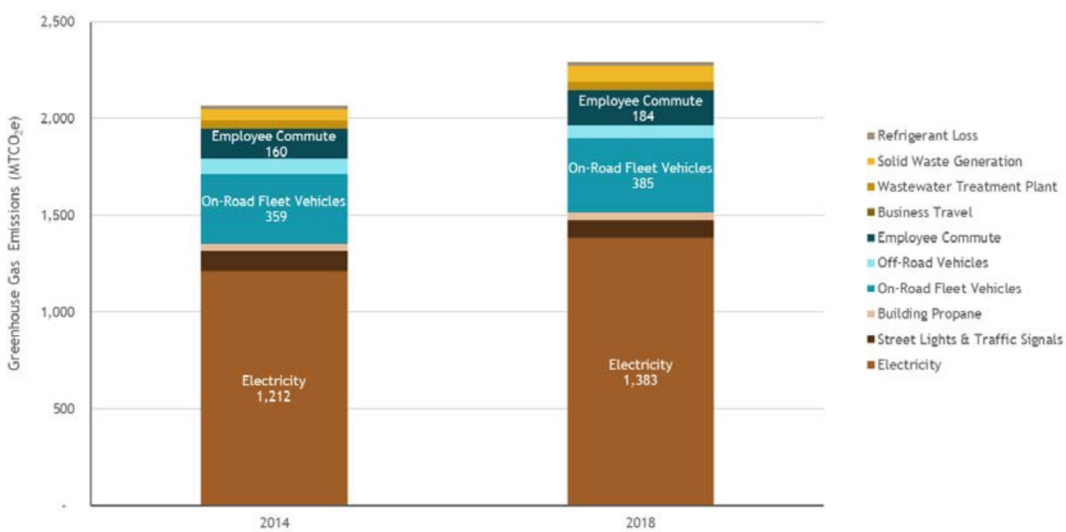



**Figure 5. Bainbridge Island city operations emissions trends, by year and source.**

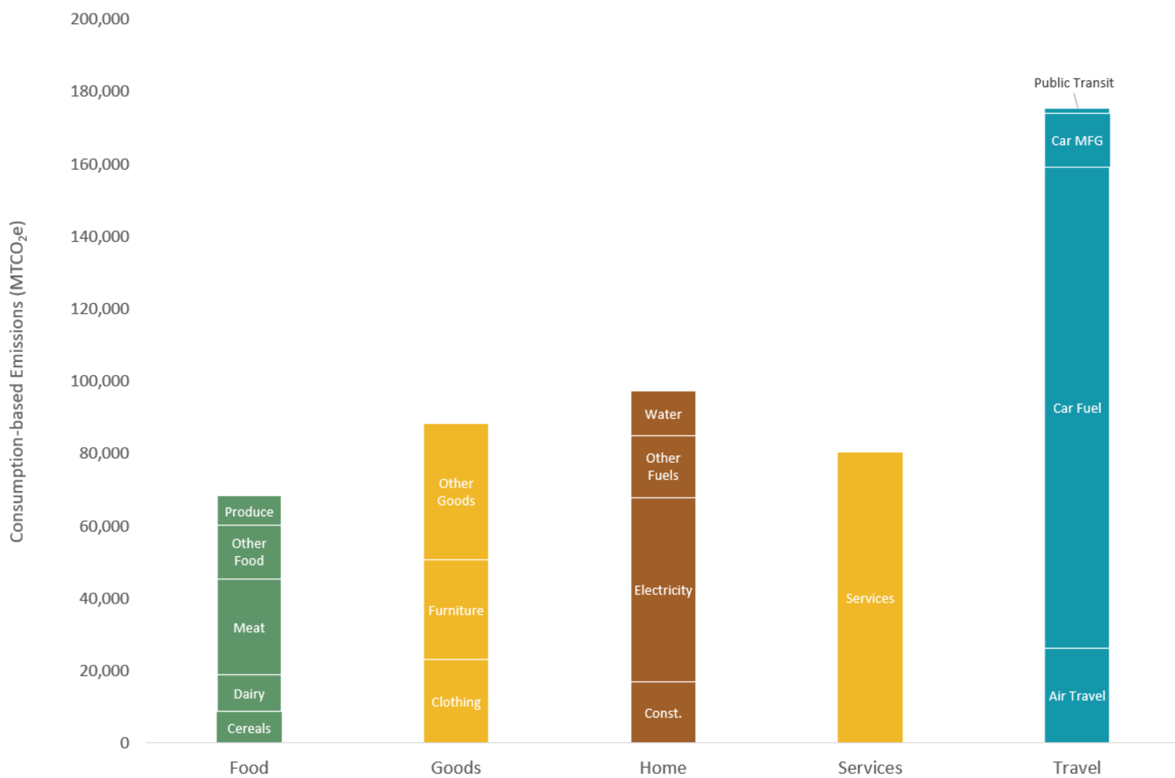


## Consumption-based Emissions

The purchasing decisions we make impact the environment. Some types of foods and materials, such as meat and furniture, can carry a significant GHG emissions burden. For example, meat and dairy cows emit methane—a potent greenhouse gas. Residents in Bainbridge Island who consume beef contribute to the emissions from these cows—even if the cows are raised outside the island.

Results from a household-based economic modeling tool suggest that the average Bainbridge Island household emits 52 $MTCO_2e$ a year through their purchasing behaviors.[3] There were an estimated 9,404 and 9,798 households on Bainbridge Island in 2014 and 2018, respectively, indicating that total consumption-based emissions from all households on Bainbridge Island could have reached approximately 510,000 $MTCO_2e$ in 2018. Major drivers include the purchase of meat, furniture, clothing, home energy, and travel-related expenses such as car fuel and air travel.

**Figure 6. Consumption-based emissions per Bainbridge Island household.**




[3] As indicated from U.C. Berkeley's *CoolClimate* Calculator. Outcomes from the consumption-based inventory analysis are presented at the per-household level because purchasing behavior is typically examined and analyzed at the household—not individual—level.

## Tree Carbon Sequestration

While GHG emissions inventories quantify the release of greenhouse gases into the atmosphere, trees and other vegetation can absorb carbon dioxide out of the atmosphere. We conducted a high-level analysis to understand how much Bainbridge Island trees are absorbing carbon dioxide from the atmosphere. Using satellite imagery, we estimate that trees cover between 46% and 56% of Bainbridge Island, and absorb an estimated 59,000 $MTCO_2e$ of carbon dioxide from the air every year—an amount that we estimate has remained largely constant between 2014 and 2018.

## Next Steps

In analyzing the GHG emissions of Bainbridge Island, this report identifies key activities and sectors at both citywide and municipal operations scales that contribute the largest relative amounts of GHG emissions. Drawing from the results in this report, activities and operations can then be targeted for improvement and mitigation. Improving the inventory process, conducting regular inventories, and incorporating these inventory results into decision-making processes will be critical for evaluating progress toward emissions reductions targets and for identifying cost-saving opportunities in the future.

# Introduction

This GHG inventory report for the City of Bainbridge Island details estimated GHG emissions from activities within the city of Bainbridge Island. GHG inventories quantify emissions associated with a specific “scope”—or boundary condition—over a specific period. By conducting GHG inventories at regular intervals, they can illuminate trends, accomplishments, and opportunities for improvement. They also hold governments and communities responsible for their impact on the environment and keep organizations on track towards reaching climate action goals.

This report describes findings from three distinct inventories (Figure 10):

- A **community inventory** that estimates GHG emissions produced by activities of the Bainbridge Island community, including residents and businesses. The community GHG inventory includes emissions due to energy used to power and heat homes and businesses; fuel used by vehicles running within Bainbridge Island; solid waste that is generated by the community; agriculture activities; fuel use by off-road equipment and vehicles; and others.
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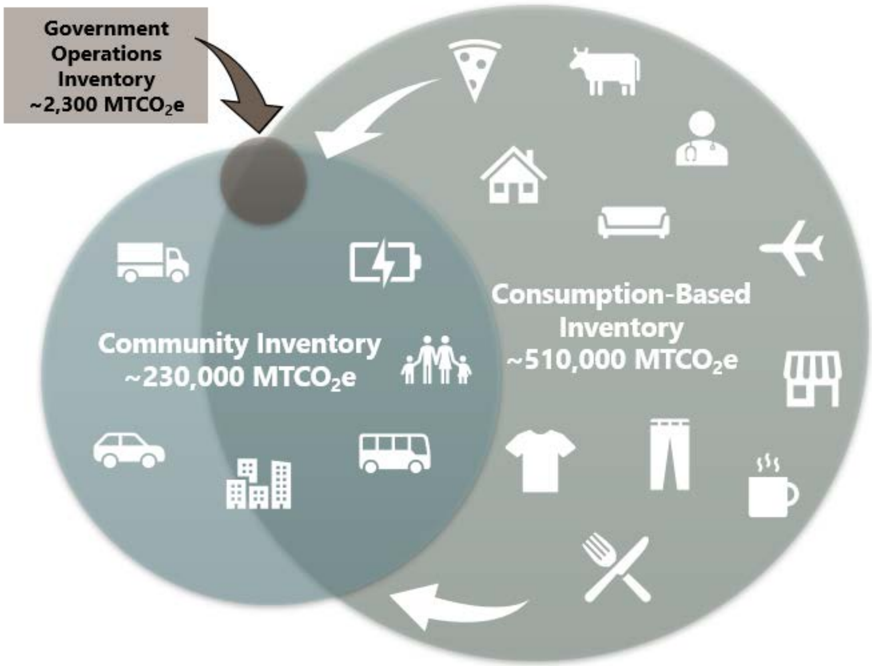
This report also presents findings from additional analyses:

- Municipal and communitywide **contribution analyses** that identify key drivers of observed emission trends. For example, analysis calculates the impact that a hotter summer or colder winter may have had on household energy use, and thus, emissions.
- A **carbon sequestration analysis** that estimates the amount of carbon dioxide that Bainbridge Island trees absorb—or sequester—from the atmosphere on an annual basis.

Figure 7. Conceptual relationship among community, government, and consumption-based inventories for Bainbridge Island.




# GREENHOUSE GAS INVENTORY OVERVIEW

## Inventory Methodology

The GHG inventories summarized in this report account for human-caused emissions of the most prominent and typical greenhouse gases for communities: carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). To account for the differences in potency among these gases, all emissions are calculated and reported in units of metric tons of carbon dioxide equivalent ($MTCO_2e$). The inventories were conducted using widely accepted tools and protocols, including The Climate Registry's *Local Government Operations Protocol*, ICLEI's *U.S. Community Protocol for Accounting and Reporting of Greenhous Gas Emissions*, and U.C. Berkeley's *CoolClimate Calculator*.

GHG emissions are inventoried by multiplying annual activity data (e.g. electricity consumption) by emission factors (greenhouse gas emissions produced per kWh of electricity). For the municipal operations inventory, we obtained most data from City staff and local documentation such as Puget Sound Energy's (PSE) billing records, records from local wastewater treatment facilities, and fleet vehicle fuel use records. For the communitywide inventory, key data sources included electricity consumption data from PSE, Puget Sound Regional Council (PSRC) modeling outputs for vehicle miles traveled by fuel type, Bainbridge Disposal tonnage records, and Kitsap County Conservation District estimates of agricultural landowners and acreage. Where local data were not available, we referenced and downscaled national data sources such as from the Federal Transit Administration, U.S. Census Bureau, and the U.S. Department of Agriculture.

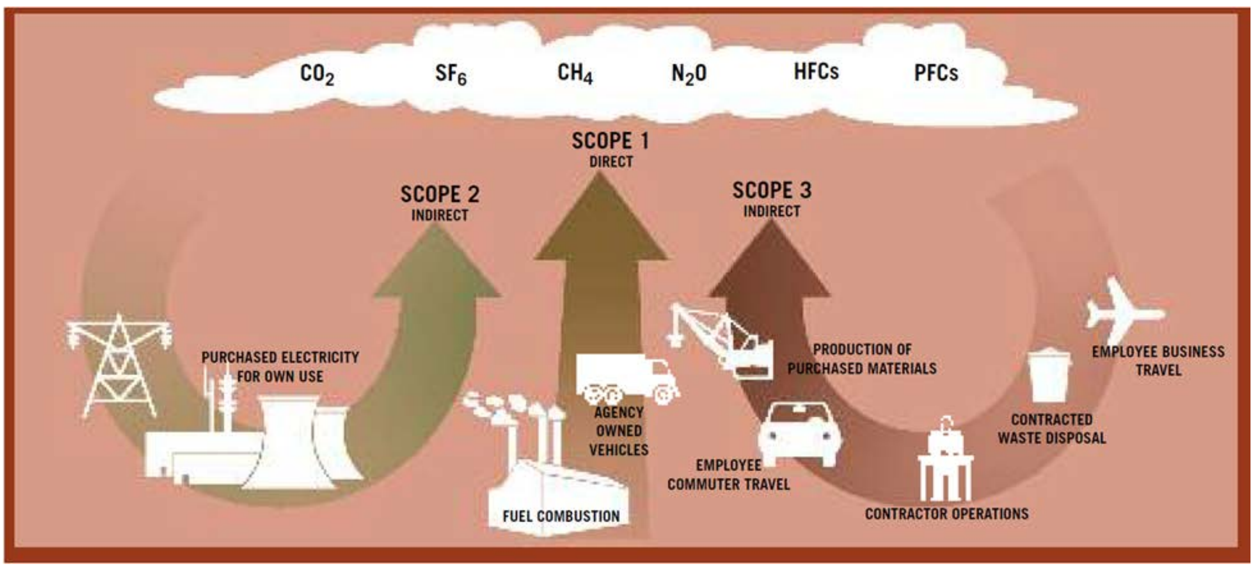
## Inventory Boundaries

The activities and sectors included in GHG inventories are often classified into three "scopes," which represent relative levels of control over an emissions source (see Figure 8 and Figure 9):

- **Scope 1** emission sources include those directly caused by an organization's actions, such as from owned equipment and facilities.[4]
- **Scope 2** emissions are those indirectly associated with purchased electricity, steam, heating, or cooling.
- **Scope 3** includes all other indirect emissions that are not covered in Scope 2.

The communitywide and municipal inventories for Bainbridge Island included emissions sources from all three scopes: Scope 1, Scope 2, and Scope 3. The inventories included all sources required by the consulted protocols and additional sources, as relevant.

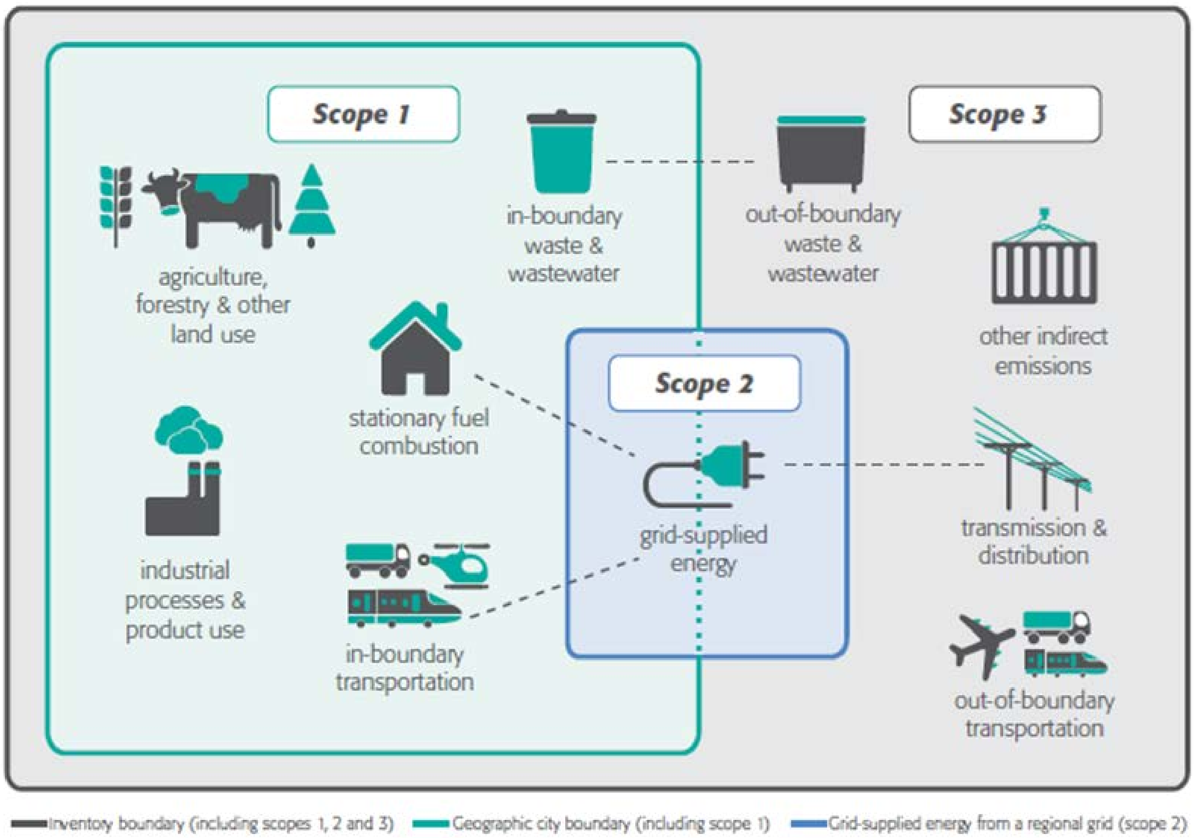
**Figure 8. Sources and boundaries of municipal GHG emissions.**[5]




[4] Except direct carbon dioxide emissions from biogenic sources.

[5] The Climate Registry. (2010). *Local Government Operations Protocol: For the quantification and reporting of greenhouse gas emissions inventories.*

**Figure 9. Sources and boundaries of community GHG emissions.**[6]




[6] World Resource Institute (2014). Greenhouse Gas Protocol: *Global protocol for community-scale greenhouse gas emission inventories.*

The tables below summarize sectors included in the municipal and communitywide inventories.

**Table 1. Community inventory emissions sources and scope categories.**

| Emissions Type | Required? | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| Residential Energy | | | | |
| Electricity | × | | ✓ | |
| Propane | × | ✓ | | |
| Fuel Oil | × | ✓ | | |
| Commercial Energy | | | | |
| Electricity | × | | ✓ | |
| Propane | × | ✓ | | |
| Industrial Energy | | | | |
| Electricity | × | | ✓ | |
| Propane | | ✓ | | |
| Transportation | | | | |
| On-Road Passenger Vehicles | × | ✓ | | |
| On-Road Freight Vehicles | × | ✓ | | |
| On-Road Transit Vehicles | | ✓ | | |
| Off-Road Vehicles and Equipment | | ✓ | | |
| Air Travel | | | | ✓ |
| Ferry Travel | | | | ✓ |
| Solid Waste, Potable Water, and Wastewater | | | | |
| Solid Waste | × | | | ✓ |
| Potable Water Use Energy* | × | | ✓ | |
| Wastewater Treatment | × | | ✓ | |
| Refrigerant Leakage | × | ✓ | | |
| Agriculture | | ✓ | | |

** Potable water use energy—energy associated with treating and distributing potable water systems on the Island (e.g., from pumping stations)—is included in the non-residential energy consumption sector. Energy used for pumping individual wells is included in the residential energy consumption sector.*

**Table 2. Municipal inventory emissions sources and scope categories.**

| Emissions Type | Required? | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| Buildings and Facility Energy | | | | |
| Electricity | × | | ✓ | |
| Propane | × | ✓ | | |
| Streetlights and Traffic Signals | × | | ✓ | |
| Transportation | | | | |
| On-Road Fleet Vehicles | × | ✓ | | |
| Off-Road Vehicles | × | ✓ | | |
| Employee Commute | | | | ✓ |
| Business Travel | | | | ✓ |
| Solid Waste, Potable Water, and Wastewater | | | | |
| Solid Waste | × | | | ✓ |
| Potable Water Use Energy | × | | ✓ | |
| Wastewater Treatment | × | | ✓ | |
| Refrigerant Leakage | × | ✓ | | |

**Table 3. Consumption-based inventory emissions sources and scope categories.**

| Emissions Type | Required? | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| **Consumption-Based Emissions** | | | | |
| Household Consumption | | | | ✓ |
| City Government Consumption | | | | ✓ |
| Upstream Energy | | | | ✓ |

## Inventory Years

To provide Bainbridge Island with the most up-to-date information on their GHG emissions, we selected the most recent year available as an inventory year: 2018. For a comparison year, we selected 2014 because no major changes in organizational structure or infrastructure occurred after that year. For example, the wastewater treatment facility update was completed before 2014, so those changes would be reflected in the 2014 inventory, enabling a more apples-to-apples comparison with 2018. Other factors in that deciding the inventory years include:

- **Data availability:** The availability of City data is scarcer further in the past.
- **Data consistency:** Some data were either modeled differently or organized differently in the past (i.e., methodologies changed over the last decade). Having a more recent baseline better ensures more of accurate comparison over time.
- **Relevance:** Choosing a more recent comparison inventory year allows for a more productive assessment of trends over time to inform climate action planning. For example, if the baseline year of 1990 was chosen it would be difficult to understand distinct drivers of changes between 1990 and 2019 due to the many interim changes and that occurred within that time frame.

# ROADMAP OF THIS REPORT

This report is organized into the following sections to assess GHG emissions associated with Bainbridge Island:

- The **Communitywide Emissions** section presents methodologies and results for community-based inventory.
- The **Communitywide Contribution Analysis** section explores the drivers of communitywide emission trends.
- The **Municipal Operation Emissions** section presents methodologies and results for municipal-based inventory.
- The **Municipal Contribution Analysis** section that explores drivers of municipal operation emission trends.
- The **Consumption-Based Emissions** section presents methodologies and results from the consumption-based inventory.
- The **Tree Carbon Sequestration** section presents methodologies and results of the tree carbon sequestration analysis.

Each inventory section is organized as follows:

- **Results** section presents GHG inventory results for the study years. The results are quantified and, where relevant, summarized for trends between the two inventory years.
- **Data Sources and Methodology** section details the sources of inventory information by sector, with calculation methodologies, where relevant. The section also describes any data limitations or considerations.

The report concludes with a summary of the major trends across all the inventories and future considerations for climate action planning.

# Communitywide Emissions

The communitywide GHG emissions inventory estimates GHG emissions from individuals, businesses, and commercial and industrial processes *within* Bainbridge Island. It also includes emissions associated with some residential and business activities that occur *outside* of Bainbridge Island, such as from electricity generation and solid waste transport to an out-of-state landfill.

Overall communitywide emissions are provided in units of metric tons of carbon dioxide equivalent ($MTCO_2e$). Table 5 below outlines the various emissions sources included in the communitywide inventory, along with their corresponding scope. The table also shows which sectors are required by the *U.S. Community Protocol*.

**Table 4. Community inventory emissions and scope categories.**

| Emissions Type | Required? | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| Residential Energy | | | | |
| Electricity | ✗ | | ✓ | |
| Propane | ✗ | ✓ | | |
| Fuel Oil | ✗ | ✓ | | |
| Commercial Energy | | | | |
| Electricity | ✗ | | ✓ | |
| Propane | ✗ | ✓ | | |
| Industrial Energy | | | | |
| Electricity | ✗ | | ✓ | |
| Propane | | ✓ | | |
| Transportation | | | | |
| On-Road Passenger Vehicles | ✗ | ✓ | | |
| On-Road Freight Vehicles | ✗ | ✓ | | |
| On-Road Transit Vehicles | | ✓ | | |
| Off-road Vehicles and Equipment | | ✓ | | |
| Air travel | | | | ✓ |
| Ferry | | | | ✓ |
| Solid Waste, Potable Water, and Wastewater | | | | |
| Solid Waste | ✗ | | | ✓ |
| Potable Water Use Energy* | ✗ | | ✓ | |
| Wastewater Treatment | ✗ | | ✓ | |
| Other Process & Fugitive Emissions | ✗ | ✓ | | |
| Agriculture | | ✓ | | |

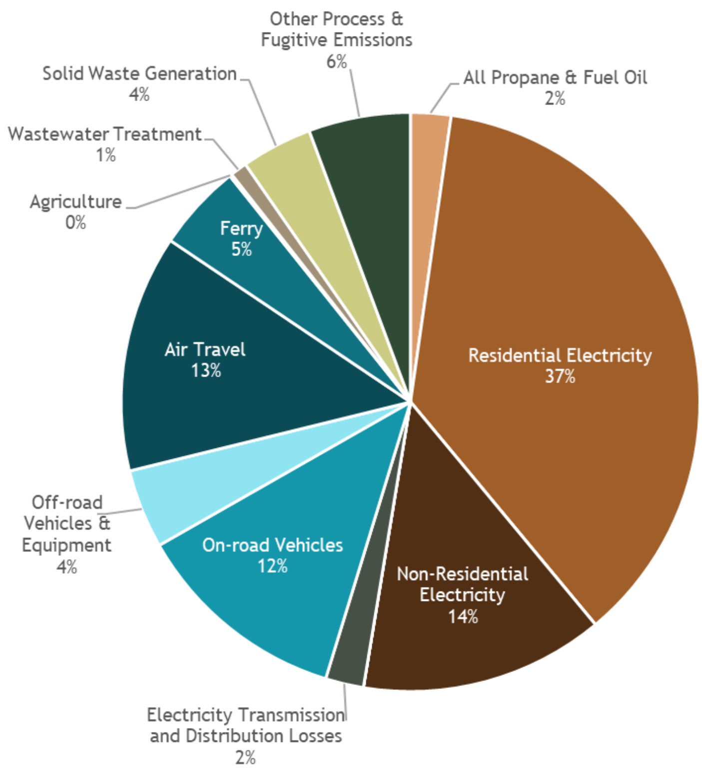
** Potable water use energy—energy associated with treating and distributing potable water systems on the Island (e.g., from pumping stations)—is included in the non-residential energy consumption sector. Energy used for pumping individual wells is included in the residential energy consumption sector.*

# RESULTS

## Overview

Bainbridge Island's communitywide emissions in 2018 totaled 233,998 $MTCO_2e$—equivalent to 9.4 $MTCO_2e$ per resident. Residential energy (37%) was responsible for the greatest proportion of communitywide emissions, followed by non-residential energy (14%), air travel (13%), and on-road vehicles (12%) (see Figure 11).

**Figure 10. Bainbridge Island community emissions by source, 2018 (total = 233,998 $MTCO_2e$)**




Communitywide GHG emissions increased by 9% from 2014 to 2018 (see Figure 12, Table 6, and Figure 13). These increases are primarily due to changes in electricity fuel sources (e.g., proportion of coal in the utility fuel mix) and growth in population and employment. Improvements in vehicle fuel economy, reductions in the distance each person drives, and declining per-household and per-business energy consumption all reduced the extent of this increase. Although communitywide emissions have increased by 9%, per capita emissions have increased only slightly—by 1% (see Figure 12).

**Figure 11. Bainbridge Island community emissions, by year and source and resident. Major sources are labeled.**

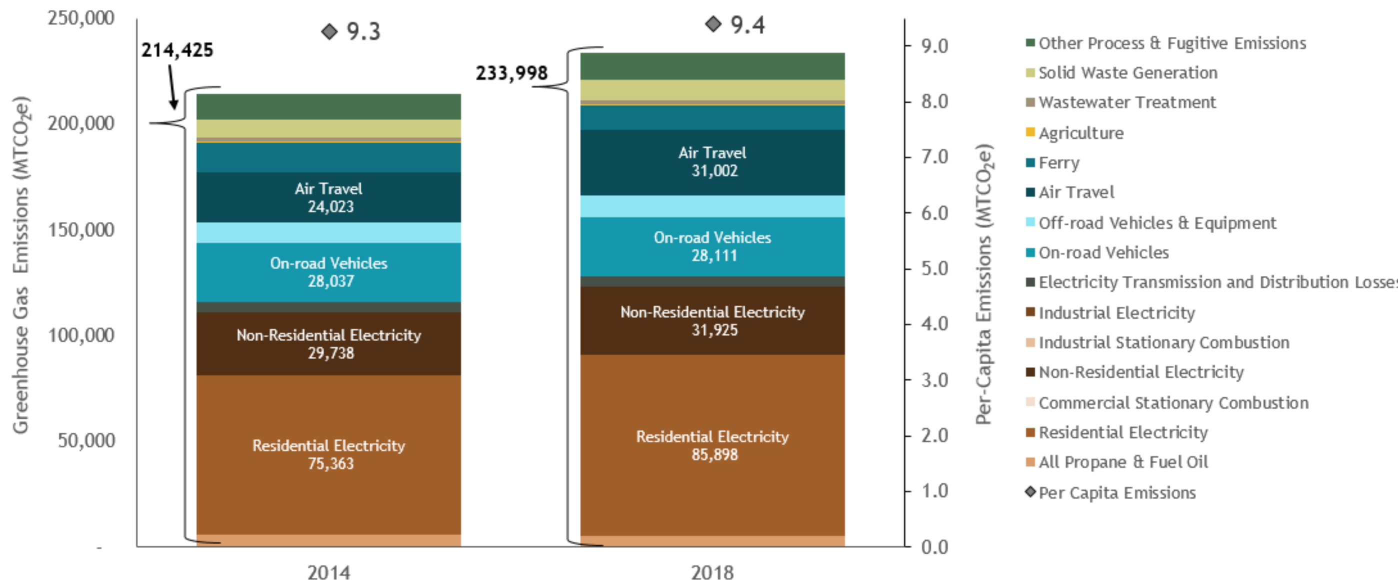
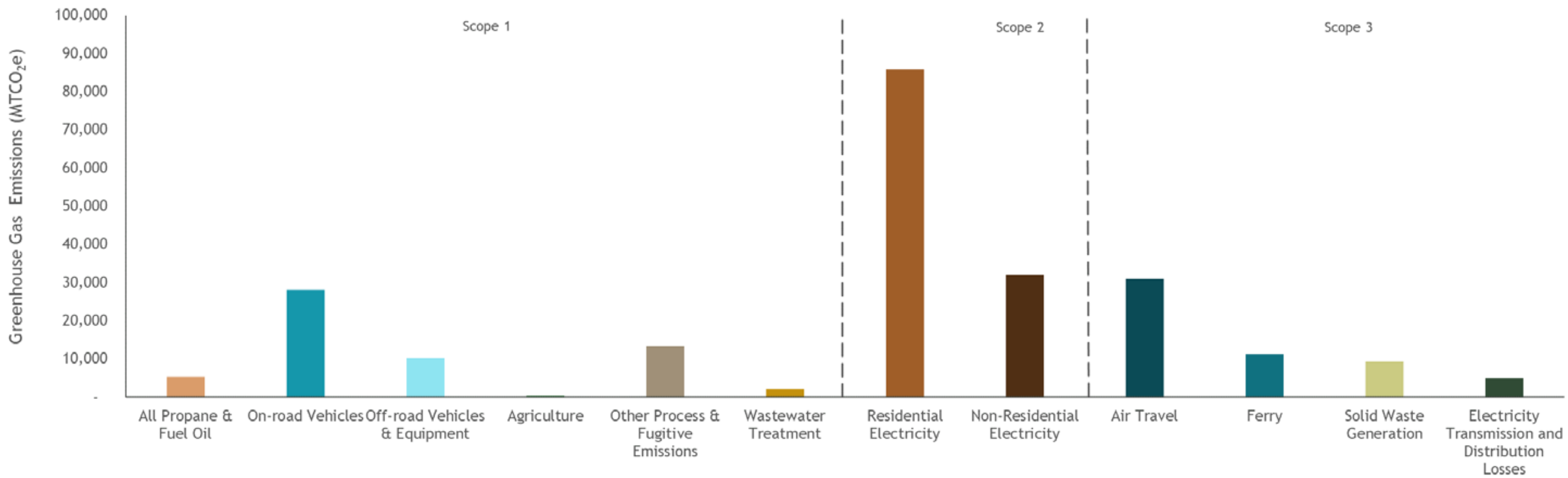



**Table 5. Communitywide emissions, by sector.**

| GHG Emissions by Sector ($MTCO_2e$) | 2014 | 2018 | Change | % Change |
|---|---|---|---|---|
| **Residential Energy** | **84,885** | **94,810** | **9,925** | **12%** |
| Electricity | 75,363 | 85,898 | 10,535 | 14% |
| Propane & Fuel Oil (Residential, Commercial, and Industrial) | 5,912 | 5,274 | -638 | -11% |
| Losses from transmission & distribution | 3,610 | 3,638 | 28 | 1% |
| **Non-Residential Energy** | **31,162** | **33,277** | **2,115** | **7%** |
| Electricity | 29,738 | 31,925 | 2,187 | 7% |
| Losses from transmission & distribution | 1,424 | 1,352 | -73 | -5% |
| **Transportation** | **75,315** | **80,778** | **5,463** | **7%** |
| On-Road Passenger & Freight Vehicles | 27,448 | 27,330 | -118 | 0% |
| On-Road Transit Vehicles | 590 | 781 | 191 | 32% |
| Air Travel | 24,023 | 31,002 | 6,979 | 29% |
| Ferry Travel | 14,051 | 11,334 | -2,716 | -19% |
| Other Off-Road Vehicles and Equipment | 9,204 | 10,331 | 1,127 | 12% |
| **Solid Waste & Wastewater Treatment** | **10,503** | **11,470** | **968** | **9%** |
| Solid Waste | 8,369 | 9,289 | 920 | 11% |
| Wastewater Treatment | 48 | 51 | 3 | 7% |
| Septic Tanks | 2,086 | 2,131 | 45 | 2% |
| **Other Process & Fugitive Emissions** | **12,209** | **13,332** | **1,123** | **9%** |
| **Agriculture** | **351** | **331** | **-20** | **-6%** |
| Enteric Fermentation | 319 | 297 | -22 | -7% |
| Manure Management | 33 | 34 | 2 | 5% |
| **TOTAL** | **214,425** | **233,998** | **19,574** | **9%** |

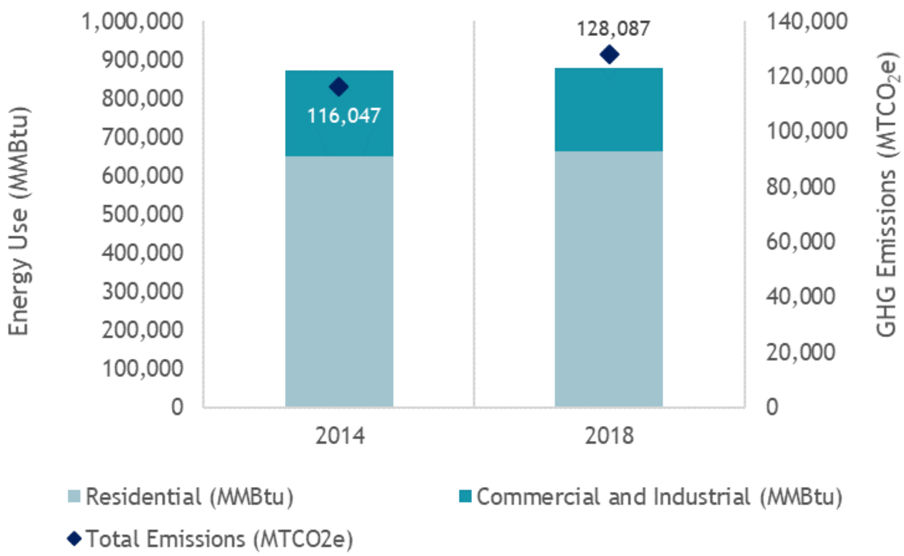
**Figure 12. Bainbridge Island community emissions by source and scope, 2018.**



## Residential Energy

Emissions from residential use of electricity, propane[7], and fuel oil accounted for 41% (94,810 $MTCO_2e$) of total communitywide emissions in 2018, a 12% increase from 2014. Residential electricity use alone makes up 37% of communitywide emissions; it also exceeds non-residential electricity use (see Figure 14).

**Figure 13. Community building energy use, by sector and year.**




### *Electricity*

Emissions from residential use of electricity increased from 75,363 $MTCO_2e$ in 2014 to 85,898 $MTCO_2e$ in 2018, a 14% change. One contributing factor is that the consumption of electricity increased slightly from 184,865,169 kWh in 2014 to 189,165,563 kWh in 2018, an increase of 2%. Additionally, Bainbridge Island's population increased 8% from 23,135 to 24,891.

Changes in the electricity fuel mix also contributed to increases in residential electricity emissions (see Table 7). Puget Sound Energy (PSE) provides power to Bainbridge Island. Approximately two-thirds of the power is from coal and hydroelectric generation. In 2017, the fuel mix was 38% coal, 33% hydroelectric, 21% natural gas, 6% wind, and 2% nuclear and other sources.[8] In 2014, the fuel mix was 35% coal, 36% hydroelectric, 20% natural gas, 3% wind, and 5% nuclear and other sources. Between 2014 and 2018, Bainbridge Island residents significantly increased their participation in PSE's Green Power Program. The

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[7] Propane amounts were derived from records that do not distinguish between residential, commercial, and industrial use. Therefore, all Bainbridge Island propane usage—regardless of sector—is included within the residential summary of emissions.

[8] Puget Sound Energy. Electricity Supply. www.pse.com/pages/energy-supply/electric-supply (accessed June 27, 2019). The emissions inventory for 2017 was used because the 2018 inventory was not yet available during the time of study.

2018 10% participation rate is among the highest in PSE's service area. However, due to the complexities of the electricity grid, the *U.S. Community Protocol* discourages consideration of renewable energy participation in calculating communitywide GHG inventories (see text box).

**Table 6. Puget Sound Energy (PSE) electricity generation fuel mix for 2014 and 2017.**[9]

| Electricity Generation Fuel Type | 2014 | 2017 |
|---|---|---|
| **Biomass** | 0% | 0% |
| **Coal** | 35% | 38% |
| **Cogeneration** | 4% | 0% |
| **Geothermal** | 0% | 0% |
| **Hydro** | 36% | 33% |
| **Landfill Gas** | 0% | 0% |
| **Natural Gas** | 20% | 21% |
| **Nuclear** | 1% | 1% |
| **Other** | 0% | 0% |
| **Petroleum** | 0% | 0% |
| **Solar** | 0% | 0% |
| **Waste** | 0% | 0% |
| **Wind** | 3% | 6% |

### Green Power Purchases

Puget Sound Energy allows electricity users to enroll in a Green Power purchasing program to support renewable energy generation in the region. When utility customers enroll in this program, they are not paying for 100% renewable energy to be delivered directly to their home or business, but rather for their utility to buy a certain amount of renewable energy as part of the utility's overall fuel mix. Because utility fuel mixes are used to calculate the GHG emissions of consumed electricity in a community, the renewable energy purchases made through Green Power programs are already included in the emissions calculations of the community GHG inventory. Therefore, accounting for Green Power purchases separately within a GHG inventory risks double-counting the benefits of a renewable energy system.

[9] Puget Sound Energy. Electricity Supply. www.pse.com/pages/energy-supply/electric-supply (accessed June 27, 2019). The emissions inventory for 2017 was used because the 2018 inventory was not yet available during the time of study.

### *Propane and Fuel Oil*

Due to a lack in locally available usage data, consumption of residential propane and fuel oil were estimated using data from local propane sales tax revenues, the U.S. Energy Information Administration (EIA), and 2017 American Community Surveys (ACS). These estimations suggest that emissions from residential use of propane[10] and fuel oil totaled 5,912 $MTCO_2e$ in 2014 and 5,274 $MTCO_2e$ in 2018, an 11% decrease in four years. This decline is primarily due to a decrease in the number of households using those fuel sources, including for cooking and heating.

### *Electricity Transmission and Distribution Losses*

As electricity travels from where it was generated, such as a hydroelectric dam or wind farm, to individual homes, businesses, and other buildings, some of the electricity is naturally lost over power lines and in substations and transformers. The proportion of the total electricity initially generated that is lost through these processes in a given year and region is known as the "grid loss" factor. This grid loss proportion can change from year-to-year based on a number of factors, including weather, transmission distance, power line size, and transmission voltage. Although lost electricity is not ultimately delivered to the consumer, it still results in the emission of greenhouse gases. We estimate that emissions from transmitting and distributing residential electricity to Bainbridge Island residents increased slightly from 3,610 $MTCO_2e$ in 2014 to 3,638 $MTCO_2e$ in 2018—a less than 1% change. These changes are a result of changes to the amount of electricity consumed and the "grid loss" factor of PSE infrastructure.

## Non-Residential Energy

The non-residential energy sector includes greenhouse gas emissions from commercial and industrial electricity; losses due to the transmission and distribution of that electricity; and energy associated with treating and distributing potable water (e.g., from pumping stations). Commercial and industrial propane consumption emissions are included within the residential emissions sector, as the source data did not distinguish between different use sectors.

### *Electricity and Transmission and Distribution Losses*

Emissions from commercial and industrial electricity accounted for 14% (31,925 $MTCO_2e$) of total communitywide emissions in 2018, making it the second-largest source along with air travel. Emissions from commercial and industrial use of electricity increased from 29,738 $MTCO_2e$ in 2014 to 31,925 $MTCO_2e$ in 2018, a 7% change. The increase in emissions can be partially attributed to the increased workforce from 8,224 to 8,943 employees, as well as from changes in the electricity fuel mix(see Figure 14 on page 23) Emissions from non-residential electricity transmission and distribution decreased approximately 5%, from 1,424 $MTCO_2e$ in 2014 to 1,352 $MTCO_2e$ in 2018. These changes are a result of changes in the amount of electricity consumed and the "grid loss factor" associated with PSE infrastructure.

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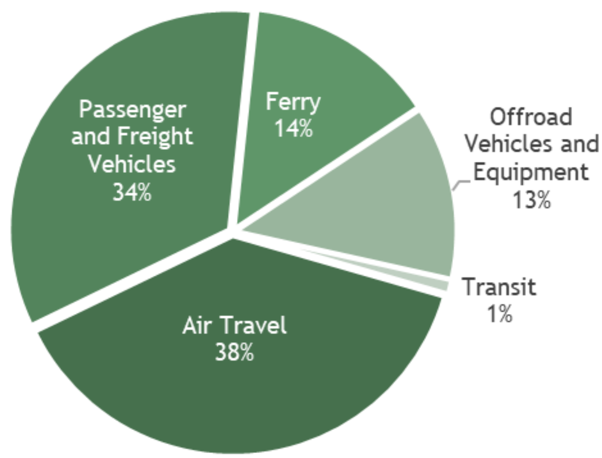
[10] Propane amounts were derived from records that do not distinguish between residential, commercial, and industrial use. Therefore, all Bainbridge Island propane usage—regardless of sector—is included within the residential summary of emissions.

## Transportation

Transportation contributed over a third of Bainbridge Island community emissions in 2018, making it the second-largest contributor to the community's greenhouse gas emissions. In 2014, most transportation emissions came from passenger and freight vehicles, followed by air travel. However, in 2018, this trend shifted, with most transportation emissions coming from air travel followed by passenger and freight vehicles (Figure 15). The rapid growth of Sea-Tac Airport explains this shift: there was a 30% increase in landings at SeaTac International Airport between 2014 and 2018.[11]

Figure 14. Community transportation emissions in 2018 (total = 80,778 $MTCO_2e$).




### *On-Road Vehicles*

Most on-road vehicle emissions in Bainbridge Island stem from passenger cars. Downscaled modeling by the Puget Sound Regional Council suggests that passenger vehicles traveled over 69 million miles in Bainbridge Island in 2018 (Table 8 and Figure 16).

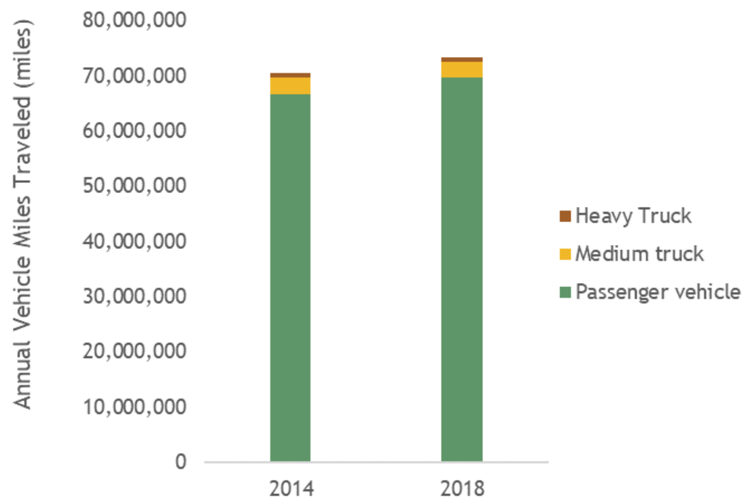
Table 7. Annual vehicle miles estimated for Bainbridge Island.

| Type | 2014 | 2018 | Change |
|---|---:|---:|---:|
| Passenger vehicle | 66,612,870 | 69,543,904 | 4% |
| Medium truck | 3,011,067 | 2,993,763 | -1% |
| Heavy Truck | 708,280 | 708,118 | 0% |
| Transit bus* | 394,450 | 397,634 | 1% |

**Miles for transit buses are in annual revenue miles.*

[11] Air travel emissions from Bainbridge residents were attributed by downscaling total fuel use at Sea-Tac Airport to the Bainbridge Island community based on population. More information can be found in the "Data Sources and Methodology" section of this report.

**Figure 15. Distribution of on-road vehicle miles traveled, by vehicle type.**




Transportation data are typically recorded as vehicle miles traveled, or VMT. VMT is the total number of miles driven by motorized vehicles of specific types. Although the model used to estimate GHG emissions by VMT and vehicle type does not separately note hybrids and electric vehicles, these vehicles are subject to the same emissions standards as conventional gasoline or diesel vehicles. As such, hybrid and electric vehicle VMT are incorporated into the average emissions factors used for each vehicle type and model year, despite not being reported separately from general passenger vehicles.

Despite a 4% increase in VMT for passenger vehicles between 2014 and 2018, emissions from on-road vehicles increased minimally—by 0.3%. The increasing average fuel economy of passenger vehicles accounts for this minimal change (Figure 16).

We estimate that transit vehicle emissions increased 32% between 2014 and 2018, rising from an estimated 590 $MTCO_2e$ in 2014 to 781 $MTCO_2e$ in 2018. As reported by Kitsap Transit to the Federal Transit Administration, annual revenue miles remained relatively constant between the two inventory years—only increasing 1%. This trend suggests that increased transit emissions may be the result of decreased fuel economy and increased use of high emitting fuels, such as gasoline and liquified petroleum gasoline. In 2014, the reported average fuel economy for transit vehicles was 7 mpg, which decreased 29% in 2018 to approximately 5 mpg. Gasoline use increased 79% from 1,081 gallons in 2014 to 5,112 in 2018. Liquified petroleum gasoline consumption also increased from zero gallons consumed in 2014 to 9,761 gallons in 2018.

## *Off-Road Vehicles & Equipment*

This inventory categorizes off-road vehicles and equipment into three categories: ferry travel, air travel, and other off-road vehicles and equipment. Other off-road vehicles and equipment includes emissions from vehicles and equipment used for agriculture, construction, lawn/gardening, and recreation such as boating.

### Ferry Travel

Emissions from ferry travel decreased from 14,051 $MTCO_2e$ in 2014 to 11,334 $MTCO_2e$ in 2018, an overall decrease of 19%. This decrease is a result of a large reduction in fuel consumption by Washington State ferries traveling the Seattle-Bainbridge Island route. In 2014, we estimate that Bainbridge Island's share of ferry travel accounted for the consumption of 2.7 million gallons of fuel, compared to 2.2 million gallons in 2018.

### Air Travel

We estimate that air travel contributed 13% to communitywide emissions, making it the largest source of off-road GHG emissions and second-largest source of emissions overall (tied with non-residential energy). Emissions from air travel increased 29%, from an estimated 24,023 $MTCO_2e$ in 2014 to 31,002 $MTCO_2e$ in 2018. This increase is largely attributable to population growth on Bainbridge Island and a 30% increase in total landings at SeaTac International Airport between 2014 and 2018. Our calculations are based on available jet fuel usage data (from 2015), which were scaled by the proportion of landings at SeaTac International Airport. Bainbridge Island's population and businesses make up approximately 0.5% of the four-county area that SeaTac predominantly serves (King, Kitsap, Pierce, and Snohomish counties).

### Other Off-Road Vehicles & Equipment

We estimate that emissions from other off-road equipment accounted for 4% of overall emissions in Bainbridge Island in 2018 (10,331 $MTCO_2e$). Most of these emissions—which are estimated by scaling county-level model outputs to Bainbridge Island based on population—are generated by construction equipment, lawn and garden equipment, and pleasure watercraft.

## Solid Waste and Wastewater

### *Solid Waste*

Most emissions from the disposal of solid waste are associated with the release of methane from decomposing waste in the landfill (see Figure 17 and Table 9). Emissions from waste disposal increased from 5,527 $MTCO_2e$ in 2014 to 6,134 $MTCO_2e$ in 2018, an 11% change that is largely due to population growth and associated increases in tons disposed. Based on waste characterization studies from Kitsap County, King County, and Washington State, the composition of waste over time remained relatively constant. Approximately two-thirds of disposed waste is mixed solid waste, and about one-quarter is food scraps.

All of Bainbridge Island's waste is transported off-Island, first in trucks to the Olympic View Landfill in Bremerton then via train to the Columbia Landfill near Arlington, Oregon. We estimate that emissions from waste transportation increased from 2,352 $MTCO_2e$ to 2,611 $MTCO_2e$. This is associated with the rise in waste collected and transported, which grew from an estimated 22,616 tons in 2014 to 25,102 tons in 2018.

Emissions from equipment used at the landfill to process waste and from yard waste composting make up a nominal proportion of the Island's solid waste emissions. We estimate that the diesel-powered equipment at Columbia Landfill generated 371 $MTCO_2e$ and 412 $MTCO_2e$ in 2014 and 2018, respectively. In 2018, Bainbridge Disposal reported 1,900 tons of yard waste were composted, which generated 132 $MTCO_2e$.

**Figure 16. Solid waste emissions in 2018, by source.**

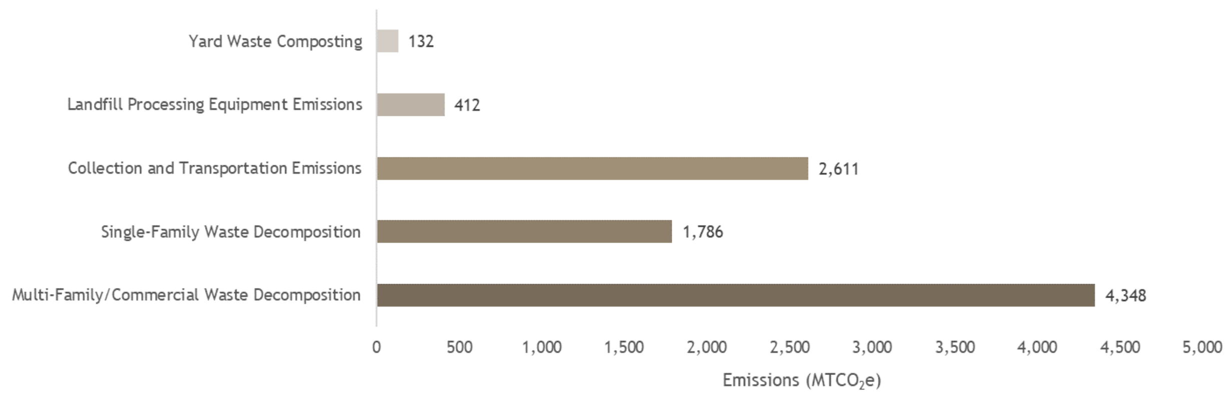



**Table 8. Summary of solid waste emissions, by process.**

| Process | Emissions ($MTCO_2e$) | | |
|---|---|---|---|
| | 2014 | 2018 | Difference |
| Solid Waste Disposal & Decomposition | 5,527 | 6,134 | +607 |
| Yard Waste Composting | 119 | 132 | +13 |
| Collection & Transportation to Landfill | 2,352 | 2,611 | +258 |
| Processing with Equipment at Landfill | 371 | 412 | +41 |
| ***Total*** | ***8,369*** | ***9,289*** | ***+920*** |
| **Process** | **Emissions by Weight ($MTCO_2e$/ton waste)** | | |
| | 2014 | 2018 | Difference |
| Solid Waste Disposal & Decomposition | 0.244 | 0.244 | — |
| Yard Waste Composting | 0.070 | 0.070 | — |
| Collection & Transportation to Landfill | 0.104 | 0.104 | — |
| Processing with Equipment at Landfill | 0.016 | 0.016 | — |
| ***Total*** | 0.344 | 0.344 | — |

### *Wastewater Treatment*

The combined emissions from wastewater treatment (process and effluent emissions) and fugitive emissions[12] from septic sources contributed to 1% of communitywide emissions in 2018. This small proportion is associated with an overall 2% increase in emissions from these sources, from 2,134 $MTCO_2e$ in 2014 to 2,182 $MTCO_2e$ in 2018 (see Table 10). This increase is due to population growth and the associated increase in waste generated and processed (calculations for emissions from septic tanks were scaled based on Bainbridge Island population trends and calculating emissions from WWTP also accounted for population growth).

**Table 9. Emissions from wastewater treatment and septic tanks ($MTCO_2e$).**

| Source | Emissions ($MTCO_2e$) | | | |
|---|---|---|---|---|
| | 2014 | 2018 | Difference | % change |
| WWTP Process | 13 | 14 | +1 | +7% |
| WWTP Effluent | 35 | 37 | +2 | +7% |
| Septic Tanks | 2,086 | 2,131 | +45 | +2% |
| ***Total*** | **2,134** | **2,182** | **+48** | **+2%** |

## Other Process & Fugitive Emissions

Emissions from other processes and fugitive sources—including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride ($SF_6$)–contributed 6% of Bainbridge Island's communitywide emissions in 2018.[13] Emissions from HFCs—a common refrigerant used in refrigeration and air conditioning—comprised nearly all of these emissions (99%; 13,234 $MTCO_2e$).

We estimate that emissions from HFCs and PFCs increased 10% between 2014 and 2018, from 12,061 $MTCO_2e$ to 13,237 $MTCO_2e$. This increase is driven by population growth, as emissions were scaled down by population from national-level emissions due to lack of locally available data.

Fugitive emissions from leaks of $SF_6$ in electricity transmission and distribution operating equipment declined an estimated 36%, from 147 $MTCO_2e$ in 2014 to 95 $MTCO_2e$ in 2018. Our calculations are based on data reported by PSE in their 2014 and 2017 GHG inventories, scaled down to the 1% of customers Bainbridge Island represents within PSE's service area.

Data on process and fugitive sources such as HFC, PFC, and $SF_6$ emissions at city scales are scarce. The U.S. EPA's 2019 *Inventory of GHG Sources and Sinks* was used as a proxy and the data was scaled to Bainbridge Island's population. Estimating emissions from process and fugitive sources can be highly uncertain. Factors vary between individual pieces of equipment. Even if the leak rate of a piece of equipment has been tracked carefully, , that leak rate can change after the leak is repaired or as the

[12] Fugitive emissions are from leaks.

[13] Fugitive emissions are those that are not physically controlled but result from the intentional or unintentional release of GHGs. They commonly arise from the production, processing, transmission, storage and use of fuels or other substances, often through joints, seals, packing, and gaskets. Examples include HFCs from refrigeration leaks, $SF_6$ from electrical power distributors, and $CH_4$ from solid waste landfills.

equipment ages. For example, equipment can leak for two or more years before requiring a recharge, so emissions over this timeframe are typically not detected until after they occur.

**Table 10. Summary of emissions from other processes and fugitive sources.**

| GHG | Emissions ($MTCO_2e$) | | | |
|---|---|---|---|---|
| | 2014 | 2018 | Difference | % change |
| HFC | 12,058 | 13,234 | +1,176 | +10% |
| PFC | 3 | 3 | 0 | 0% |
| $SF_6$ | 147 | 95 | -53 | -36% |
| ***Total*** | ***12,209*** | ***13,332*** | ***+1,123*** | ***+9%*** |

## Agriculture

The Kitsap County agricultural census reported 11,483 and 12,539 livestock animals in 2012 and 2017, respectively. To determine what proportion of livestock animals were on Bainbridge Island during these years, we scaled agricultural census data for Kitsap County to Bainbridge Island based on land area. Using this methodology, we estimate that Bainbridge Island had 803 and 875 livestock animals in 2014 and 2018; representing a 9% increase in animals between the two years.

While the total animal population increased on the Island, we estimate that the number of cattle decreased by 12%. This decline drove estimated reductions in enteric fermentation emissions—the release of methane ($CH_4$) as livestock digest food—of 7%, from 319 $MTCO_2e$ in 2014 to 297 $MTCO_2e$ in 2018.

Emissions from manure management increased 5%, from 33 $MTCO_2e$ in 2014 to 34 $MTCO_2e$ in 2018, driven by the overall increase in livestock animal population.

**Table 11. Agricultural acres and population trends, by livestock.**

| Animal | Population | | |
|---|---|---|---|
| | 2014 | 2018 | % change |
| Horses | 98 | 100 | +2% |
| Sheep | 41 | 82 | +100% |
| Goats | 35 | 44 | +26% |
| Cattle | 92 | 81 | -12% |
| Poultry | 517 | 538 | +4% |
| Swine | 20 | 30 | +50% |
| ***Total*** | ***803*** | ***875*** | ***+9%*** |

# DATA SOURCES AND METHODOLOGY

We followed the *U.S. Community Protocol* (Version 1.1) to complete the communitywide emissions inventory for 2014 and 2018, using the U.S. EPA's *GHG Inventory Sources and Sinks Annexes* for 2014 and 2019 and the IPCC's *5th Assessment Report* (AR5) for updated GWPs and emissions factors where available. All emissions were calculated in ClearPath and were based on verified local data when they were available. When local data were not available, data inputs were scaled down from Kitsap County, King County, or national datasets. Most data were deemed medium quality due to assumptions about local data.

Completing this inventory involved acquiring the following data, summarized in Table 13 and detailed in the followed sections:

- **Activity data** that quantifies levels of activity that generate greenhouse gas emissions, such as vehicle miles traveled, and tons of waste generated.
- **Emission factors** that translate activity levels into emissions.

Data quality is assessed and reported on a High (H), Medium (M), and Low (L) scale in accordance with GHG inventory best practices:

- A *High* rating indicates data are detailed and specific to the local geography
- A *Medium* rating indicates data are more general or modeled with robust assumptions and may not be specific to the local geography, but are downscaled from a slightly broader geography (e.g., state-level)
- A *Low* rating indicates data are highly modeled, uncertain, or a default value was used based on national characteristics.

**Table 12. Key data sources for the City of Bainbridge Island's communitywide inventory.**

| Sector | Activity Data (AD) | AD Quality | Emissions Factors (EF) | EF Quality |
|---|---|---|---|---|
| **Residential Energy** | | | | |
| **Electricity** | • Overall kWh consumption from the three substations serving the Island<br>• Residential proportion based on sample of customer data in 2014 and 2018 | H | • PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2014 & 2017, Table 7.1) | H |
| **Stationary Fuel Combustion** | • Local propane sales tax information for Bainbridge Island (2014 and 2018)<br>• EIA's average propane price per gallon of fuel for 2014 and 2018. | M | • Emissions factors provided in ClearPath program | M |
| **Electricity Transmission & Distribution Losses** | • See "Electricity"<br>• eGRID Western region grid gross loss percentage (2014 and 2016) | M | • PSE-reported emissions factors (PSE Greenhouse Gas Inventory, 2014 & 2017, Table 7.1) | H |

| Sector | Activity Data (AD) | AD Quality | Emissions Factors (EF) | EF Quality |
|---|---|---|---|---|
| **Non-Residential Energy** | | | | |
| **Electricity** | • kWh consumption from the three substations serving the Island<br>• Non-residential proportion based on sample of customer data in 2014 and 2018 | **H** | • PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2014 & 2017, Table 7.1) | **H** |
| **Electricity Transmission & Distribution Losses** | • See "Electricity"<br>• eGRID Western region grid gross loss percentage (2014 and 2016) | **M** | • PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2014 & 2017, Table 7.1) | **H** |
| **Transportation** | | | | |
| **On-Road Vehicles** | • Annual miles traveled, by vehicle and fuel type, provided by EPA MOVES analysis of travel model data, for proportion of Kitsap County VMT occurring in Bainbridge Island<br>• Annual revenue miles traveled and fuel consumption by type provided by National Transit Database for Kitsap County, then scaled down to Bainbridge Island by population | **M** | • $CO_2$, $CH_4$, and $N_2O$ emission factors are defaults from the U.S. Community Protocol | **L** |
| **Off-Road Vehicles & Equipment** | • Emissions by off-road sector and fuel type, along with days of use per year, provided by nonroad module of the EPA MOVES model, for proportion of Kitsap County activity occurring in Bainbridge Island | **M** | • $CO_2$, $CH_4$, and $N_2O$ emission factors are defaults from the U.S EPA MOVES nonroad model | **L** |
| **Air travel** | • 2015 Jet fuel consumption from Port of Seattle, scaled to target years by total landings and to the Island by population/employment | **M** | • $CO_2$, $CH_4$, and $N_2O$ emission factor defaults from ClearPath | **H** |
| **Ferry travel** | • Ferry fuel price, from EIA, and cost, from WSDOT | **M** | • $CO_2$, $CH_4$, and $N_2O$ emission factor defaults from ClearPath | **H** |
| **Solid Waste and Wastewater** | | | | |
| **Solid Waste Generation** | • Single-family waste tonnages from Bainbridge Disposal<br>• Multi-family + commercial tonnages estimated from ratio of single-family to multi-family + commercial from 2015-2016 WA Waste Characterization Study, for Kitsap County<br>• Landfill methane collection scenario confirmed "typical" by Columbia Landfill<br>• Annual precipitation from National Weather Service, Arlington, OR | **M** | • Waste characterizations from 2015-2016 WA Waste Characterization Study, for Kitsap County<br>• Waste characterization was comparable across Port Orchard samples and the Puget Sound-wide data from the aforementioned study; there was also little difference compared to King County compositions, which were assessed as a reference | **M** |

| Sector | Activity Data (AD) | AD Quality | Emissions Factors (EF) | EF Quality |
|---|---|---|---|---|
| **Solid Waste Collection & Transportation** | • Mass of solid waste from Bainbridge Disposal, with multi-family + commercial estimated from Kitsap County ratio of single-family to multi-family + commercial (see above)<br>• Mileage from Google maps | **M** | • Default EF from ClearPath | **L** |
| **Yard Waste Composting** | • Yard waste tonnage from Bainbridge Disposal for 2018; extrapolated for 2014 using 2014:2018 single-family solid waste ratio | **M** | • Default EF from ClearPath | **L** |
| **Landfill Processing** | • Mass of solid waste from Bainbridge Disposal, with multi-family + commercial estimated from Kitsap County ratio of single-family to multi-family + commercial (see above)<br>• Fuel type for equipment confirmed by Columbia Landfill | **M** | • Default EF from ClearPath | **L** |
| **Wastewater Treatment Facility** | • Wastewater treatment facility processes determined based on desktop research and confirmed with City staff<br>• Population served by wastewater treatment facility estimated by multiplying the number of sewer connections by the average household size from ACS | **M** | • Default EF from ClearPath<br>• $CH_4$ emissions were not applicable since the system is aerobic | **L** |
| **Septic Tanks** | • Population data estimated based on number of septic systems reported to the Department of Health and the number of sewer connections in the community. | **M** | • Default EF from ClearPath<br>• Fugitive emissions calculated using Community Protocol WW.11 Alternative Method for Methane Emissions from Septic Systems if Only the Population is Known | **L** |
| **Refrigerant Leakage** | | | | |
| **Refrigerant Leakage from Building Heating and Cooling Equipment, and Fugitive Emissions from Electricity Generation & Transmission** | • HFC and PFC tonnage from Annex 6 in U.S. EPA GHG Inventory Sources and Sinks, scaled down to Bainbridge Island population<br>• $SF_6$ tonnage and customer data from PSE, scaled down to Bainbridge Island customers | **L** | • HFC and PFC GWP from IPCC 5$^{th}$ Assessment Report, with adjustment for climate-carbon feedback<br>• $SF_6$ 100-Year GWP from U.S. EPA GHG Sources and Sinks<br>• Emissions calculated using Community Protocol Alternative Method BE.7.1.A | **H** |

| Sector | Activity Data (AD) | AD Quality | Emissions Factors (EF) | EF Quality |
|---|---|---|---|---|
| **Agriculture** | | | | |
| **Enteric Fermentation and Manure Management** | • Animal population and pastureland from USDA Agricultural Census, for Kitsap County<br>• Agricultural acres with livestock on Bainbridge Island and waste management system, from Kitsap County Conservation District<br>• Typical animal mass and $B_o$ from U.S. EPA GHG Inventory Sources & Sinks, 2017 Annexes<br>• Volatile solids and excreted nitrogen from U.S. EPA GHG Inventory Sources & Sinks, 2014 and 2017 Annexes<br>• Methane conversion factors from *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2017,* with annual average temperature from Climate Bremerton | **M** | • EF, 100-year GWP for $CH_4$ and $N_2O$, and volatilization nitrogen loss from U.S. EPA GHG Inventory Sources & Sinks, 2017 Annexes<br>• EF for nitrogen volatilization and runoff/leaching from U.S. Community Protocol, Appendix G<br>• Indirect $N_2O$ emissions calculated using U.S Community Protocol, Appendix G | **M** |

## The U.S. Community & Local Government Operations Protocols

The *U.S. Community* and *Local Government Operations* Protocols were built to provide easily applicable and accurate community-level and municipal estimates of GHG emissions. These protocols provide a consistent framework in which to compare emissions from a geographic or operational boundary across time. The *U.S. Community Protocol* was designed for community-scale GHG accounting, making it a valuable tool for counties and cities, and an appropriate choice for the City of Bainbridge Island. The *U.S. Community* and *Local Government Operations* Protocols are widely used, understood, and respected.

These community and municipal inventories follow the *U.S. Community* and *Local Government Operations Protocol* methodologies and deviate from their stated methods only when more precise, local data are available, per Protocol recommendations. The Local Governments for Sustainability (ICLEI) created the *U.S. Community Protocol* in 2013 and the *Local Government Operations Protocol* in 2010. The U.S. Community Protocol requires, at a minimum, reporting of the following five activities: 1) Use of electricity by the community 2) Use of fuel in residential and commercial stationary combustion equipment 3) On-road passenger and freight motor vehicle travel 4) Use of energy in potable water and wastewater treatment and distribution 5) Generation of solid waste by the community. These activities are required because they represent the largest sources of GHG emissions for most communities and are activities that can be impacted by local government actions. The *Local Government Operations Protocol* includes similar reporting requirements with a focus on only those emission sources that are within the government's control and are the result of day-to-day operations.

## Residential Energy

- Data on **electricity** use were provided by the utility serving Bainbridge Island, PSE, and for transmission and distribution losses, by eGRID.
- Stationary fuel combustion consisted of residential **fuel oil,** with data from EIA and the number of households from ACS.
- **Propane** usage for residential, commercial, and industrial sectors was estimated using local sales tax data and EIA information on average propane fuel prices per gallon.

## Non-Residential Energy

- Data on **electricity** use were provided by the utility serving Bainbridge Island, PSE, and for transmission and distribution losses, by eGRID. PSE does not track commercial and industrial energy separately, hence they were combined in this analysis.

## Transportation

- **Vehicle miles traveled** were derived from Puget Sound Regional Council's MOVES analysis of travel model data and account for all mileage within the Kitsap County boundary regardless of trip origin or destination. Emissions for Bainbridge Island are assumed proportional to the share of Kitsap County VMT occurring in Bainbridge Island city limits. Share of average weekday VMT occurring in Bainbridge Island was calculated from 2014 travel model data and includes all vehicle types. Bainbridge Island VMT shares represents all trips to/from Bainbridge Island as well as those driving through the city boundaries. Year 2018 was extrapolated from the rates between 2014 and 2016. The PSRC data reported VMT and emissions for passenger vehicles, medium trucks, heavy trucks, and transit. In ClearPath, we reported medium trucks as light trucks.
- **Annual revenue miles** and **fuel consumption** data for Kitsap County were acquired from the National Transit Database from the Federal Transit Administration. These data were scaled down to Bainbridge Island by population.
- The Port of Seattle supplied **jet fuel consumption** data for SeaTac Airport for 2015, of which 0.5-1% was attributable to Bainbridge Island. SeaTac passenger enplaning surveys and population and employment statistics were used to assign the above fraction of the total airshed emissions to the Bainbridge Island community. This allocation methodology means that communities with more residents and business travelers are assigned a greater proportion of travel-related emissions at SeaTac airport. We scaled 2015 jet fuel usage to 2014 and 2018 based on the total landings in those years.
- **Ferry fuel consumption** was derived from EIA data on diesel fuel price and from WSDOT data on the reported fuel cost for the Bainbridge Island route in fiscal year 2015.
- **Off-road emissions** were calculated from the nonroad module of the EPA MOVES model for 2014 and 2018. The model estimates emissions at the county level, which were then scaled down to Bainbridge Island by population. Emissions include common non-road equipment, including construction, agriculture, lawn/gardening, and recreational equipment.

### Ferry Emissions Attribution

Accounting for emissions related to ferry transportation can be complicated by the fact that ferries typically travel between multiple jurisdictions. To simplify the methodology for calculating these emissions, the *U.S. Community Protocol* recommends allocating portions of the total emissions related to ferry transportation according to the number of stops located in each jurisdiction. For example, for the Bainbridge Island-Seattle ferry, this would equate to a 50/50 split of emissions since there is one ferry stop in each city. This is the calculation approach that was used in this community inventory.

However, another possible method for attributing emissions to a particular jurisdiction is by ridership and examining the proportion of ferry riders from each city. To test that the 50/50 allocation was the correct choice for Bainbridge Island, we performed a sensitivity analysis using a ridership-based methodology. Using data reported by Washington State, we assumed that where travelers were heading in the evening on a weekday was likely where they reside. Based on this assumption and available data, we examined the proportion of total ferry travelers that end in Bainbridge Island in the evening versus elsewhere. Using this technique, we deduced that 47% of weekday ferry commuters are residents of Bainbridge Island—a value that is very close to the original 50% estimate.

Given that this proportion strongly aligns with the 50/50 approach recommended by the *U.S. Community Protocol*, we ultimately followed the U.S. Community Protocol attribution approach to align with the robust and established methodology used by other communities in the region.

## Solid Waste and Wastewater

- Bainbridge Disposal single-family tonnages and Kitsap County waste characterization data, along with default emissions factors provided in ClearPath, were used to calculate emissions from **waste disposal and composting.** Multi-family and commercial tonnages were not directly available and were estimated using a single-family to multi-family + commercial ratio of 32:68, based on the transfer station survey data collected for the 2015-2016 Washington Waste Characterization Study. Waste characterization was comparable across Port Orchard samples and the Puget Sound-wide data from the aforementioned study; there was also little difference compared to King County compositions, which were assessed as a reference.
- **Landfill emissions** assumed an 82.5% capture rate, based on Columbia Landfill's confirmation of a "typical" collection scenario and ClearPath's associated capture rates.
- Wastewater emission calculations required data from Kitsap County Sewer District #7 and the City of Bainbridge Island **wastewater treatment plants**. City and County staff provided the data.
- Data required for higher quality calculations in ClearPath, such as $BOD_5$ or population specifically using septic systems (including unpermitted systems), were not available. Therefore, **fugitive septic tank** emissions were estimated based on the number of Bainbridge Island residents not served by a sewer connection.

## Other Process & Fugitive Emissions

- Data on **fugitive refrigerant** HFC and PFC emissions at city scales is scarce. We used the U.S. EPA's 2019 Inventory of GHG Sources and Sinks and scaled the data to Bainbridge Island by population. GWP were adjusted to the latest available values in 2014 and 2018, which corresponded to the values in the 4$^{th}$ and 5$^{th}$ Assessment Reports, respectively.
- PSE's greenhouse gas inventories from 2014 and 2017 provided **fugitive electric transmission and distribution** emissions data for $SF_6$. We scaled the data to Bainbridge Island using PSE customer data.

## Agriculture

- The USDA provides publicly available data on the number of animals by county, which was scaled down to Bainbridge Island according to the ratio of livestock to land area. Kitsap County Conservation District provided data on manure management systems. The EPA provides national-level **animal enteric and manure** emissions factors, and state-level emissions factors for cattle.

## Considerations

At the time of this inventory, not all communitywide data were available. Many calculations were scaled from national or county estimates by population. ClearPath's default emissions factors were used in cases where local data were not available. There is always a certain level of uncertainty associated with inventories, given constraints in data availability for most communities. However, the goal of performing inventories is to attempt to accurately and precisely account for all sources of emissions using best available data and unbiased methodologies. While ranges of uncertainty are typically not quantified, we strive to use approaches that produce estimates that are neither conservative nor liberal in their leanings, and are based on the most locally-specific and reputable data sources.

A list of data limitations and other considerations specific to Bainbridge Island's communitywide inventory is provided below.

- **Multi-family and commercial solid waste tonnage:** Since tonnage data was not available, we assumed a 32:68 ratio of single-family to multi-family and commercial waste, based on Port Orchard transfer station surveys in 2015.
- **Yard waste composting tonnage:** Bainbridge Disposal data was available for 2018. To derive 2014 yard waste composting tonnage, we calculated the 2018 ratio of single-family tonnage to yard waste composting tonnage and applied the same ratio to 2014 single-family tonnage.
- **2018 VMT:** PSRC data was available for 2014 and 2016. To derive 2018 VMT, we assumed a linear rate of increase from 2014 to 2016 to 2018.
- **2014 and 2018 Annual Revenue Miles:** We scaled Kitsap County data to Bainbridge Island according to population, which may not accurately reflect public transit ridership on Bainbridge Island.
- **Septic tank fugitive emissions:** In the absence of data on $BOD_5$, we used the U.S. Community Protocol WW.11 Alternative Method to calculate methane emissions when only total population is known.
- **HFC and PFC tonnage:** National data was available for 2014 and 2017 and was scaled down to Bainbridge Island by population. We assumed semiconductor manufacture, and the production of magnesium and aluminum, did not apply to Bainbridge Island and excluded contributions from those sources. The PFC-Substitution of ODS value provided was "does not exceed 0.05"; 0.04 was used as an estimate and may be an overestimate.
- **Air travel:** We were not able to obtain fuel use data for 2018, so the air travel emissions were estimated by using a scaling factor from 2015 fuel use data based on the total landings for 2014 and 2018.
- **Off-road vehicle and equipment:** We used the EPA MOVES model to estimate off-road vehicle and equipment emissions. The model estimates emissions at the county-level; we scaled Kitsap County emissions to Bainbridge Island by population.

These considerations should be taken into account when interpreting findings from this inventory. We also recommend that future inventories seek to address these data limitations, if possible.

# COMMUNITY CONTRIBUTION ANALYSIS

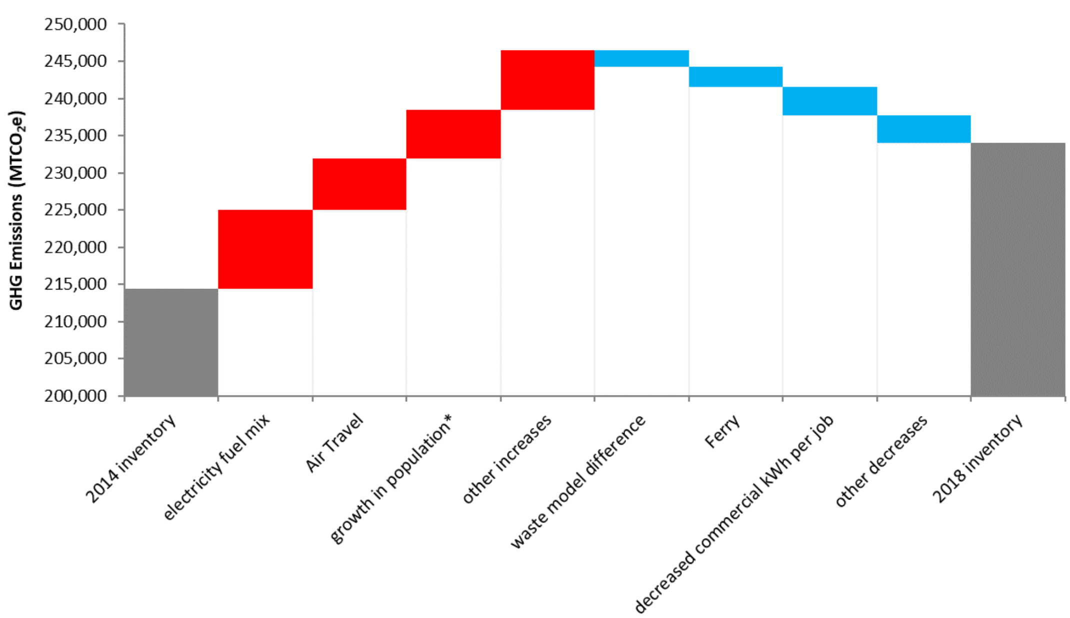
## Introduction

In 2014, Bainbridge Island's 23,135 residents and 9,404 emitted approximately 214,425 $MTCO_2e$. In 2018, the population increased 7% (24,891), the number of households increased 4% (9,798), and communitywide emissions increased 9% (to 233,998 $MTCO_2e$). Apart from population growth, what drove that estimated change in emissions? We utilized the *Analyzing Drivers of Change in Greenhouse Gas Emissions Inventories* tool available from ICLEI USA to attribute changes in the community inventories to the economic, social and technological forces that influenced them.[14]

## Results

The communitywide contribution analysis highlighted factors that lead to the most significant changes in emissions between 2014 and 2018. The analysis revealed that changes to the PSE electricity fuel mix, increased activity at SeaTac airport (and, thus, higher estimated air travel emissions), and growth in population and employment all contributed to increases in emissions within the community. Conversely, downward forces on emissions included reduced ferry fuel use and more efficient driving and energy use. Figure 18 below shows the influences of the top three drivers on the two inventory years, plus a category labeled "other"—a compilation of contributors illustrated in Figure 19.

**Figure 17. High-level summary of major drivers of communitywide inventory increases and decreases.**

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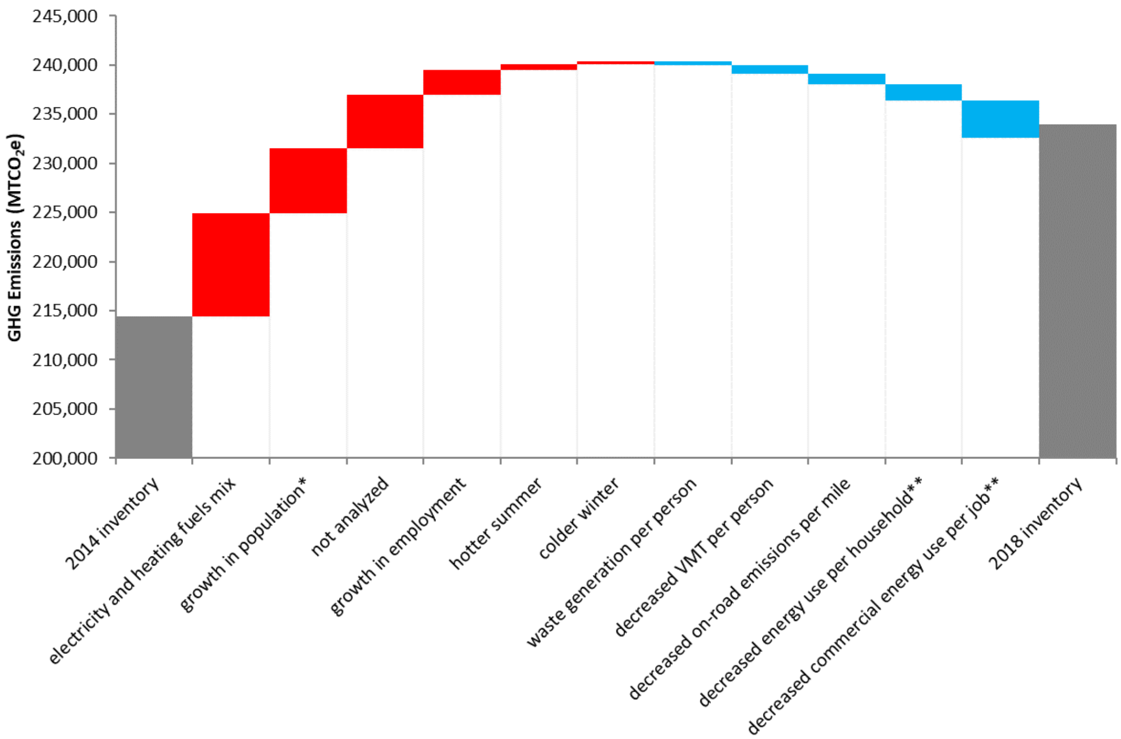
[14] ICELI USA *Analyzing Drivers of Change in Greenhouse Gas Emissions Inventories* tool. http://icleiusa.org/ghg-contribution-analysis/ (Accessed July 1, 2019).

Figure 18. Detailed depiction of major drivers of inventory increases and decreases.




Specifically, contributors to inventory changes included the following, in order of highest increase to lowest decrease:

- **Electricity fuel mix (+10,542)** describes changes to types of resources used to generate electricity for the community. For example, increased use of renewable sources such as hydroelectricity and solar and wind power would drive emissions *decreases* in the electricity fuel mix. For Bainbridge Island, changes in the PSE electricity fuel mix contributed to *increases* in electricity emissions.
- **Growth in population (+6,581)** includes the impacts of increased housing, driving, and waste generation from Bainbridge Island's growing population. Population grew 7.1% from 23,135 in 2014 to 24,891 in 2018.
- **Not analyzed (+5,418)** describes the emissions from multiple sources—including increases in emissions from off-road vehicles, air travel, agriculture, wastewater, and refrigerant loss—that are not explicitly linked to a variable available in the tool. Due to the calculation methodology used to estimate emissions from these sources, many of these increases can be linked to population growth, which was used as a scaling factor to estimate emissions.[15]

[15] These sources are classified as "not analyzed" because population is used as a scaling factor to estimate emissions for these sources, and therefore population growth is already "baked into" the estimation. Thus, it would be inappropriate to group these sources with the "growth in population" driver.

- **Growth in employment (+2,583)** describes the effect of increased job growth and GDP per person on emissions. Economic growth leads to larger consumption of goods and services, therefore resulting in emissions increases.

- **Hotter summer (+499)** is the increase emissions associated the enlarged strain on various systems due to hotter temperatures during the summer, such as increased electricity and energy consumption for residential and commercial cooling. The summer in 2018 was hotter than in 2014.

- **Colder winter (+366)** is the increase emissions associated with the amplified strain on various systems due to colder temperatures during the winter, such as increased electricity and energy use for residential and commercial heating. The winter in 2018 was colder than in 2014.

- **Waste generation per person (-386)** describes the impacts from change in the amount of waste disposed per person. In Bainbridge Island, the growth of waste generation was slower than that of population, which resulted in reduced per-person waste generation.

- **Decreased VMT per person (-919)** describes changes from people driving more or less in the community. On average, each Bainbridge Island resident drove fewer miles, resulting in emissions decreases.

- **Decreased on-road emissions per mile (-1,061)** represents changes in the amount of emissions per vehicle mile driven. These changes could be due to better driving behavior or more fuel-efficient vehicles.

- **Decreased energy use per household (-1,687)** denotes a decline in the amount of energy used by the average Bainbridge Island household. This change could be due to more energy efficient behaviors or appliances.

- **Decreased commercial energy use per job (-3,754)** incorporates the fact that job growth has increased, but a large conversion of energy efficient standards has been made throughout the commercial sector resulting in a decrease in emissions.

# Municipal Operation Emissions

The municipal operation emissions inventory accounts for the GHG emissions resulting from Bainbridge Island City government operations. Bainbridge Island's government provides a range of municipal services including police, streets, planning, zoning, and general administration services. The City also operates the water and wastewater utilities for a portion of the island.

Table 14 below provides an outline of the various emissions sources included in the municipal inventory, paired with their respective Scope. The table also specifies which sectors are required by the *Local Government Operations Protocol.*

**Table 13. Municipal inventory emissions and scope categories.**

| Emissions Type | Required? | Scope 1 | Scope 2 | Scope 3 |
|---|---|---|---|---|
| Buildings and Facilities Energy | | | | |
| Electricity | × | | ✓ | |
| Stationary Fuel Consumption | × | ✓ | | |
| Streetlights and Traffic Signals | × | | ✓ | |
| Transportation | | | | |
| On-Road Fleet Vehicles | × | ✓ | | |
| Off-Road vehicles | × | ✓ | | |
| Employee Commute | | | | ✓ |
| Business Travel | | | | ✓ |
| Solid Waste, Potable Water, and Wastewater | | | | |
| Solid Waste | | | | ✓ |
| Wastewater Treatment | × | ✓ | | |
| Refrigerant Leakage | × | ✓ | | |

## RESULTS

### Overview

Bainbridge Island's 2014 municipal-based GHG inventory totaled 2,067 $MTCO_2e$. Municipal emissions in 2018 increased 11% to 2,291 $MTCO_2e$. Major emissions sources in 2018 included facility electricity consumption (60%) and on-road fleet vehicles (17%) (see Table 15).

Transportation and electricity also contributed some of the largest increases in emissions from 2014 to 2018. Municipal facility electricity and on-road fleet vehicles increased by 14% and 7%, respectively. Just four facilities accounted for 80% of all facility electricity use: Bainbridge Island Waste Water Treatment Plant (WWTP), City Hall, Fletcher Bay: Well Field, and Bainbridge Island Public Works Operations and Maintenance Yard. There were a few sectors with decreases in emissions, the largest of which was from streetlight and traffic signal improvements.

Table 14. Municipal GHG emissions by year, sector, and scope.

| | | GHG Emissions ($MTCO_2e$) | |
|---|---|---|---|
| **Sector** | **Scope** | **2014** | **2018** |
| **Building Propane** | 1 | 40 | 40 |
| **On-Road Fleet Vehicles** | 1 | 359 | 385 |
| **Off-Road Vehicles** | 1 | 77 | 63 |
| **Refrigerant Loss** | 1 | 18 | 18 |
| **Wastewater Treatment Plant** | 1 | 40 | 43 |
| **Electricity** | 2 | 1,212 | 1,383 |
| **Street Lights & Traffic Signals** | 2 | 103 | 91 |
| **Solid Waste Generation** | 3 | 59 | 84 |
| **Employee Commute** | 3 | 160 | 184 |
| **Business Travel** | 3 | - | - |
| **Total** | | **2,067** | **2,291** |

Figure 19. Municipal emissions, by source and scope, for 2018 (total = 2,291 $MTCO_2e$).

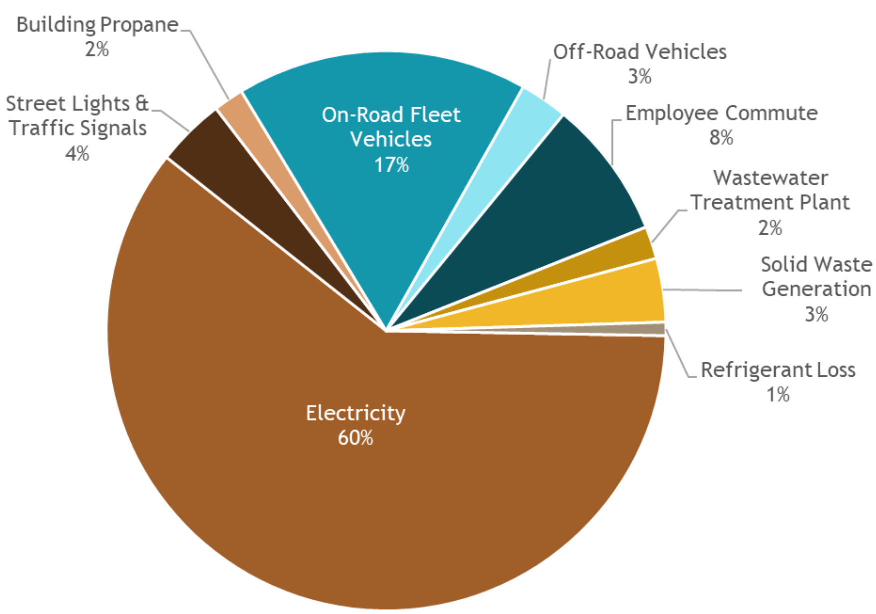
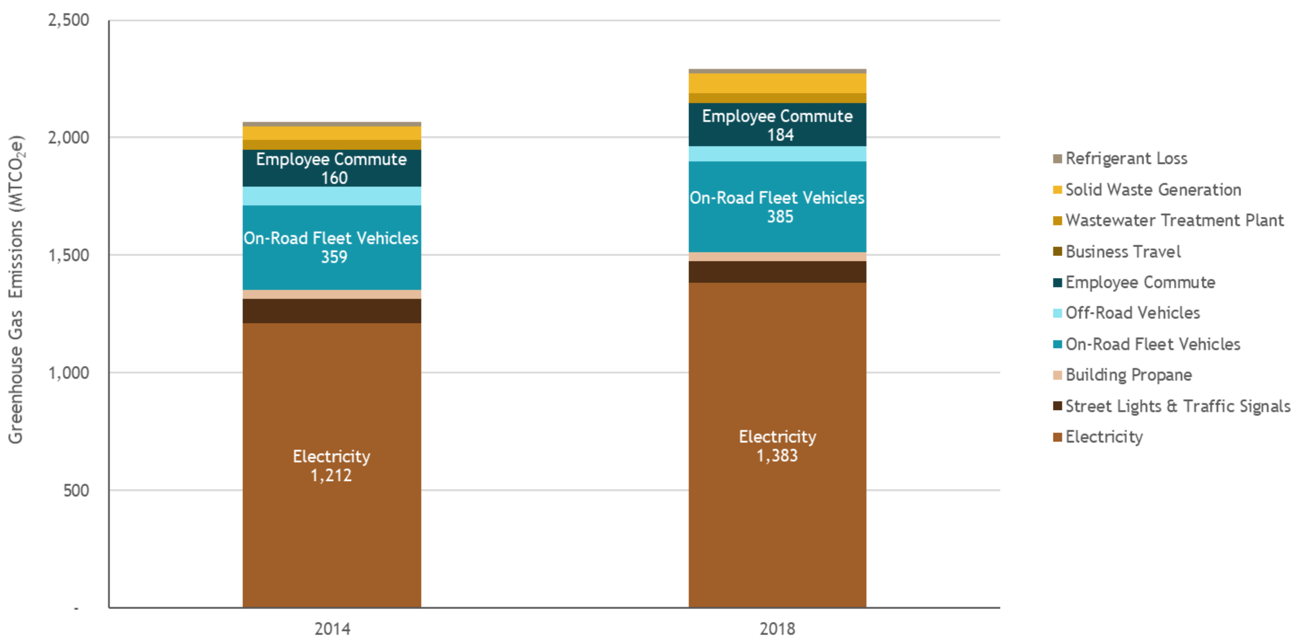


**Figure 20. Bainbridge Island municipal emissions, by year and source.**

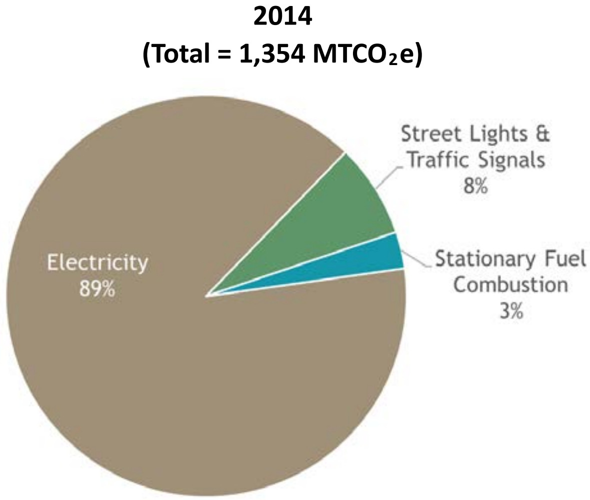


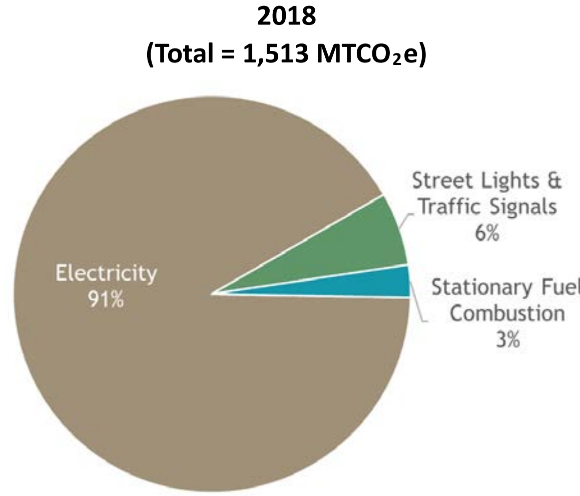

## Buildings and Facilities Energy

The City of Bainbridge Island operates several government administration buildings, including City Hall, the Police Station, the Municipal Court, and a maintenance yard, as well as several community spaces, a wastewater treatment facility, and the streetlights and traffic signals throughout the City. This section details the GHG emissions resulting from the consumption of energy at these buildings and facilities. The types of energy consumed at these locations include electricity, provided by Puget Sound Energy, and propane, which is combusted in stationary equipment on-site.

In 2018, energy consumption at City of Bainbridge Island buildings and facilities accounted for 66% of total municipal GHG emissions. Building electricity usage accounted for the bulk of emissions, comprising 89% and 91% of the energy sector's emissions in 2014 and 2018, respectively (see Figure 22). From 2014 to 2018, building and facility electricity emissions grew by 14%, primarily due to fluctuations in the electricity utility fuel mix (see *Electricity* section below). The following sections provide greater detail on trends for the three sources of building and facility energy use: electricity, stationary fuel combustion, and streetlights and traffic signals.

**Figure 21. Bainbridge Island municipal buildings and facilities energy emissions.**




## *Electricity*

Electricity usage contributed the largest portion of GHG emissions within the City's buildings and facilities sector, resulting in the emission of 1,212 $MTCO_2e$ in 2014 and 1,383 $MTCO_2e$ in 2018. Between 2014 and 2018, electricity emissions grew by 14%. However, electricity usage in kWh only grew by 4% within this same time period. This indicates that the growth in emissions between 2014 and 2018 was primarily due to fluctuations in the electricity utility fuel mix (i.e., changes in the proportion of fossil fuel sources used by the utility to generate electricity in a given year) rather than substantial increases in electricity usage.

The two facilities with the greatest electricity usage in both years were the wastewater treatment facility (WWTP) and City Hall. These two facilities also experienced the greatest *reductions* in electricity usage between 2014 and 2018, demonstrating that the City is continuing to make progress on energy efficiency and conservation in the highest consumption facilities (see Figure 23 Figure 24 below). One way the City has reduced electricity usage at City Hall is through on-site solar electricity production: the solar panels at City Hall produced 71,300 kWh and 74,500 kWh of solar electricity in 2014 and 2018, respectively.

**Figure 22. Top electricity-using facilities in 2018.**

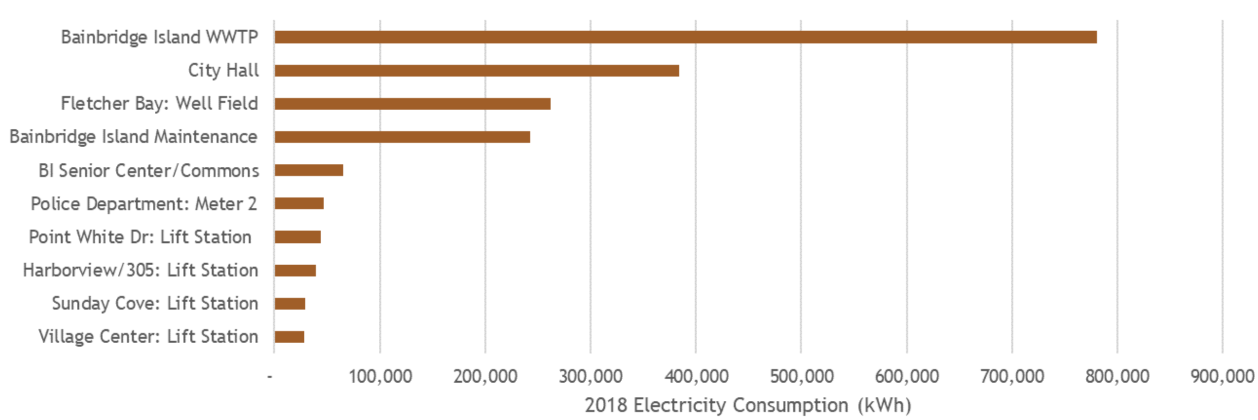


**Figure 23. Facilities with the greatest electricity consumption *increases* between 2014 and 2018.**

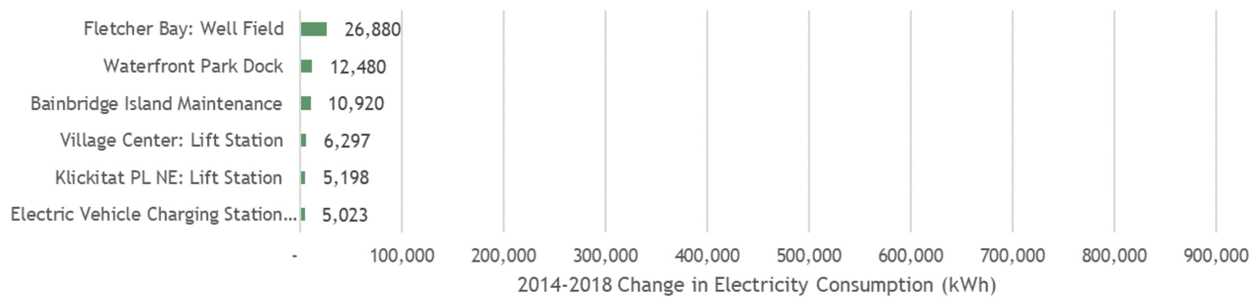
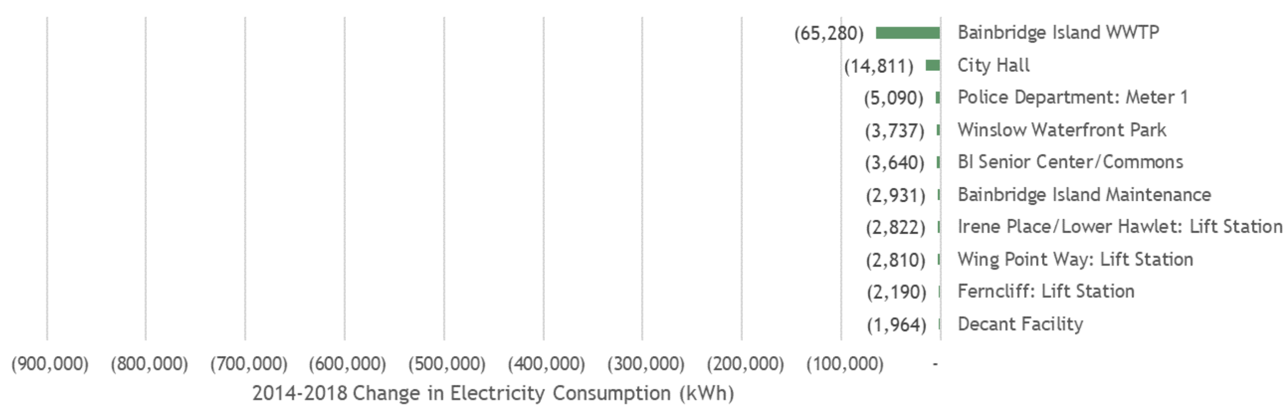



**Figure 24. Facilities with the greatest electricity consumption *decreases* between 2014 and 2018.**




## *Stationary Fuel Combustion*

Stationary fuel (propane) combustion was the lowest contributor to building-related municipal GHG emissions in both 2014 and 2018. Between both years, emissions remained constant at 40 $MTCO_2e$. The only source for stationary fuel combustion is the Public Works Operations and Maintenance shop, which consumed an estimated 7,077 gallons of propane for heating. The number of gallons consumed remained constant from 2014 to 2018 and therefore resulted in no change in emissions.

## *Streetlights and Traffic Signals*

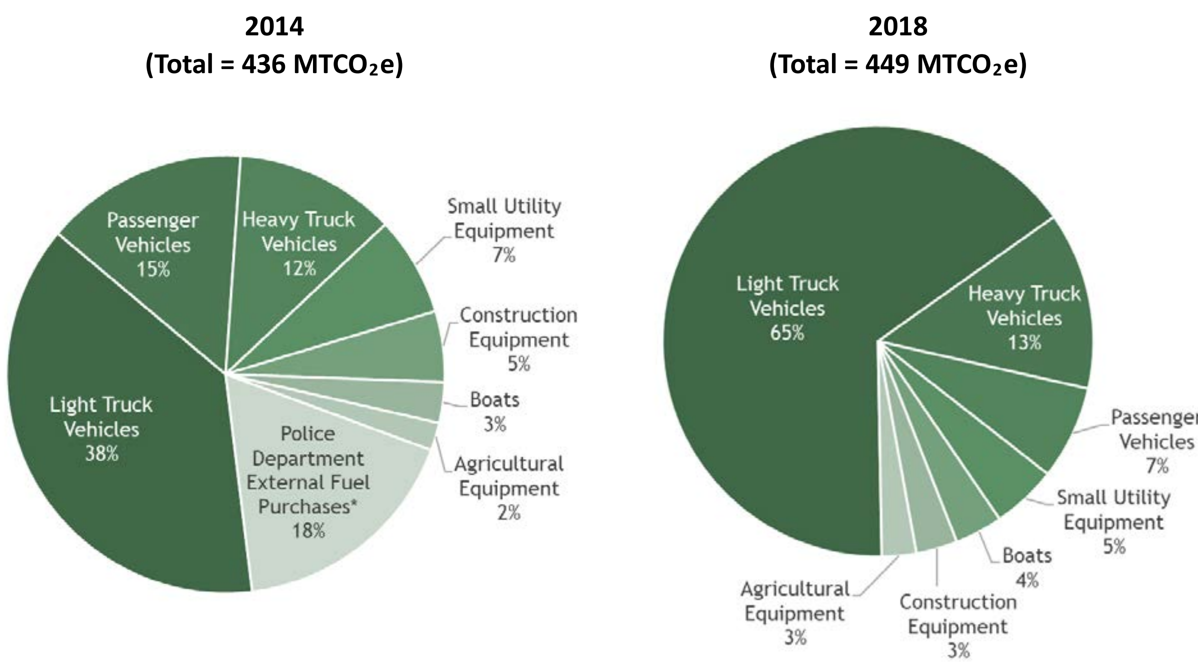
The second largest contributor to GHG emissions 2018 were streetlights and traffic signals. Between 2014 and 2018, the City of Bainbridge Island increased the number of streetlights from 328 to 343. However, the emissions produced and electricity consumed by the streetlights has decreased by 12%. This decrease can be attributed to the City's increased use of energy efficient bulbs.

## Transportation

Transportation sector emissions are the third largest contributor to the City of Bainbridge Island's municipal emissions. This section details the GHG emissions resulting from the consumption of gasoline, diesel, biodiesel, and propane in various vehicles. These vehicles are a part of numerous city operations, such as emergency services, landscaping, and government travel.

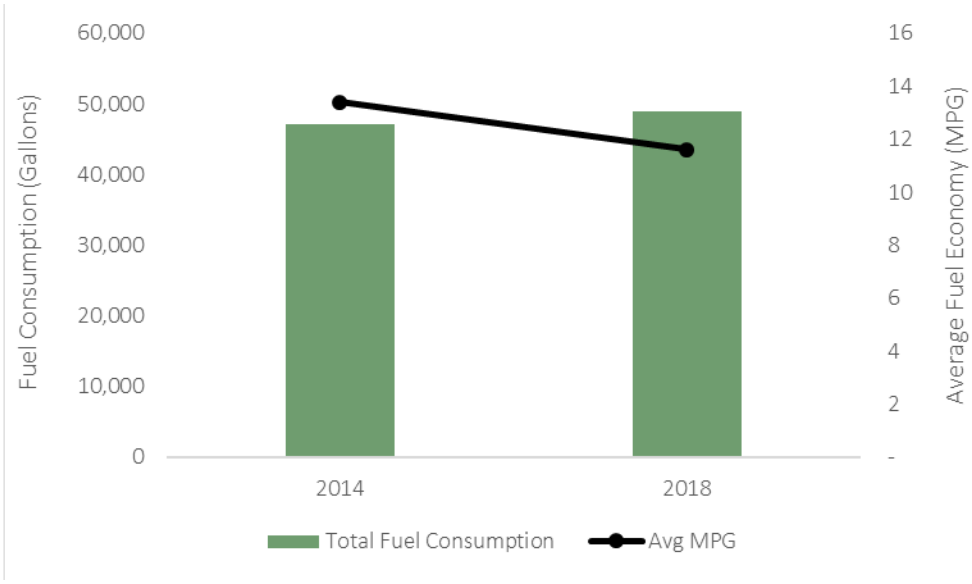
In 2018, the transportation sector contributed 28% of all emissions, totaling 663 $MTCO_2e$. The City of Bainbridge Island utilizes fuel for different vehicles such as boats, pickup-trucks, dump trucks, construction equipment, and patrol vehicles (see Figure 26). Municipal fuel consumption and emissions increased between 2014 and 2018, and there was a small decrease in fuel economy. Between 2014 and 2018, average municipal fuel economy decreased from 13 mpg to 12 mpg (see Figure 27).

**Figure 25. City of Bainbridge Island fleet vehicle emissions, by type.**




*[*] Refers to police department fuel purchased outside of O&M. This data is not connected to specific vehicle types.*

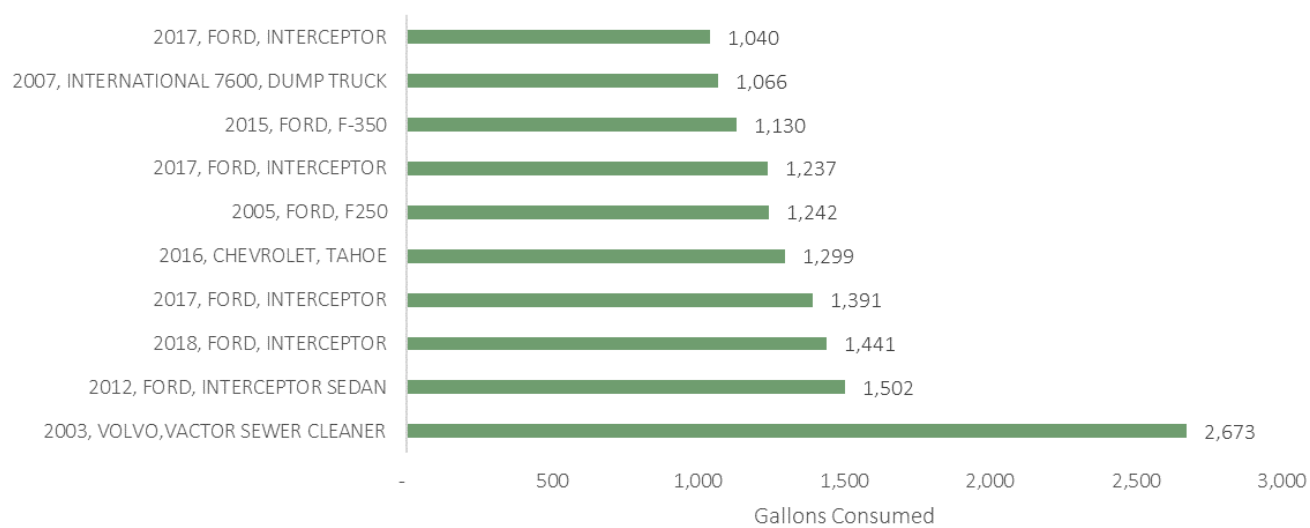
**Figure 26. Municipal fleet fuel consumption and average fuel economies, by year.**




## *On-Road Fleet Vehicles*

On-road vehicles made up the majority of transportation emissions in 2014 and 2018. Emissions come from on-road fleet vehicles driving on roadways within the community. In 2018, on-road vehicles consisted of 61% of all transportation sector emissions. We estimate that municipal on-road vehicles produced 359 $MTCO_2e$ and 385 $MTCO_2e$ in 2014 and 2018, respectively. The 2003 Volvo Vactor Sewer Cleaner consumed the greatest amount of fuel both years (1,518 gallons of diesel in 2014 and 2,673 gallons in 2018). The Patrol/Interceptor vehicles sector contained the largest number of fuel-consuming vehicles. Figure 28 presents the top-10 fuel consuming vehicles in 2018.

**Figure 27. Top 10 fuel-consuming fleet vehicles, 2018.**



### *Off-Road Vehicles*

Off-road equipment, such as lawnmowers, boats, and forklifts, contribute another 10% of transportation sector emissions in 2018. There was a 17% reduction in emissions between 2014 and 2018, from 77 $MTCO_2e$ to 63 $MTCO_2e$. Reductions in emissions are from reduced fuel consumption, decreasing from 7,730 gallons in 2014 to 6,474 gallons in 2018.

### *Employee Commute*

Employee commute includes single-occupancy vehicles (SOV), vanpools and carpools. In 2014, employee commuting produced an estimated 160 $MTCO_2e$ from 486,922 VMT. There were 106 full-time equivalent municipal employees, resulting in 1.51 $MTCO_2e$ emitted per employee. The emissions increased in 2018 to 184 $MTCO_2e$. This was a consequence of an increase in VMT to 646,027. In 2018, there were 119 full-time equivalent employees for the city with only a small increase to 1.55 $MTCO_2e$ per person.

## Solid Waste and Wastewater

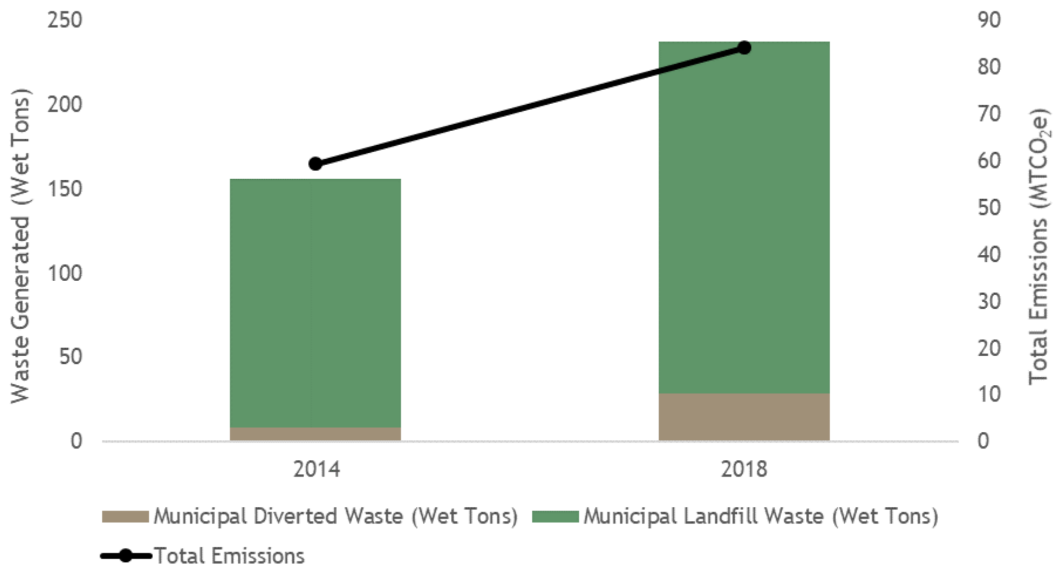
Waste sector includes emissions from solid waste generation and biological process emissions related to wastewater treatment—detailed below.

### *Solid Waste*

Solid waste is comprised of municipal landfill waste and municipal diverted waste (recycling, cardboard, and yard waste). We estimate that emissions from waste increased from 59 $MTCO_2e$ in 2014 to 84 $MTCO_2e$ in 2018. Much of this increase can be attributed to additional service at the Waterfront Park and downtown areas. An increase in foot traffic in the Winslow downtown area, as well as the reconstruction of the Waterfront Park and City Dock, required the installation of more waste receptacles in these areas. We estimate that 147 tons of waste was sent to the landfill in 2014 and that amount increased to 209 tons in 2018.

Between 2014 and 2018, the amount of diverted waste increased from 8.6 tons to 28.8 tons. Yard waste in particular, increased from 2.1 tons in 2014 to 3.9 tons in 2018. This increase in yard waste composting contributed to a slight increase in emissions within the diverted waste category, from 0.15 $MTCO_2e$ to 0.27 $MTCO_2e$ (Figure 29).

Figure 28. Municipal solid waste disposal trends.




### *Wastewater Treatment*

The City owns and operates the Winslow Wastewater Treatment Plant and operates collection for the South Island Sewer System. The Winslow Sewer System serves the historic downtown Winslow area and the South Island Sewer System serves the Lynnwood Center, Point White, Pleasant Beach, Emerald Heights, Blakely School, and Rockaway Beach neighborhoods. The collection systems have a combined infrastructure that includes: emergency generators, manholes, residential grinder pumps and sewage pump stations.

In 2018, emissions from wastewater treatment totaled an estimated 43 $MTCO_2e$. This was an 7% increase from 2014 where emissions were 40 $MTCO_2e$. This can be attributed to the increase in population served from 4,743 in 2014 to 5,079 in 2018.[16]

## Refrigerant Leakage

Leaks in refrigeration systems cause emissions of potent greenhouse gases. These losses can occur in domestic refrigeration, commercial refrigeration, industrial refrigeration, chillers, and residential/commercial air conditioning units. Refrigerant gases differ in their Global Warming Potential (GWP)—the amount of heat a greenhouse gas traps in the atmosphere relative to carbon dioxide. Emissions from R-22 leaks, for example, are especially impactful: they have a GWP 1,760, which means that they are over one thousand times more damaging than carbon dioxide. The City's heating and cooling systems largely use R-22, which we estimate produces 18 $MTCO_2e$ per year.

[16] Service populations were estimated at 25% of the total Bainbridge Island population, as estimated by Bainbridge Island City staff.

## DATA SOURCES AND METHODOLOGY

The municipal emissions inventory involved acquiring the following data types, summarized in Table 16 and detailed in the following sections:

- **Activity data** that quantifies levels of activity that generate GHG emissions, such as miles traveled, and kWh of electricity consumed.
- **Emissions factors** that translate activity levels into emissions (e.g., $MgCO_2e$ per kWh).

Data quality is assessed and reported on a High (H), Medium (M), and Low (L) scale in accordance with GHG inventory best practices:

- A *High* rating indicates data are detailed and specific to the local geography
- A *Medium* rating indicates data are more general or modeled with robust assumptions and may not be specific to the local geography, but are downscaled from a slightly broader geography (e.g., state-level)
- A *Low* rating indicates data are highly modeled, uncertain, or a default value was used based on national characteristics.

**Table 15. Key data sources for the City of Bainbridge Island's municipal inventory.**

| Sector | Activity Data (AD) | AD Quality | Emissions Factors (EF) | EF Quality |
|---|---|---|---|---|
| **Buildings and Facilities Energy** | | | | |
| **Electricity** | • kWh consumption compiled from PSE bills | H | • PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2014 & 2017, Table 7.1) | H |
| **Stationary Fuel Combustion** | • Gallons of propane used for heating compiled based on municipal purchasing information provided by O&M | M | • Emissions factors provided in ClearPath program | M |
| **Streetlights and Traffic Signals** | • Quantity, type, and wattage of each streetlight and traffic signal transcribed from PSE bills<br>• Installed wattage used to estimate electricity consumption in kWh | M | • PSE reported emissions factors (PSE Greenhouse Gas Inventory, 2014 & 2017, Table 7.1) | H |
| **Transportation** | | | | |

| Sector | Activity Data (AD) | AD Quality | Emissions Factors (EF) | EF Quality |
|---|---|---|---|---|
| **On-Road Fleet Vehicles** | • Fuel volumes by vehicle and type, along with annual miles traveled, provided by Public Works staff<br>• Where fuel volumes and miles traveled were unavailable for specific vehicles, the total quantity of fuel purchased was provided (with no vehicle information associated) | H | • $CO_2$ emission factors provided in ClearPath program<br>• $CH_4$ and $N_2O$ average emissions factors for each vehicle and fuel type were calculated based on the model year composition of the municipal fleet vehicles<br>• Emissions factors used in these calculations were derived from the EPA (2017) Inventory of U.S. Greenhouse Gas Emissions and Sinks (Climate Leadership Resource) | H |
| **Off-Road Vehicles** | • Fuel volumes by vehicle and type, along with annual hours of use, provided by Public Works staff<br>• Where fuel volumes were unavailable for specific vehicles, the total quantity of fuel purchased was provided (with no vehicle information associated) | H | • Emissions factors provided in ClearPath program<br>• Emissions factors for off-road vehicle/equipment propane use were missing from the ClearPath program; these emissions were calculated separately using emissions factors derived from the EPA (2017) Inventory of U.S. Greenhouse Gas Emissions and Sinks (Climate Leadership Resource) | M |
| **Employee Commute** | • $MTCO_2e$ obtained from Commute Trip Reduction survey conducted by WSDOT | M | • N/A; value converted to $MTCO_2e$ by WSDOT | N/A |
| **Solid Waste and Wastewater** | | | | |
| **Solid Waste Generation** | • Bin sizes, pickup frequency, and waste type were transcribed from solid waste bills<br>• Estimated cubic yards of waste were then converted to tons using EPA solid waste weight conversions<br>• This methodology assumes all waste pickup containers were full | L | • Waste characterizations from King County multifamily and commercial buildings used to estimate Bainbridge Island municipal waste composition<br>• ClearPath default emissions factors used to estimate all future methane emissions resulting from the decomposition of each waste type | L |
| **Wastewater Treatment Facility** | • Wastewater treatment facility processes determined based on desktop research and confirmed with city staff<br>• Population served by wastewater treatment facility estimated by multiplying the number of sewer connections (city staff) by the average household size (ACS) | M | • Local Government Operations Protocol equations 10.8 and 10.10 used to calculate $N_2O$ emissions<br>• $CH_4$ emissions were not applicable since the system is aerobic | L |
| **Refrigerant Leakage** | | | | |

| Sector | Activity Data (AD) | AD Quality | Emissions Factors (EF) | EF Quality |
|---|---|---|---|---|
| **Refrigerant Leakage from Building Heating and Cooling Equipment** | • List of heating/cooling equipment provided by city staff<br>• Equipment categorized by type and refrigerant used | L | • Emissions calculated using Equation 6.35 and the default factors in Table 6.4 of the Local Government Operations Protocol | L |

## Buildings and Facilities Energy

- We acquired **electricity consumption** data by hand transcribing individual monthly PSE electricity bills for the City of Bainbridge Island's municipal operations. City staff photocopied and provided these bills.
- In 2018, gallons of **propane** used to heat the **maintenance shop** were tracked in City records. However, only cost information was tracked in 2014. Based on the comparison of cost information between the two years, City staff estimated the propane use at this facility was the same in 2014 and 2018.
- **Propane usage** in an emergency generator at the Senior Center was omitted from the 2014 and 2018 inventories. In 2014, the generator was not maintained by the City and in 2018 the generator was not used.
- We estimated the total **electricity usage of streetlights and traffic signals** operated by the City of Bainbridge Island by counting the number, wattage, and types of streetlights and traffic signals included in the individual monthly PSE electricity bills. We used Equation 6.15 in the *Local Government Operations Protocol* to convert wattage to estimated electricity consumption in kWh. We assumed an average daily operating time of 12 hours for streetlights and 8 hours for traffic signals.

## Transportation

- We categorized the list of **on-road and off-road vehicles** and equipment into standard vehicle types (i.e., passenger car, light-duty truck, heavy-duty truck, etc.) based on provided vehicle descriptions and make/model information. We totaled fuel gallons and vehicle miles traveled by each vehicle category and type of fuel. $CO_2$ emissions were derived based on usage volumes by type of fuel and ClearPath default emissions factors. $CH_4$ and $N_2O$ emissions were derived based on miles traveled by vehicle category and fuel type. We used $CH_4$ and $N_2O$ emissions factors for each vehicle category-fuel type combination originally derived from the *EPA (2017) Inventory of U.S. Greenhouse Gas Emissions and Sinks* and modified these factors to reflect the municipal fleet age composition.
- One forklift within the municipal fleet used **propane**. However, propane is not an available fuel type for off-road equipment in the ClearPath program. Therefore, we calculated propane emissions outside of ClearPath using emissions factors derived from the *EPA (2017) Inventory of U.S. Greenhouse Gas Emissions and Sinks.*
- We obtained total emissions (in $MTCO_2e$) associated with **employee commuting** from the *Commute Trip Reduction Survey* conducted by WSDOT.

## Solid Waste and Wastewater

- We acquired **waste generation** data by hand transcribing individual monthly Bainbridge Disposal bills for the City of Bainbridge Island's municipal operations. City staff photocopied and provided these bills.
- Waste bills generally indicated the disposal bin volume, the pickup frequency, and the waste stream (i.e., recycling, yard waste, trash, etc.). We assumed that waste bins were full at time of pickup and

that waste described as recycling or cardboard was recycled, waste described as yard waste was composted, and waste described as trash was landfilled. We converted annual volumes of waste by type into tons of waste by type using EPA solid waste weight conversions. We then used King County waste composition information and ClearPath default emissions factors to estimate emissions associated with **waste generation and composting.**

- We estimated **wastewater treatment $N_2O$ emissions** using Equation 10.7 and 10.10 of the *Local Government Operations Protocol.* Population served was estimated by Bainbridge Island City staff. Default nitrogen load information was used since local data was not available.

## Refrigerant Leakage

- We acquired a list of **heating/cooling equipment** used in municipal buildings from Bainbridge staff. We did an online search of the equipment models and serial numbers to determine how to best categorize each piece of equipment. Using these categorizations, we estimated emissions from refrigerant leakage using Equation 6.35 and Table 6.4 of the *Local Government Operations Protocol*.

## Considerations

There is some degree of uncertainty in any GHG inventory. This uncertainty can come from incomplete data, but it can also result from uncertainty in the methodology or emissions factors used in calculating units of activity (e.g. gallon of fuel, kilowatt-hour of electricity, short ton of solid waste) into $CO_2$-equivalent emissions. These considerations should inform future inventory and reporting efforts, including prioritization of additional data collection, understanding of inventory results, and in the development of mitigation goals and monitoring systems.

Considerations for the municipal operations inventory include:

- **Electricity consumption:** The hand transcribing of electricity and waste bills introduces a greater potential for human error.
- **Streetlight and traffic signal daily operations:** Assumptions made on average daily operating time could affect electricity consumption amounts.
- **Employee commuting emissions:** WSDOT modeled the *Commute Trip Reduction Survey,* therefore the methodology, such as emissions factors assumed for passenger vehicles, could be different from those used for community passenger vehicles.
- **Municipal vehicle fleet:** Some municipal feel vehicles and equipment are fueled by bulk fuel purchases or mobile fueling tanks. In these instances, we had to estimate vehicle miles traveled and vehicle composition, potentially affecting the $CH_4$ and $N_2O$ calculations.
- **Solid waste generation:** Disposal frequency can be difficult to determine from solid waste bills—which was the only data available to deduce solid waste disposal amounts. We also lacked data on the amount of waste included in each disposal bin at the time of pickup, we assumed all bins were full. The hand transcribing of waste bills introduces a greater potential for human error.
- **Solid waste characterization:** Bainbridge Island lacked a local waste characterization study, therefore, we applied King County waste characterization data to estimate the relative proportions of different materials in the waste stream. The waste composition for Bainbridge Island may be different than for King County.
- **Wastewater treatment:** Due to limitations in local data availability, the calculations used were default national values based on the treatment method.

# MUNICIPAL CONTRIBUTION ANALYSIS

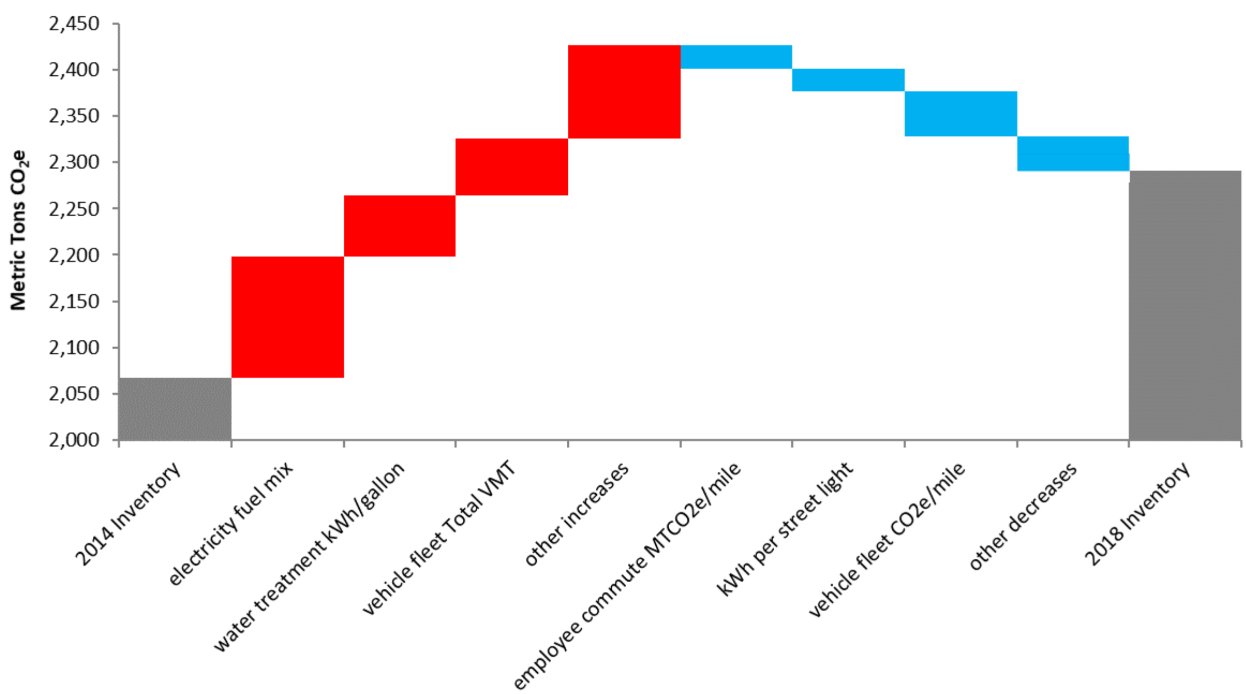
## Introduction

In 2014, total municipal emissions were 2,067 $MTCO_2e$. In 2018, total emissions increased to 2,291 $MTCO_2e$, resulting in a 11% (223 $MTCO_2e$) increase from the 2014 inventory. We employed the *Analyzing Drivers of Change in Greenhouse Gas Emissions Inventories* tool available from ICLEI USA to attribute changes in the municipal inventories to the economic, social and technological forces that caused them.[17] The primary goal of this tool is to provide a methodology for discovering the drivers for change between the two inventory years.

## Results

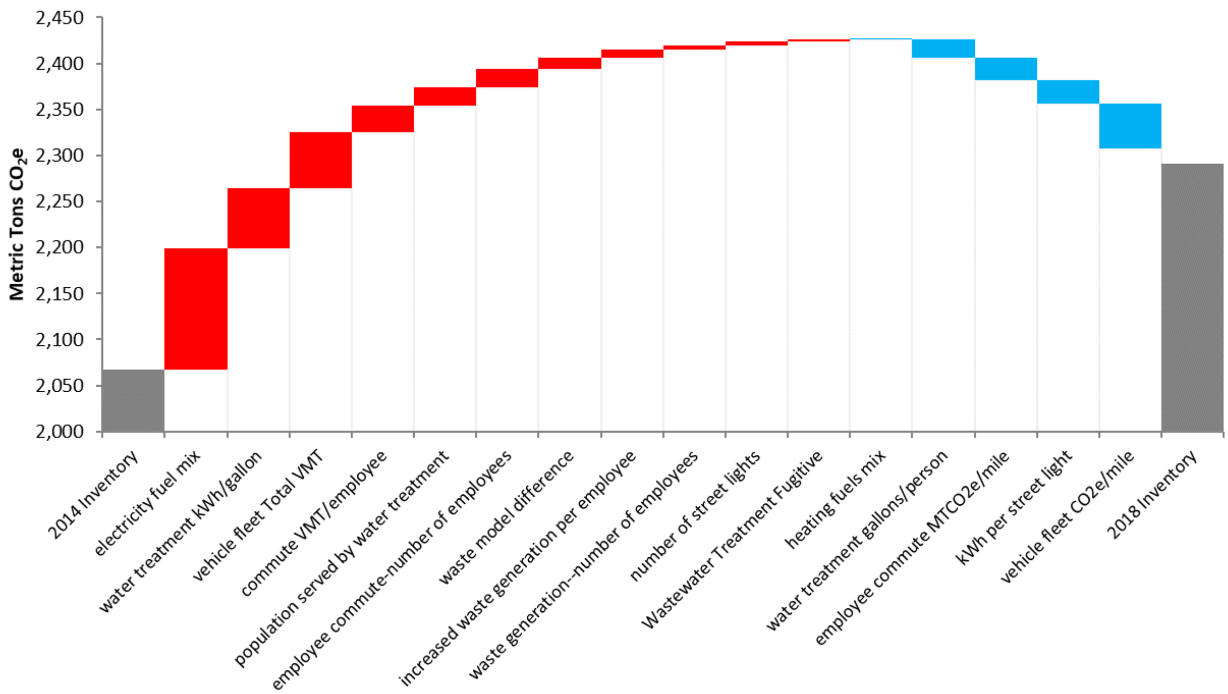
The contribution analysis revealed the factors that led to the net increase in emissions between 2014 and 2018. In summary, a lower-renewables electricity fuel mix as reported by Puget Sound Energy, increased water treatment electricity use, and increased use of fleet vehicles all contributed to emissions increases. Reductions were due to more carbon-efficient employee commuting, more energy-efficient streetlights, and increased fuel economy of the vehicle fleet. Figure 30 shows the influences of major forces on the inventory between 2014 and 2018, and Figure 31 presents a more detailed depiction.

**Figure 29. High-level summary of major drivers of government operations inventory increase and decreases.**




[17] ICELI USA *Analyzing Drivers of Change in Greenhouse Gas Emissions Inventories* tool. http://icleiusa.org/ghg-contribution-analysis/ (Accessed July 1, 2019).

**Figure 30. Detailed depiction of contributions to change for Bainbridge Island government operations GHG emissions.**




Contributors to inventory changes included the following, in order from highest increases to lowest decreases:

- **Electricity fuel mix (+131 $MTCO_2e$)** describes changes to types of resources used to generate electricity for the community. For example, increased use of renewable sources such as hydroelectricity and solar and wind power would drive emissions *decreases* in the electricity fuel mix. For Bainbridge Island, changes in the PSE electricity fuel mix contributed to *increases* in electricity emissions.
- **Water treatment kWh/gallon (+66 $MTCO_2e$)** includes changes in the energy efficiency of processing wastewater.
- **Vehicle fleet total VMT (+61 $MTCO_2e$)** describes the increase emissions due to a rise in total vehicle miles traveled for municipally owned vehicles.
- **Other Increases (+103 $MTCO_2e$)** is a compilation of changes in: population served by water treatment, number of employees commuting, waste generation per employee, and number of streetlights.
- **Employee commute $MTCO_2e$/mile (-25 $MTCO_2e$)** represents more efficient commuting behaviors, possibly by changes in mode, distance, or vehicle efficiency.
- **kWh per street light (-25 $MTCO_2e$)** incorporates the fact that streetlight and traffic signal numbers have increased, but a large conversion to LED prior to 2018 reduced electricity use and emissions.

- **Vehicle fleet $CO_2e$/mile (-48 $MTCO_2e$)** is the reduction in emissions associated with reduced gasoline consumption in newer vehicles meeting more stringent federal standards, as well as the retiring of older, less fuel-efficient vehicles.
- **Other decreases (-21 $MTCO_2e$)** includes decreased emissions from changes in the type of heating fuels used and less wastewater produced per-person.

# Consumption-Based Emissions

The purchasing decisions we make impact the environment. Some types of foods and materials, such as meat and furniture, can carry a significant GHG emissions burden. For example, meat and dairy cows emit methane—a potent greenhouse gas. Residents in Bainbridge Island who consume beef contribute to the emissions from these cows—even if the cows are raised outside the island. This section presents estimated emissions associated with the purchasing decisions made by Bainbridge Island households.

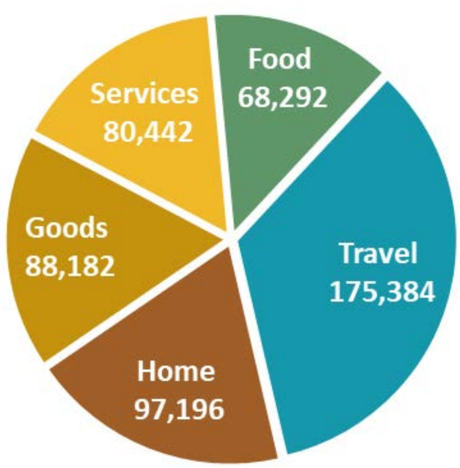
Consumption-based emissions are provided on a *per-household* basis because a household is the economic unit used in the underlying analyses (in other words, the analytical approach is based on household, not individual, purchasing trends and decisions). For example, food and home goods are generally purchased by one person for the use of their entire household.

## RESULTS

### Overview

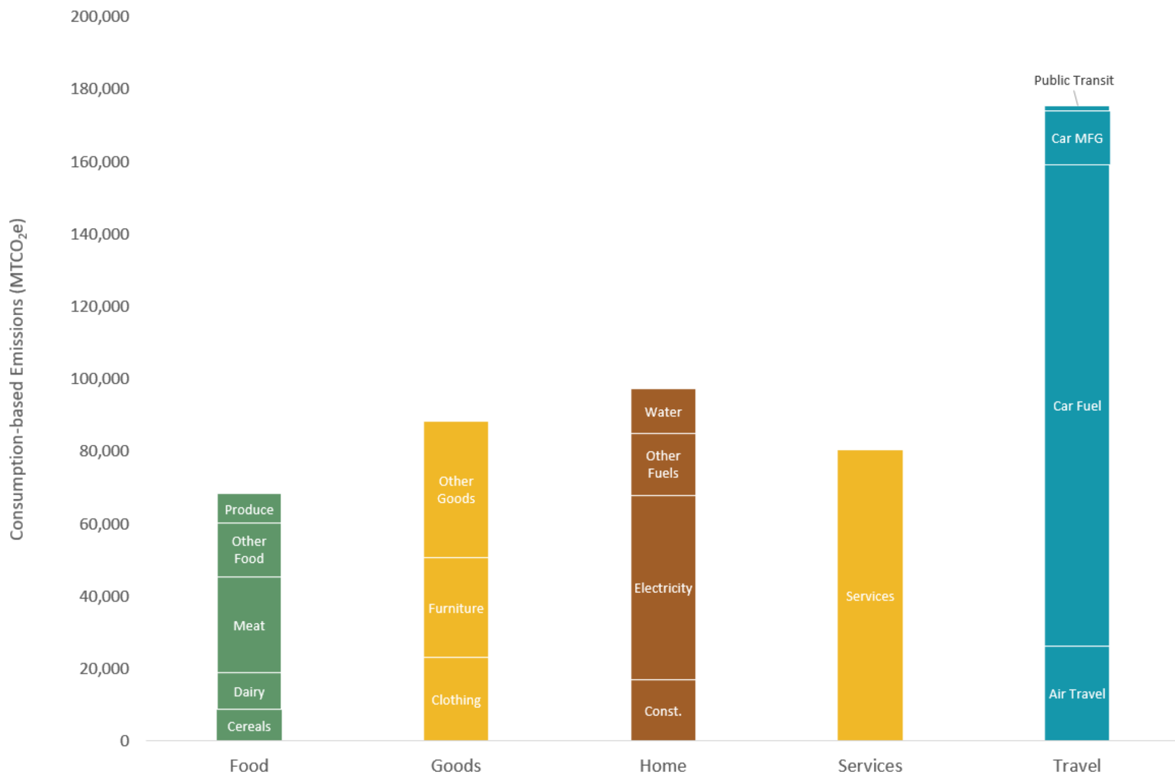
Results from a household-based economic modeling tool suggest that the average Bainbridge Island household emits 52 $MTCO_2e$ a year through their purchasing behaviors.[18] There were an estimated 9,404 and 9,798 households on Bainbridge Island in 2014 and 2018, respectively, indicating that total consumption-based emissions from all households on Bainbridge Island could have reached approximately 510,000 $MTCO_2e$ in 2018. Major drivers include the purchase of meat, furniture, clothing, home energy, and travel-related expenses such as car fuel and air travel (see Figure 32 and Figure 33).

**Figure 31. Estimated 2018 consumption-based emissions for Bainbridge Island (total = 509,496 $MTCO_2e$).**




[18] As indicated from U.C. Berkeley's *CoolClimate* Calculator. Outcomes from the consumption-based inventory analysis are presented at the per-household level because purchasing behavior is typically examined and analyzed at the household—not individual—level.

**Figure 32. Estimated annual individual household consumption-based emissions for Bainbridge Island residents (total = 52 $MTCO_2e$/year).**




# DATA SOURCES AND METHODOLOGY

Because consumption-based inventories are inevitably coarse in scale compared to other inventory sectors, we used readily available sources to estimate Bainbridge Island's consumption-based emissions. Specifically, we used UC Berkeley's CoolClimate Calculator, which employs an Economic Input-Output Life Cycle Assessment model (EIO-LCA), designed by Carnegie Mellon University, and the Comprehensive Environmental Database Archive to calculate consumption-based emissions. This model employs an economy-wide model of cradle-to-grave emissions of all major greenhouse gases for over 400 economic sectors of the economy.

## Considerations

The CoolClimate Calculator largely uses national-level data to estimate emissions associated with purchased goods and services. This means that more locally-specific emissions factors—such as those associated with the electricity we purchase—are not incorporated. For Bainbridge Island, that may mean that the calculator is slightly overestimating household emissions, since the Puget Sound Energy electricity fuel mix different than the national average. However, the calculator does use regionally-specific economic data to characterize spending habits.

# Tree Carbon Sequestration

While inventories focus on emissions of greenhouse gases *into* the atmosphere, vegetation such as trees and grasslands can sequester—or absorb—carbon dioxide *from* the atmosphere. Land use changes, such as development of open and working forest and agricultural lands, can affect this process. To illustrate and better understand this benefit, we sought to quantify the extent to which existing trees in Bainbridge Island sequester carbon from the atmosphere.

It is important to note that while vegetation on Bainbridge Island is taking carbon dioxide out of the atmosphere, this process does not offset or counteract emissions of greenhouse gases from the community, as quantified in the other sections of this report. Such land carbon "offsets" can only be achieved through rigorous and verifiable changes in land management that result in a net increase in carbon sequestration as compared to a pre-established baseline. This analysis does not quantify such activities, but rather offers some insight into the ecosystem services the trees and natural and working forests of Bainbridge Island provide, and the potential losses of services that could result from their development or removal.

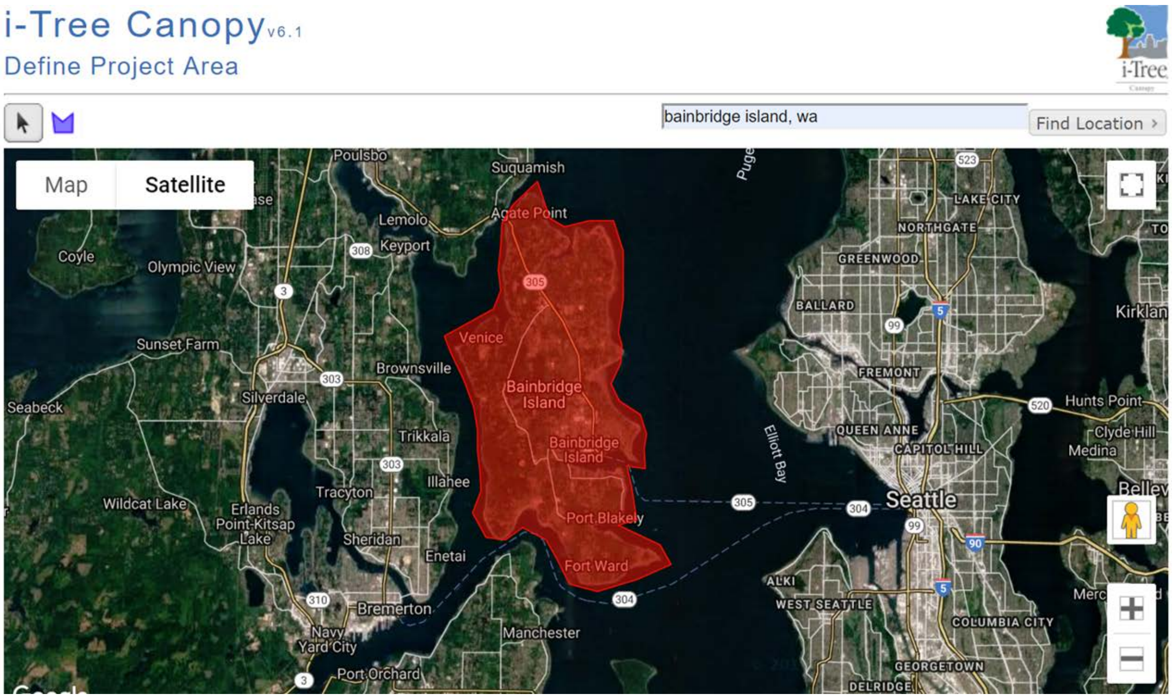
## DATA SOURCES AND METHODOLOGY

We utilized the i-Tree Canopy software to estimate annual tree carbon sequestration on Bainbridge Island. The software facilitates a supervised random sampling using Google Maps aerial photography. Specifically, the software walks users through the following steps:[19]

- **Define the project area** using Google Maps aerial photography (see Figure 35).
- **Select project location** using dropdown menus. This step characterizes per-acre carbon sequestration based on anticipated vegetation types (e.g., types of trees) typical in that location. For Bainbridge Island, the selected location was Kitsap County (see Figure 36).
- **Conduct random sampling**. i-Tree Canopy shows a magnified image from the project area with a point identified with crosshairs (see Figure 37). The user then identifies whether the crosshairs are on a tree or "non-tree" area.
- **Repeat random sampling.** The tree/non-tree identification is repeated multiple times to increase statistical precision of the estimated percent tree canopy cover of the project area. For this exercise, we classified 100 random samples.
- **Analyze results.** i-Tree Canopy uses the random sampling to provide an estimate of overall percent tree canopy cover and resultant tree carbon benefits. The estimate carries a level of uncertainty (results are indicated by a mean value +/- one standard error). This uncertainty stems from limitations associated with the sampling approach.

[19] More information regarding the methodology used by i-Tree Canopy can be found at https://canopy.itreetools.org/resources/iTree_Canopy_Methodology.pdf.

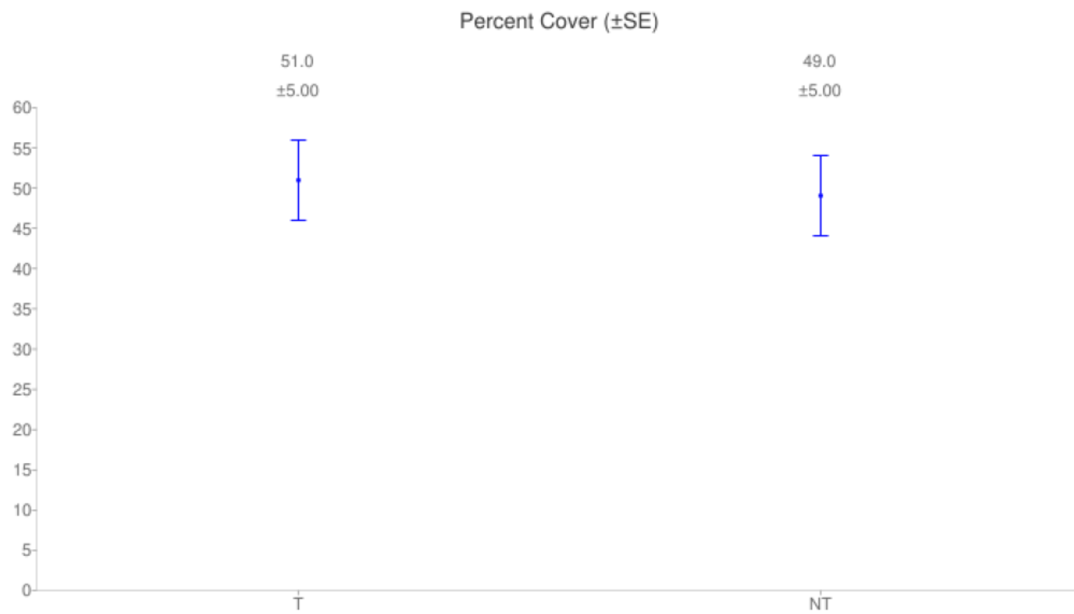
**Figure 33. Defining the project area within i-Tree Canopy.**



## RESULTS

Outcomes from the i-Tree Canopy analysis suggest that 51% of the Bainbridge Island land mass was covered with trees in 2018.[20] Those trees sequester an estimated 58,727 $MTCO_2e$ from the atmosphere every year.[21] This value appears to have decreased slightly since 2014; sampling of historical aerial imagery suggests a tree canopy cover of 55% in 2014 (equivalent to an estimated 63,334 $MTCO_2e$ annual sequestration rate).[22] This change in tree canopy cover would result in an estimated net loss of 4,607 $MTCO_2e$ in carbon sequestration benefits annually.

**Figure 34. Estimated tree canopy cover on Bainbridge Island in 2018, using random sampling from the i-Tree Canopy software.**[23]




| Cover Class | Description | Abbr. | Points | % Cover |
|---|---|---|---|---|
| Tree | Tree, non-shrub | T | 51 | 51.0 ±5.00 |
| Non-Tree | All other surfaces | NT | 49 | 49.0 ±5.00 |

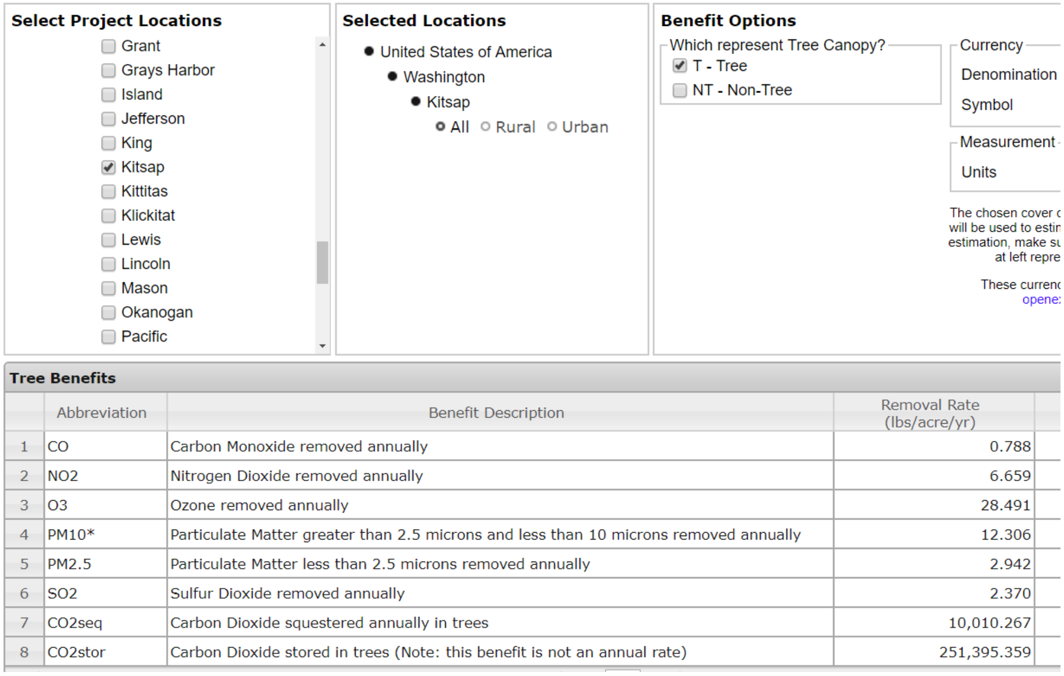
[20] Value depicted as mean estimate, with 95% confidence interval of 41.2% to 60.8%.

[21] Assumes a sequestration rate of 10,010 lbs. $CO_2$/acre/year. Source: i-Tree Canopy v.6.1.

[22] Value depicted as mean estimate, with 95% confidence interval of 45.3% to 64.7%.

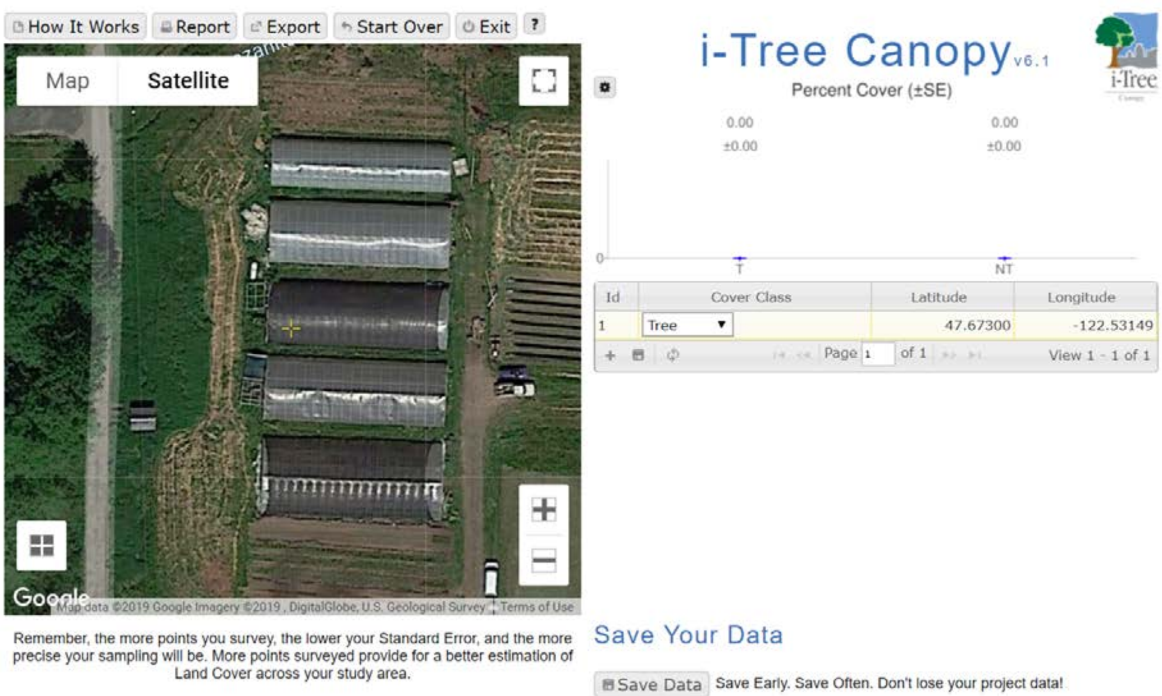
[23] https://canopy.itreetools.org/

**Figure 35. Selected project location for the Bainbridge Island study.**




| | Abbreviation | Benefit Description | Removal Rate (lbs/acre/yr) |
|---|---|---|---|
| 1 | CO | Carbon Monoxide removed annually | 0.788 |
| 2 | NO2 | Nitrogen Dioxide removed annually | 6.659 |
| 3 | O3 | Ozone removed annually | 28.491 |
| 4 | PM10* | Particulate Matter greater than 2.5 microns and less than 10 microns removed annually | 12.306 |
| 5 | PM2.5 | Particulate Matter less than 2.5 microns removed annually | 2.942 |
| 6 | SO2 | Sulfur Dioxide removed annually | 2.370 |
| 7 | CO2seq | Carbon Dioxide squestered annually in trees | 10,010.267 |
| 8 | CO2stor | Carbon Dioxide stored in trees (Note: this benefit is not an annual rate) | 251,395.359 |

**Figure 36. Example of random sampling classification exercise.**



## Considerations

This carbon sequestration analysis represents a high-level estimate of annual land carbon sequestration on Bainbridge Island. Data limitations and other considerations include the following:

- **Omission of non-tree vegetation:** This approach assumes that non-tree vegetation does not sequester carbon, which is not the case. This analysis does not include carbon benefits from non-tree vegetation such as agriculture, pasture, and shrubs.
- **Tree generalization:** This approach does not explicitly differentiate between tree types, but assumes that all trees sequester an average, representative amount of carbon every year.
- **Statistical sampling:** This approach extrapolates a statistical sampling of an area, rather than analyze the area in its entirety, which inevitably results in some level of statistical uncertainty and imprecision.

# Conclusion and Next Steps

These GHG inventories provide a **solid and informative foundation** for taking climate action:

- The **Bainbridge Island community** now understands its major contributors of GHG emissions—residential electricity, non-residential electricity, on-road vehicles, and air travel—revealing major sectors to focus climate action efforts. Conducting inventories for two years also revealed emissions trends: a 9% increase between the two inventory years as well as increased emissions in almost all sectors. The community could consider approaches for addressing emissions sources that are increasing, such as increasing electric vehicle uptake, incentivizing alternatives to air travel, continuing to increase building use efficiency, and reducing growth. The contribution analysis also provided insight into the underlying drivers of these trends: we learned that continuing to push for lower-emissions electricity sources will be important for lowering Bainbridge Island's climate impact.
- The **City of Bainbridge Island** now understands its key drivers of greenhouse gas emissions—transportation, electricity, and wastewater treatment—which highlight key areas for reduction. The inventories for the two years demonstrated an upward trend in emissions, similar to the community inventory. Between 2014 and 2018, a 11% increase in emissions occurred. The municipal contribution analysis highlighted the drivers of these trends: changes in electricity fuel mix, water treatment operations, and vehicle fleet usage. The City of Bainbridge Island did see small reductions in streetlight and traffic signal use and fleet vehicle fuel economy. The City can consider actions for reducing emissions from increasing sources, such as transferring to a low-carbon electricity fuel mix and decreasing the amount of vehicle travel.
- **Bainbridge Island households** learned the impact of spending habits—an estimated 52 $MTCO_2e$ of emissions per year, on average. The consumption-based inventory also exposed key contributors to that footprint: meat consumption, travel expenses, and the purchase of furniture, clothing, and energy. Bainbridge households could consider behavior changes to lower these emissions, such as switching to a low-carbon diet-which includes more vegetables, fruits and whole grains; utilizing alternative forms of travel; and purchasing second-hand goods.
- **Bainbridge Island landowners** now understand the importance of tree carbon sequestration and its benefit to the climate. We estimate that slightly over 50% of Bainbridge Island is covered with trees, sequestering an estimated 58,727 $MTCO_2e$ from the atmosphere each year. Continued tree planting and conservation on Bainbridge Island can maintain and expand these carbon benefits.

This foundational work also illuminated opportunities for **improving and expanding future inventories**. We were not able to obtain data related to commercial propane use, for example. The City can continue to work with local propane vendors to start collecting these data and, eventually, begin incorporating this important emissions source into the city's inventory. These and other improvements will not only paint a fuller picture of the community's overall environmental impact but can also motivate businesses and individuals to better understand their personal carbon footprint and identify pathways for reducing that impact.

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# UNDERSTANDING OUR IMPACT

## Bainbridge Island's Greenhouse Gas (GHG) Inventory Results

The City of Bainbridge Island (City) recently completed a comprehensive greenhouse gas (GHG) inventory. GHG inventories quantify the amount of climate pollution produced by an entity—in this case, from the Bainbridge Island community and municipal government operations. As the City continues to take action to reduce emissions, these inventories will serve as helpful tools for tracking progress and making improvements along the way.

## What are our emissions?

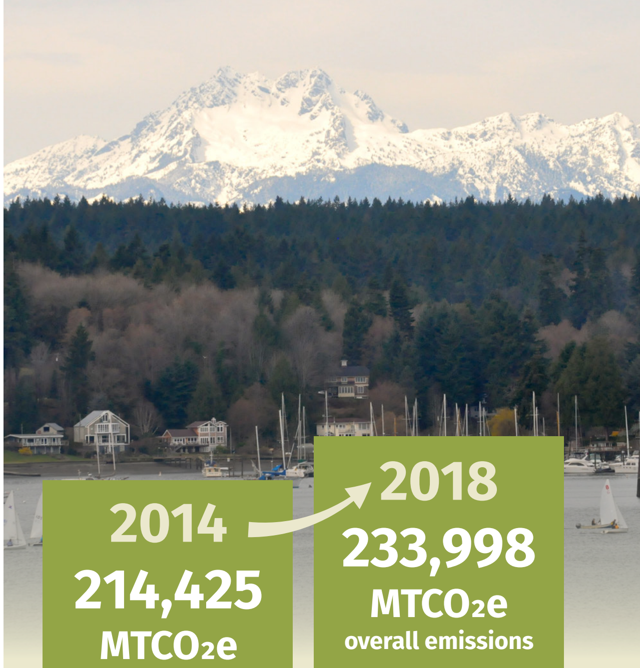
We estimate that the Bainbridge Island community emitted 233,998 metric tons of carbon dioxide equivalent (MTCO₂e) in 2018—or 9.4 MTCO₂e per resident. **Offsetting those emissions would require every Bainbridge resident to grow 11.1 acres of forestland for one year.** The biggest emissions contributors:

**Energy use** by residential and commercial buildings

**55%** of our emissions come from building energy use, residential fuels, and transmission and distribution losses.

**Transportation**, mainly on-road vehicles and air travel

**33%** of our emissions come from on-road and off-road vehicles, air travel, and ferry transportation.



**2014**
**214,425**
**MTCO₂e**
overall emissions

**2018**
**233,998**
**MTCO₂e**
overall emissions

Since 2014, our emissions have increased per person and community-wide.

**9.3 MTCO₂e** per-capita

**9.4 MTCO₂e** per-capita

## GHG Inventory Quick Facts

### Three inventory types

**Communitywide**
Emissions from community activities, like energy use, travel, and waste disposal.

**City Government Operations**
Emissions from everyday government activities.

**Consumption-based**
Emissions associated with our goods and services.

### Three accepted protocols

The inventories were conducted using widely-accepted tools and protocols, including The Climate Registry's **Local Government Operations Protocol**, the **U.S. Community Protocol**, and U.C. Berkeley's **CoolClimate Calculator**.

### Two representative years

Conducting inventories for both **2014** and **2018** allows us to see whether emissions are trending upward or downward over time.

## Trends Over Time...

**The 2018 emissions results showed a 9% overall increase over 2014 emissions, but only a 1% increase in per-capita emissions.** **To meet our goals, we will need to decrease our overall emissions as well as our per-capita emissions.**

**Emissions increases were driven by:**

- ↑ Changes in **electricity fuel sources** (e.g., from renewables versus coal)
- ↑ Growth in **population** and employment

**Emissions increases were limited by:**

- ↓ Improvements in **vehicle fuel economy**
- ↓ Reductions in the **distance** each person drives
- ↓ Declining per-household and per-business **energy consumption**

See full inventory results on the back!

CITY OF BAINBRIDGE ISLAND

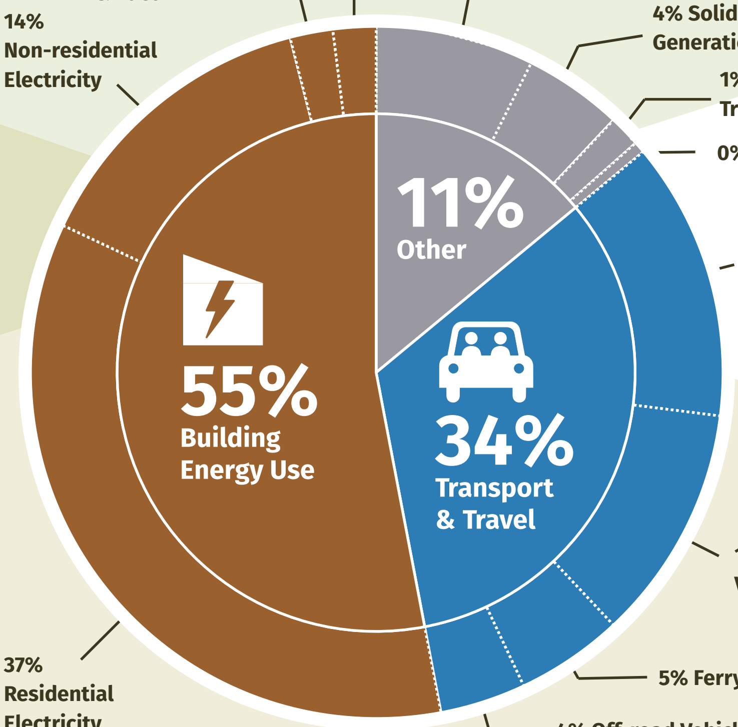
# INVENTORY RESULTS

CITY OF
BAINBRIDGE ISLAND

## Community Overall Emissions

# 233,998 MTCO2e

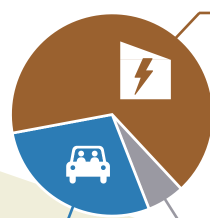
The Bainbridge Island community emitted an estimated 233,998 MTCO2e in 2018. That equates to 9.4 MTCO2e per person—equivalent to the emissions from driving 50,000 passenger vehicles for a year! The majority of those emissions are from consumption of energy in homes and commercial buildings.




## City Government Emissions

### 2,291 MTCO2e in 2018

Emissions from City of Bainbridge Island activities—which only make up about 1% of the total community emissions—are largely from energy needed to power municipal buildings, equipment, and vehicles.




## Tree Carbon Sequestration

While GHG emissions inventories quantify the release of greenhouse gases into the atmosphere, trees and other vegetation can absorb carbon dioxide out of the atmosphere. We conducted a high-level analysis to understand how much carbon dioxide Bainbridge Island trees are pulling from the atmosphere and storing in their roots, trunk, branches, and leaves.

Using satellite imagery, we estimate that trees cover about 51% of Bainbridge Island, and absorb an estimated 59,000 MTCO2e of carbon dioxide from the air every year.

## Be a part of the solution

Everyone has a role in reducing Bainbridge Island's greenhouse gas emissions. The things we buy, the way we commute to work, the food we eat, and the way we use energy in our home all have an impact.

| Revision | Status | Notes |
|---|---|---|
| Attend additional Committee meeting. | Complete | |
| Follow up with the committee on the uncertainty and sampling for the i-tree tool. | Complete | Included in report. |
| Further explore commercial and industrial propane. Look at sales tax information. | Complete | Used sales tax information. Estimate might be low. |
| Use boat registration information to estimate the number of marine vessels. | Complete | Found a vessel registration count for Kitsap County in 2016. Ellen also requested city level data from DOL, but hasn't yet been received. Moving forward with using non-road model data, given that it also estimates at the county level. |
| Explore whether detailed ridership data-including home location of riders-are available for ferry trips. Would like to avoid doing a 50/50 split of travel. Research how Seattle handles this in their inventory. | Complete | Protocol says to split ferry by the number of stops in the jurisdiction (this would be 50%). Committee was interested in splitting by the proportion of riders that are residents of the island. Assume those traveling to BI in the evening are going home to spend the night. That would mean the proportion of travelers that are BI residents is ~47%. Stick with the 50% but add a text box to explain this. |
| Get non-default values for septic by either contacting the department of health or figure out how many homes are connected to sewer and assuming the rest are septic. | Complete | We have department of health septic system numbers, but they do not include unpermitted systems (which there are a fair amount of on BI) and BOD5 values. Obtained the number of sewer connections on the island and assumed any household without a sewer connection has a septic system instead. Multiplied the number of households on septic by the average household size in each year (about 2.4-2.5) to determine the population served by septic systems. Used the population-based calculation methodology in ClearPath. |
| Animal census information seems too high. Contact Friends of the Farm to get more local information (Deb to send contact). | Complete | Reached out to Deb's contact at the Bainbridge Island Land Trust to get more specific information on agriculture in the area. She was unable to provide the level of granularity we needed to perform the agriculture calculations and had some uncertainty around the total agriculture land area acres she was able to provide. Instead, we used the Kitsap County animal census information we originally utilized, but instead of downscaling based on estimated agriculture acres in each region, we downscaled based on each area's total land area (Bainbridge Island is about 7% of the Kitsap County total land area and this methodology assumes the two have a roughly similar agriculture: developed area split). This methodology yielded results that aligned with the BI Land Trust estimates, which helped us to determine it was the best technique to use with the available information. |
| Get more accurate estimates of the population served by the wastewater treatment facility. | Complete | Used the number of sewer connections and multiplied by the average household size to get service population. |
| Provide an i-tree analysis for both 2014 and 2018, rather than 2019. | Complete | Updated report accordingly. |
| Add a "real" executive summary and provide a brief overview of methodology. In particular, explain the difference between the community and consumption inventory methodologies. | Complete | Added description of inventory approaches, including visual. |
| When discussing emissions by household, explain why households are used in this part of the analysis and disclose the average number of people per household and the number of households on Bainbridge Island. Include a brief summary of this information in the executive summary. | Complete | Included this in various sections throughout report. |
| Add visual that shows the relationship between the community, municipal, and consumption inventories. Also elaborate on descriptions and methodologies of each. | Complete | |
| When noting the baseline year, explain the rationale behind why this year was chosen. | Complete | Included in both executive summary and introduction section. |
| Provide more explanation into what potable water use energy means and how it differs from wells (which are included elsewhere in the inventory). Name the specific water distribution systems that are included. | Complete | Added footnote to thie efect. |
| Add PSE fuel mix tables into the report to better explain how fuel mix changes impacted inventory emissions. | Complete | |
| Add a call out box on Green Power Purchases and RECs and how they relate to the inventory. Include the kWh of green power purchased for 2014 and 2018, if available. | Complete | |
| In Considerations section, include a sentence about uncertainty in inventories and why we talk about it the way we do (why we can't provide a statistical value). | Complete | |
| Play with the axis on the contribution analysis to make the chart more visible. | Complete | |
| Add in background information on why municipal solid waste increased from 2014 to 2018. | Complete | |
| Make sure there is no "offsetting" language in the materials. | Complete | Removed offsetting language throughout the report. Added language in carbon sequestration section of report. |
| Table formatting. | Complete | |
| Add per-capita emissions to overview. | Complete | |
| Consider combining figures 8 and 9 – add % change to sectors in 2018 bar graph. Consider removing Figure 10. | Complete | Combined Figure 8 and 9. Didn't include % change as it would be too busy. Leaving in Figure 10 because some people are interested in knowing the scope. |
| Reformat Figure 11 and check for accuracy. | Complete | Visual was old, updated and re-pasted. |
| Add explanation of electricity grid loss factor and contributions to trends. | Complete | |
| Add locality of data to the Data Quality tables. | Complete | Added a description of how location factors into the ranking. The descriptions in the tables already describe where the data is acquired and whether it is a local source. |
| Change public facing 2-pager charts to say "energy" rather than "electricity" in charts. | Complete | |
| Explain why the protocol includes certain sectors, and why the protocol matters. | Complete | |
| Correct reference errors. | Complete | |
| Define VMT. | Complete | Defined in the Communitywide transportation emissions section. |
| Add explanation of transit emissions increase. | Complete | |
| Further explain air travel emissions methodology. | Complete | |
| Clarify community solid waste description (where materials are transported). | Complete | "All of Bainbridge Island's waste is transported off-Island, first in trucks to the Olympic View Landfill in Bremerton then via train to the Columbia Landfill near Arlington, Oregon." This is stated in the report. |
| Express Table 7 in terms of kg/kg basis. | Complete | |
| Mention process and fugitive emission uncertainty for the community inventory. | Complete | |
| Add King County waste characterization study as a reference. | Complete | |
| Explain carbon dioxide equivalents. | Complete | Added definition. |
| Include a pie chart visual for consumption inventory. | Complete | Added. |
| Write a section on actions and next steps. | Complete | |
| Include municipal solar generation numbers. | Complete | |
| Change emissions equivalencies and comparisons to something more meaningful than amount of coal. | Complete | Removed equivalencies because I think other options may be confusing. |
| Explain how EVs factor into the inventory. | Complete | The MOVES model calculates an average emissions factor for all vehicles of a certain model year. Hybrids and electric vehicles are included in these calculations and thus the inventory, but are not reported separately. Therefore, the report will only include an explanation of the fact that EVs are accounted for, but will not list the number of EVs estimated. |
| On page 6, add a comparison of BI community emissions to other communities. | Complete | |
| **Total** | | |

**BI GHG Emissions Inventory: Comments on Final Findings Report (11/14/19)**

Thank you very much for attending our last meeting and making all the changes in the report. We believe the changes generally reflect our comments and we believe we are very close to finalizing the report. We have one general comment and several smaller editorial comments below. **We do not believe this requires gathering any additional data or any further analysis.**

**General**

1. Carbon Sequestration Analysis: We thought at the September meeting that we agreed to not include the Carbon Sequestration analysis in this report for several reasons. We continue to believe that while this is an important analysis, we believe it should be a separate effort and not included in the report.

   We continue to worry that this analysis will make people think that all they need to do is plant more trees and they do not need to make the changes needed such to move us away from fossil fuels in our energy supply, driving less, and making our buildings more efficient.

   If you decide to move forward with the Carbon Sequestration analysis in the report, we suggest the following.

   - The summary of the carbon sequestration analysis at the front says that CO2 absorption has remained relatively constant. But the analysis points to a substantive reduction between 2014 to 2018 of 4600 MTco2e associated with canopy cover reduction, or about an 7% loss. Please clarify.
   - In the conclusion it says: "Bainbridge Island landowners now understand the importance of tree carbon sequestration and its benefit to the climate. We estimate that slightly over 50% of Bainbridge Island is covered with trees, sequestering an estimated 58,727 MTCO2e from the atmosphere each year. Continued tree planting and conservation on Bainbridge Island can maintain and expand these carbon benefits."
     - We would suggest changing landowners to residents as we are all stewards of our forested areas whether we own the land or not.
     - We would suggest not using "continued tree planting". We believe we need forestry management on Bainbridge to meet multiple goals. We are concerned that "tree planting" is too simplistic and does not convey the complexity of managing our forests.
     - How about "The tree sequestration analysis shows that trees are present on about half the Island, that this number has declined slightly over the four-year period bracketed by this analysis, and that these trees are estimated to sequester in the neighborhood of 58K MTCO2e on an annual basis."

**Fact sheet**

2. Carbon Sequestration Analysis: Per our discussion above, we would suggest not including the carbon sequestration analysis in this report. If you do continue to have this analysis, we

would suggest removing the reference to planting trees as an offset to our emissions for the reasons stated above. “Offsetting those emissions would require every Bainbridge resident to grow 11.1 acres of forestland for one year”.

3. Citizen Actions: We would suggest adding a few specific actions people could take to reduce their GHG emissions. It is alluded to in “Be part of the Solution”, but we thought it could be more explicit with a few specific actions.

**Executive Summary**

4. Per Household Consumption: Could you explain what per household means? Does this mean an average of 4 people per household?

**Introduction**

5. Table 2 footnote: The table 2 footnote for potable water now says that pumping for distribution is counted in the "non-residential" sector.
   - We did not see any non-residential category in the Table? Could you use what you did in the last report “it was attributed to the commercial sector”.

**Communitywide Emissions**

6. Page 26, first paragraph states
   "Transportation data are typically recorded as vehicle miles traveled, or VMT. VMT is the total number of miles driven by motorized vehicles of specific types. Although the model used to estimate GHG emissions by VMT and vehicle type does not separately note hybrids and electric vehicles, these vehicles are subject to the same emissions standards as conventional gasoline or diesel vehicles. As such, hybrid and electric vehicle VMT are incorporated into the average emissions factors used for each vehicle type and model year, despite not being reported separately from general passenger vehicles."
   - Could you clarify what this means? Does this mean that EVs and hybrids are being treated as if they are internal combustion cars in the accounting for VMT and emissions? If so, this could be a substantive overestimate that will only grow over time.

7. Table 13: Stationary Fuel Combustion. The table identifies both the local propane sales tax information and EIA propane price as Medium quality.
   - Can we say the National average price for propane is moderate quality or is it low quality given we do not know how close it comes to local pricing?

8. Page 61: States “For Bainbridge Island, that may mean that the calculator is slightly overestimating household emissions, since the Puget Sound Energy electricity fuel mix different than the national average”. Need to modify sentence to say “…..**is different from the national average”.**

- Also, can you clarify how this being different leads to the conclusion of an "overestimate". Is the PSE fuel mix of a lower carbon profile than the national average? Please clarify.

**Bainbridge Island Climate Action Plan: Draft Goals (November 14th, 2019)**

We are proposing three goals for the Bainbridge Island Climate Action Plan (CAP).

**Mitigation Goal:** By 2040 Bainbridge Island shall reduce its greenhouse gas emissions by 90% compared to 2014 levels with interim goals of reducing greenhouse gases by 25% by 2023 and 60% by 2033 compared to 2014 levels

**Adaptation Goal:** Bainbridge Island shall become climate savvy, and can withstand the impacts of climate change (e.g., sea level rise, warming temperatures, changing precipitation patterns, and changing vegetation).

**Community Engagement/Citizen Action Goal:** The City of Bainbridge Island encourages timely and measurable action by the community and partners including local and regional organizations to address climate change mitigation and adaptation in meaningful ways.

**Content**

The CAP has six focus areas: 1) Energy; 2) Transportation; 3) Buildings; 4) Waste; 5) Forests, Agriculture, and Shorelines; and 6) Community Engagement and Citizen Action

Each focus area will contain the following: 1) Goals; 2) Targets; 3) Strategies; 4) Actions; 5) Timelines; and 6) Responsibilities

**Focus area goals**

Energy

- Increase energy conservation and efficiency across all energy sectors.
- Eliminate carbon-based energy sources from all energy sectors.
- Create energy self-sufficiency for emergency preparedness and increase energy infrastructure reliability/resilience.

Transportation

- Reduce motorized vehicle miles traveled, including by promoting walking and biking.
- Increase use of public transportation.
- Increase access to and use of electric mobility options (cars, bikes, and buses) and supporting development of electric ferries.

Buildings

- For all newly constructed and renovated residential, commercial, industrial and municipal buildings: reduce energy use, water consumption, greenhouse gas emissions, and increase reuse and recycling of materials during building construction and operation.

- For all existing residential commercial, industrial and municipal buildings work with homeowners and partners to: reduce energy use, water consumption, greenhouse gas emissions, and increase reuse and recycling of materials during renovations.
- Establish procedures to ensure buildings are resilient to climate change impacts (including higher precipitation, sea level rise, and temperatures).

Forests, Shorelines, and Agriculture

- Manage Bainbridge Island's natural resources to function as healthy, resilient ecosystems that can continue to provide multiple ecological functions including provision of habitat, maintaining the hydrologic cycle, storing carbon, and are resilient to the expected changes in hydrology, diseases and wildfire risk.
- Maintain and improve our Island's air quality for people, wildlife and flora in the face of climate change.
- Maintain the integrity of our Island's surface and groundwater resources in the face of climate change.
- Manage the City's shoreline to allow for resilience in the face of climate impacts including sea level rise and provide assistance to homeowners and businesses in preparing for and adapting to sea level rise.
- Support an agricultural system that prioritizes climate change resilient, local food production, ecosystem services including soil carbon storage and water management.,

Waste Reduction and Consumption

- Reduce Island waste generation.
- Increase diversion of waste from the landfill.
- Optimize collection and disposal systems to minimize GHG emissions.
- Ensure that any new waste-related infrastructure is not sited in current or future hazard areas.

Community Engagement/Citizen Action

- Increase the Bainbridge community's awareness and knowledge about current and future potential climate change related impacts and ways to reduce those impacts.
- Inspire action across the community and partner with local and regional organizations to take meaningful climate change mitigation and adaptation actions.
- Empower and prepare the City of Bainbridge, and Bainbridge Island residents, for climate impacts and emergencies.

DRAFT

# Community Climate Workshops (11/14/19)

## Assignments

December 7th: Lara, Gary and Derik are not available
December 11th: Julie and Jens are not available

| | Sat. December 7th | Wed. December 11th |
|---|---|---|
| Welcome | Nora | Mike |
| Climate Impacts including SLR | Mike and James | Lara and James |
| GHG Inventory | **TBD** | Derik |
| CAP Overview | Nora | Nora |

| | Sat. December 7th | | Wed. December 11th | |
|---|---|---|---|---|
| | Facilitator | Note taker | Facilitator | Note taker |
| Energy | David | Mike K. and Steve J. | David | Steve J. |
| Transportation | Mike | Bobbie M, Fran, and Steve J. | Derik | Steve J. |
| Buildings | Jens | Brian A. | Mike | Herb |
| Waste | Nora | | Nora | |
| Forest, Agriculture, and Shorelines | Deb | | Deb | |
| Floater(s) | Julie | | Lara/Gary | |
| Wrap Up | Julie | | Lara | |

## Community Climate Workshops

**CCAC subgroup:** Julie, Nora, Jens, and Mike.

**Purpose of Workshop:**
- Provide Community with information on climate change impacts and
- Receive input from Community on actions to reduce greenhouse gas emissions and prepare our Community for these impacts.

**Workshop Dates/Times/Locations**

**Saturday December 7th**
10:00 – 12:00 pm (we have the City Hall Chambers from 9:00 – 1:00 pm)
City Hall

**Wednesday December 11th**
6:30 – 8:30 pm
BHS Library

**Budget:** I have asked for a small budget ($250) from the City for the workshops to cover snacks, coffee, flip charts, and supplies but have not heard back.

**Promotion**

- City (City Manager weekly email newsletter & COBI Connects)
- Ferries
- Schools
- Parks
- BI Review
- Organizations

**Outputs**: We would provide a brief summary of the workshops but not a detailed report. The meeting summary will be an appendix to the Climate Action Plan. Chapter leads will take the detailed flip-chart notes from each breakout group and consider them in updating their focus area strategies and actions.

**Materials**

- We would have a few copies of the updated BI climate assessment, SLR analysis, and GHG emissions inventory available for perusal.
- We would develop a one-pager of high-level draft goals for the Climate Action Plan. We do not want it to appear that the CAP is complete. We are looking for input.
- We will print the draft focus-area goals in large font to use with the flip charts in each breakout group.
- We will provide web-links for further reading.

**Proposed Agenda (same agenda for December 11th)**

**10:00 – 10:05: Welcome by Kol Medina (need to invite)**

**10:05 – 10:10: Overview of day (Nora/Mike)** (workshop goals and agenda)

**10:10 – 10:50: Presentations**

- Updated BI Climate Impact Assessment that would include sea level rise analysis (12/7: Mike and James; 12/11: Lara and James)
- GHG emissions inventory (12/&: TBD: 12/11: Derik)
- Overview of Climate Action Plan (Nora)
    - o Scope
    - o Timeline, including future opportunities for public input
    - o Survey results
    - o Very high-level goals
    - o Instructions for next part of workshop

**10:50 – 11:10: Stations, open-house style** (We would have 5 stations with goals for each area on flip chart and ask people to circulate and add suggested actions. We will also be available to answer questions)

- Energy Supply (David)
- Buildings (12/7: Jens and 12/11: Mike)
- Transportation and Land Use (12/7: Mike and 12/11: Derik)
- Waste and Consumption (Nora)
- Agriculture, Forests, and Shorelines (Deb)

- We would not have Community Engagement or Implementation breakout groups.

**11:15 – 11:35: Breakout Group #1**

- **Attendees will be asked to select a breakout group that they would like to join.**
- We would have a facilitator and note-taker for each breakout group. Ideally the facilitator would be the person responsible for that section.
- We will need to recruit people from outside the CCAC to help, especially with note-taking.
- Facilitator would start by reviewing the goals for the specific area and then asking for strategy & action ideas, which would be written on the flip-chart (directly, or using post-it notes so they can be grouped). Facilitator will encourage brainstorming and not spending much time debating ideas that are raised, there will be other feedback opportunities at a later date.

**11:40 – 12:00: Breakout Group #2 (people would rotate to second area of their choice)**

**12:00 Adjourn (we would not have a report out, just brief announcement that workshop is over and thanks for participating)**

We would have one or two floaters who would make sure all groups are progressing and on time (Depends on who is available).