

# 1. Introduction

Whatcom County Planning and Development Services Department contracted with Cascadia Consulting Group to complete an updated greenhouse gas (GHG) emissions inventory to address [Ordinance 2017-080](#). The inventory is for analysis year 2017 and is intended to help inform the work of the County's Climate Impact Advisory Committee.

Cascadia used the ClearPath online software platform to complete and document inventory calculations and data sources in accordance with the following [protocols](#), developed by the International Council for Local Environmental Initiatives (ICLEI):

- ▶ U.S. Community Protocol (USCP) for Accounting and Reporting of Greenhouse Gas Emissions
- ▶ Local Government Operations Protocol (LGOP)

## COMPARISON TO PRIOR GHG INVENTORIES

Whatcom County completed community and local government operations GHG emissions inventories for baseline years 2001 and 2000, respectively. Baseline emissions were calculated and documented using the Clean Air and Climate Protection (CACP) software package, a predecessor to the current ClearPath program.

Interim community and government operations inventories were also completed for analysis year 2005, as noted below:

- ▶ **Community:** From 2001 to 2005, most emissions sources were relatively similar to those in the base year. However, electricity showed an increase, over 70% of which was in the industrial sector. This increase was likely due to changes in the power supply of large users such as Georgia Pacific, Bellingham Cold Storage, and BP/ARCO after the 2001 energy crisis.
- ▶ **Local Government Operations:** From 2000 to 2005, there was an overall decrease in emissions. Efficiency efforts in County facilities decreased emissions from electricity and natural gas. The only significant increases during this period were gasoline use and an increase in electricity used by streetlights due to the addition of new lighting in three districts in 2001.

Details on changes in methodologies between the 2017 and 2000/2001 baseline inventories are provided in the "Notes" column of Table 1 and Table 2 below.

Table 1. Community Inventory Summary 2001–2017

COUNTYWIDE COMMUNITY INVENTORY	2001	2017	% change	Notes
Population	170,980	216,300	+ 27%	<i>Washington State Office of Financial Management population data</i>
Residential households	75,740	96,271	+ 27%	
Total emissions, in metric tons of carbon dioxide equivalent (MT CO <sub>2</sub> e)	2,750,728	7,862,305	+286%	<i>See explanations below:</i>
Residential Energy	593,652	607,242	+ 2%	<i>Emissions from propane use in 2001 were estimated based on data provided by vendors; 2017 uses scaled Census data.</i>
Commercial Energy	416,157	483,107	+ 16%	<i>Same methodology used.</i>
Industrial Energy	678,549	878,371	+129%	<i>Same methodology used.</i>
Transportation	921,775	1,036,819	+ 12%	<i>2000 inventory used Highway Performance Monitoring System data, and 2017 inventory used data from WCOG’s Travel Demand Model. 2017 inventory includes emissions from aviation, rail, vessels, ferry, and public transit.</i>
Waste	(20,319)	88,631	+ 536%	<i>2000 inventory stated, “The net result is that a little bit more CO<sub>2</sub>e is buried and trapped in the landfill than is added to the atmosphere.” 2017 inventory includes emissions from closed landfills in Whatcom County as well as emissions from the transportation and processing of waste outside the county.</i>
Agriculture	160,915	424,380	+ 164%	<i>2001 inventory only included cattle farming emissions.</i>
Industrial point source emissions	-	4,138,650	N/A	<i>Industrial point source emissions were not included in 2001 inventory (reporting was not required until 2010).</i>
Process & fugitive emissions	-	137,202	N/A	<i>Process and fugitive emissions were not included in 2001 inventory.</i>
Upstream impacts of activities	-	58,843	N/A	<i>Upstream impacts of activities were not included in 2001 inventory.</i>
Water & wastewater	-	9,060	N/A	<i>Wastewater emissions were not included in 2001 inventory.</i>
Emissions and removals from trees	-	(3,964,569)	N/A	<i>Emissions and removals from trees were not included in 2001 inventory. Net removal not included in 2017 total above.</i>

Table 2. Local Government Operations Inventory Summary 2000-2017

LOCAL GOVERNMENT OPERATIONS INVENTORY	2000	2017	% change	Notes
Total emissions (MT CO <sub>2</sub> e)	10,318	9,950	-4%	See explanations below:
Buildings & facilities	4,510	3,919	-13%	Electricity and natural gas consumption data provided by County staff in 2017; the data were provided directly by utilities in 2000.
Vehicle fleet	3,943	3,187	-19%	Fuel consumption (gallons of diesel and gasoline) data were provided by County staff in 2017; the 2000 inventory used fuel prices and total spend to estimate fuel consumption.
Streetlights	59	66	+ 12%	Electricity consumption data provided by County staff in 2017; the data were provided directly by utilities in 2000.
Employee commute	1,849	870	-53%	Commuter Trip Reduction survey results were used to estimate commutes for Courthouse and Northwest Annex employees for the 2000 inventory. In the absence of similar data for 2017, employee counts and total mileage from office to home were used to estimate commutes for the 2017 inventory.
Waste	-42	1,874	+ 4,562%	2000 inventory stated, "The net result is that a little bit more CO <sub>2</sub> e is buried and trapped in the landfill than is added to the atmosphere." 2017 inventory includes emissions from Whatcom County's closed landfills.
Process & fugitive emissions	-	34	N/A	Process and fugitive emissions were not included in 2000 inventory.

## 2. Emissions Factors

Emissions factors are numerical values for determining an amount of a greenhouse gas emitted on a per-unit activity basis (e.g., metric tons of carbon dioxide emitted per million BTUs of coal combusted, or metric tons of CO<sub>2</sub> emitted per kilowatt-hour of electricity consumed).

Cascadia entered the emissions factors below as “Factor Sets” in ClearPath and used them to complete the communitywide and local government operations inventories. In addition to these emissions factors, some calculations relied on emissions factors built into ClearPath or other calculation tools, as indicated in this report where applicable.

### TRANSPORTATION

#### 2017 Factor Set (Multiple Sources)

GASOLINE	Passenger Vehicle	Light Truck	Heavy Truck	Transit Bus	Paratransit Bus	Motorcycle
MPG	24.215	17.524	5.3600	N/A	8.3828	43.953
g CH <sub>4</sub> /mi	0.0054	0.0084	0.0329	N/A	0.0333	0.0672
g N <sub>2</sub> O/mi	0.0018	0.0018	0.0084	N/A	0.0134	0.0069
DIESEL	Passenger Vehicle	Light Truck	Heavy Truck	Transit Bus	Paratransit Bus	Motorcycle
MPG	24.215	13.810	6.0600	4.8435	N/A	N/A
g CH <sub>4</sub> /mi	0.0302	0.0290	0.0095	0.0051	N/A	N/A
g N <sub>2</sub> O/mi	0.0192	0.0214	0.0431	0.0048	N/A	N/A
Data Sources	<ul style="list-style-type: none"> <li>▶ 2017 Climate Registry – Default Emissions Factors</li> <li>▶ USEPA Table 4-23: Average Fuel Efficiency of U.S. Light Duty Vehicles</li> <li>▶ USEPA Table 4-22: Energy Intensity of Light Duty Vehicles and Motorcycles</li> <li>▶ USEPA Emission Factors for Greenhouse Gas Inventories (Mar 26, 2020)</li> <li>▶ U.S. Community Protocol (USCP)</li> <li>▶ Whatcom Transit Authority – 2017 Annual Performance Report</li> <li>▶ Whatcom Transit Authority – 2017-2022 Transit Development Plan</li> </ul>					

## WASTE CHARACTERIZATION

WA Department of Ecology Waste Characterization Studies	2015-2016 Overall	2015-2016 Commercial
Mixed MSW	66.6 %	61.9 %
Newspaper	0.6 %	0.8 %
Office Paper	0.4 %	0.3 %
Corrugated Cardboard	3.4 %	4.5 %
Magazines / Third Class Mail	0.1 %	0.1 %
Food Scraps	20.6 %	26.3 %
Grass	0.0 %	0.0 %
Leaves	3.9 %	3.7 %
Branches	1.5 %	0.1 %
Dimensional Lumber	2.9 %	2.3 %
Data Source	▶ Washington State Department of Ecology, 2015-2016 Washington Statewide Waste Characterization Study	

## GRID ELECTRICITY

	PSE Emissions Factor 2017	BPA Emissions Factor 2017
CO <sub>2</sub> lbs/MWh	1,073.57	42.55
CH <sub>4</sub> lbs/GWh	60.24	
N <sub>2</sub> O lbs/GWh	14.66	
Data Sources	▶ Puget Sound Energy 2017 Greenhouse Gas Inventory	▶ California Air Resources Board – Asset Controlling Supplier – System Emission Factors – Bonneville Power Administration (BPA) 2017

### 3. Community Inventory

#### OVERVIEW

As shown in Figure 1 below, industrial point source emissions contribute more than half of Whatcom County’s total communitywide greenhouse gas emissions (7,862,305 MT CO<sub>2</sub>e). Figure 2 shows the remaining portions of the communitywide inventory with industrial point sources excluded. GHG emissions from residential and commercial buildings and transportation compose the next largest portions of the county’s emissions. Note that this total does not include net flux in emissions from trees and forests (described beginning on page 21).

Figure 1. Whatcom County Communitywide GHG Emissions (metric tons CO<sub>2</sub>e)

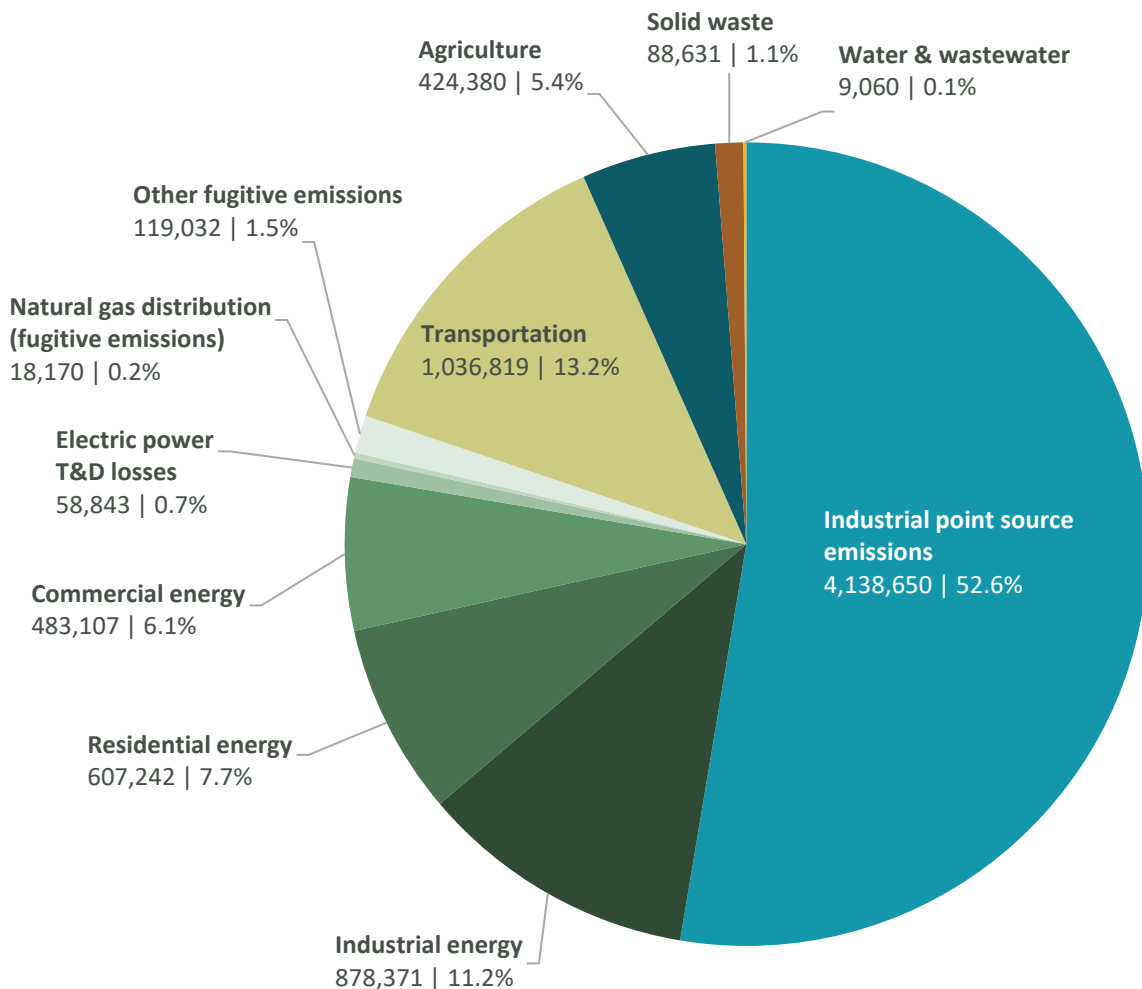
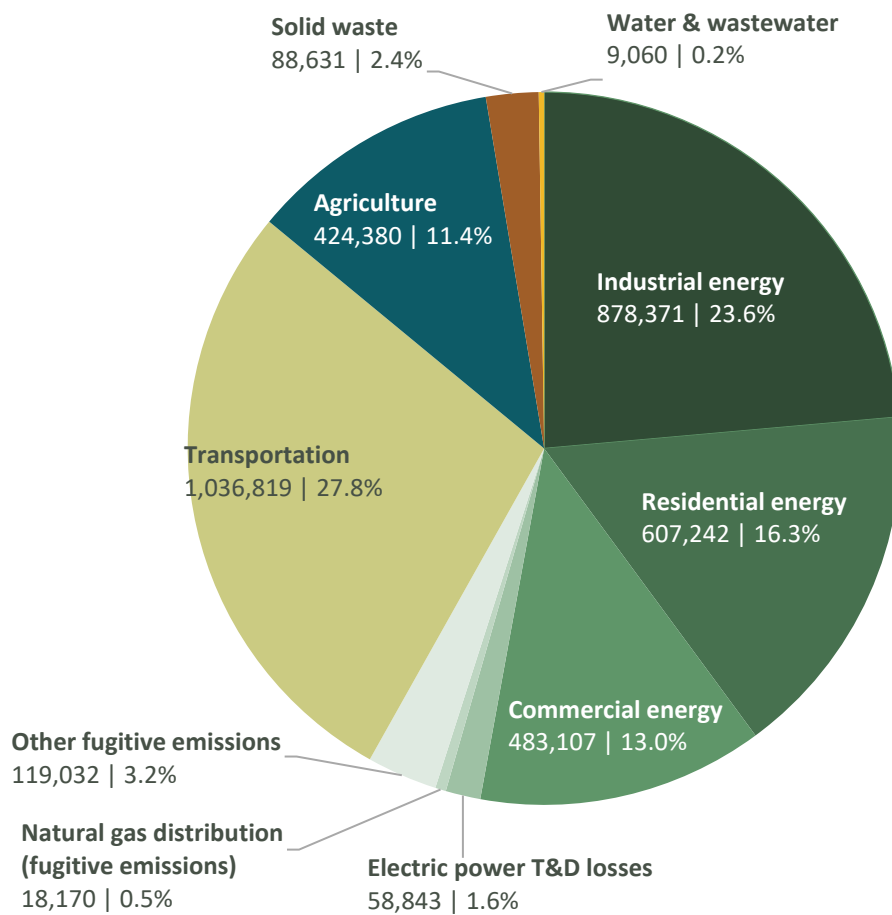


Figure 2. Communitywide GHG Emissions Excluding Industrial Point Source Emissions (metric tons CO<sub>2</sub>e)

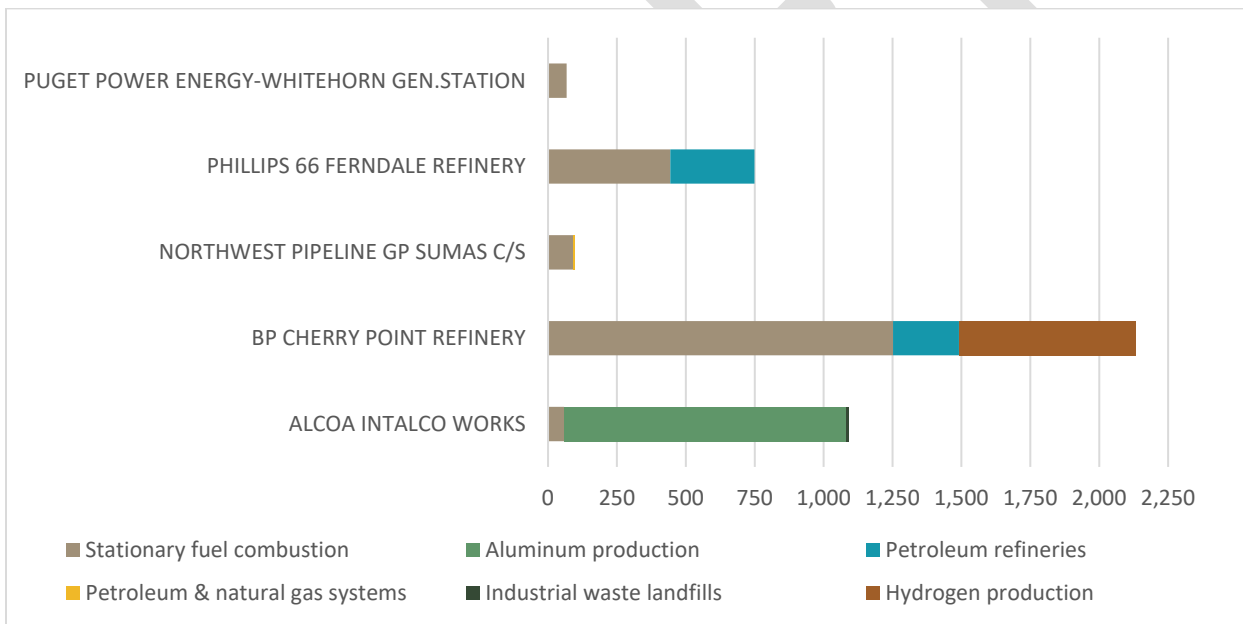


## INDUSTRIAL POINT SOURCE EMISSIONS

The U.S. Environmental Protection Agency’s Facility Level Information on Greenhouse Gases Tool (FLIGHT) provides information about greenhouse gas (GHG) emissions from large facilities in the U.S. that emit at least 25,000 MT CO<sub>2</sub>e per year. These facilities are required to report annual data about GHG emissions to USEPA as part of the Greenhouse Gas Reporting Program. Figure 3 summarizes these emissions for facilities within Whatcom County by source type.

<b>GHG emissions</b>	4,138,650 MT CO <sub>2</sub> e
<b>Activity data</b>	MT CO <sub>2</sub> e calculated and reported directly to USEPA
<b>Emission factors</b>	▶ MT CO <sub>2</sub> e calculated and reported directly to USEPA
<b>Data sources</b>	▶ USEPA's FLIGHT Tool ( <a href="http://ghgdata.epa.gov/ghgp">http://ghgdata.epa.gov/ghgp</a> )
<b>Accounting method</b>	▶ USCP BE.8.1

Figure 3. Point Source Emissions (in thousands of metric tons of CO<sub>2</sub>e)





## BUILT ENVIRONMENT

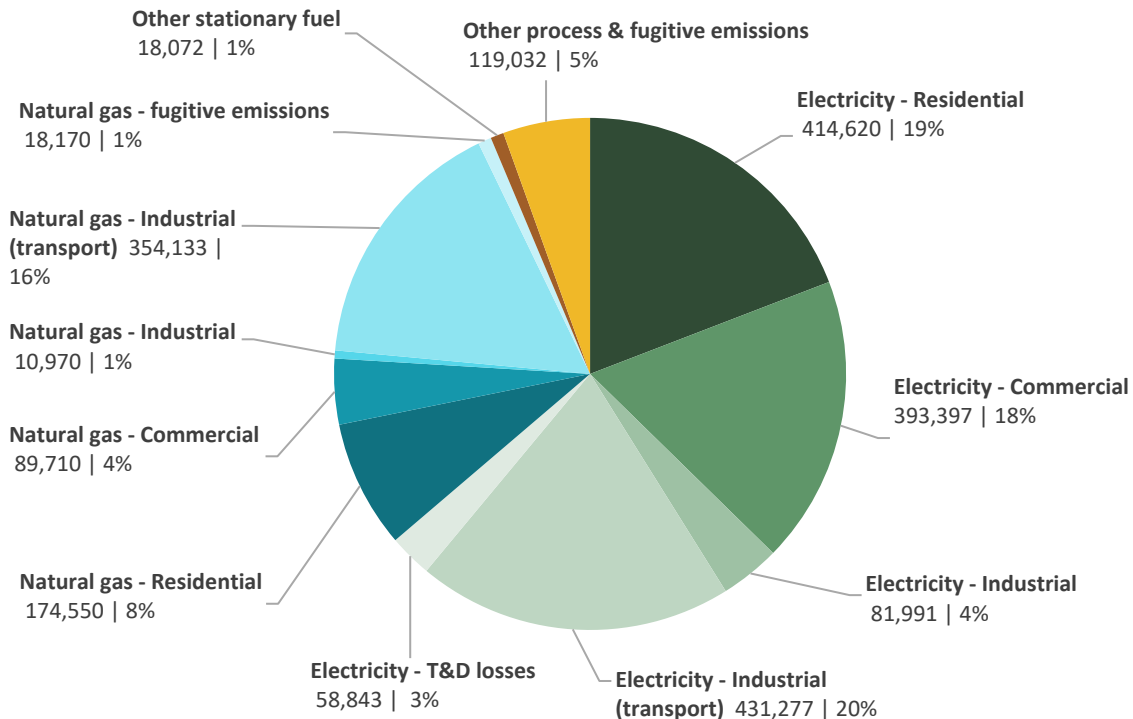
In the context of this inventory, the “built environment” refers to emissions from:

- ▶ Grid electricity consumption
- ▶ Electric power transmission and distribution (T&D) losses
- ▶ Natural gas consumption and fugitive emissions associated with natural gas distribution
- ▶ Other stationary fuel consumption (e.g., propane, kerosene, fuel oil)
- ▶ Other process and fugitive emissions (e.g., refrigerants)

Together, the built environment produce greenhouse gas emissions in the amount of 2,164,765 metric tons of CO<sub>2</sub>e. As shown in Figure 4, electricity consumption makes up over 60% of emissions from the built environment. The Industrial sector is the largest consumer of energy—from both electricity and natural gas—followed by the Residential sector, and then the Commercial sector. Industrial electricity and natural gas consumption is divided into “Industrial” for the customers of each utility and “Industrial (transport),” which covers the following:

- ▶ **Electricity:** Puget Sound Energy (PSE) uses the category “Industrial – Transportation” to describe three large users that purchase their own power. PSE provides delivery service only to these “retail wheeling” customers. Because these users procure power from other sources, the actual emissions profile is unknown. Cascadia used PSE’s emission factors to estimate these emissions for consistency.
- ▶ **Natural gas:** Similarly, Cascade Natural Gas Corporation delivers natural gas to “Noncore – Transport” customers who purchase gas from other sources but pay CNG for the transportation of their gas.

Figure 4. Whatcom County Built Environment Emissions (in metric tons of CO<sub>2</sub>e)



## Grid Electricity

Puget Sound Energy provides the majority of electricity to Whatcom County. In addition, Whatcom Public Utility District provides electricity to three customers, and the cities of Blaine and Sumas provide electricity within their jurisdictions. Whatcom PUD and the two cities purchase energy from the Bonneville Power Administration (BPA).

	Residential	Commercial	Industrial
GHG emissions (MT CO <sub>2</sub> e)	414,620	393,397	513,268
Activity data (kWh)	939,114,486	784,414,150	1,248,897,090
Emission factors	<ul style="list-style-type: none"> <li>▶ PSE Emissions Factor 2017</li> <li>▶ BPA Emissions Factor 2017</li> </ul>		
Data sources	<ul style="list-style-type: none"> <li>▶ Puget Sound Energy</li> <li>▶ Washington Fuel Mix Disclosure Report</li> </ul>		
Accounting method	<ul style="list-style-type: none"> <li>▶ USCP BE.2.1</li> </ul>		

## Emissions from Electric Power Transmission & Distribution Losses

Some electricity is lost to heat when transmitted through power lines. Cascadia estimated these losses using annual electricity consumption and emissions factors associated with PSE and BPA electricity providers.

GHG emissions	58,843 MT CO <sub>2</sub> e
Activity data	2,972,426 MWh
Emission factors	<ul style="list-style-type: none"> <li>▶ PSE Emissions Factor 2017</li> <li>▶ BPA Emissions Factor 2017</li> </ul>
Data sources	<ul style="list-style-type: none"> <li>▶ Puget Sound Energy</li> <li>▶ Washington Fuel Mix Disclosure Report</li> </ul>
Accounting method	<ul style="list-style-type: none"> <li>▶ USCP BE.4.1</li> </ul>

## Natural Gas

Cascade Natural Gas Corporation (Cascade or CNGC) provides natural gas within Whatcom County. Cascade provided natural gas consumption data (in therms) for all of Whatcom County.

	Residential	Commercial	Industrial
GHG emissions (MT CO <sub>2</sub> e)	174,550	89,710	365,103
Activity data (therms)	32,818,412	16,867,000	68,790,641
Emission factors	<ul style="list-style-type: none"> <li>▶ ClearPath: 53.02 kg CO<sub>2</sub>, 0.005 kg CH<sub>4</sub>, 0.0001 kg N<sub>2</sub>O per MMBtu</li> </ul>		
Data sources	<ul style="list-style-type: none"> <li>▶ Cascade Natural Gas Corporation</li> </ul>		
Accounting method	<ul style="list-style-type: none"> <li>▶ USCP BE.1.1</li> </ul>		

## Fugitive Emissions from Natural Gas Distribution

Cascadia calculated fugitive emissions related to leakage in the local natural gas distribution system based on the total quantity of natural gas consumed and assumed leakage rate (default value = 0.3%).

<b>GHG emissions</b>	18,170 MT CO <sub>2</sub> e
<b>Activity data</b>	118,476,053 therms
<b>Emission factors</b>	▶ USCP Table B.1; B.3
<b>Data sources</b>	▶ Cascade Natural Gas Corporation
<b>Accounting method</b>	▶ USCP BE.5.1

## Other Stationary Fuel Combustion

Due to the nature of the distribution process (which involves multiple private suppliers), local data on other stationary fuel use were not available.

- ▶ **Residential** – Emissions from the combustion of propane, wood, and kerosene were estimated using Census home heating fuel data as well as data from the U.S. Energy Information Administration. This estimation method will not reflect changes that may be induced by local climate protection efforts between inventory years. Further, this method does not include households that use a fuel source for back-up heating, cooking, or other end uses, which may underestimate total use.
- ▶ **Commercial** – Per the USCP, commercial fuel oil use should only be estimated in communities where commercial fuel oil use is widespread. For many communities in the southern and western portions of the United States, commercial fuel oil use is considered likely insignificant. As such, commercial fuel oil is not included in this inventory.
- ▶ **Industrial** – Emissions from stationary fuel combustion for the industrial sector are included in the “Industrial Point Source Emissions” section above.

	Residential	Commercial	Industrial
<b>GHG emissions (MT CO<sub>2</sub>e)</b>	18,072	N/A	N/A
<b>Activity data (MMBtu)</b>	409,416	N/A	N/A
<b>Emission factors</b>	<ul style="list-style-type: none"> <li>▶ <b>Propane</b> – ClearPath: 61.46 kg CO<sub>2</sub>/MMBtu; 0.010989 kg CH<sub>4</sub>/MMBtu; 0.0010989 kg N<sub>2</sub>O/MMBtu</li> <li>▶ <b>Wood</b> – ClearPath: 93.8 kg CO<sub>2</sub>/MMBtu; 0.316 kg CH<sub>4</sub>/MMBtu; 0.0042 kg N<sub>2</sub>O/MMBtu</li> <li>▶ <b>Kerosene</b> – ClearPath: 75.2 kg CO<sub>2</sub>/MMBtu; 0.011111 kg CH<sub>4</sub>/MMBtu; 0.00074074 kg N<sub>2</sub>O/MMBtu</li> </ul>		
<b>Data sources</b>	<ul style="list-style-type: none"> <li>▶ American Community Survey data, U.S. Census Bureau</li> <li>▶ U.S. Energy Information Administration</li> </ul>		
<b>Accounting method</b>	▶ USCP BE.1.2		

## Other Process & Fugitive Emissions

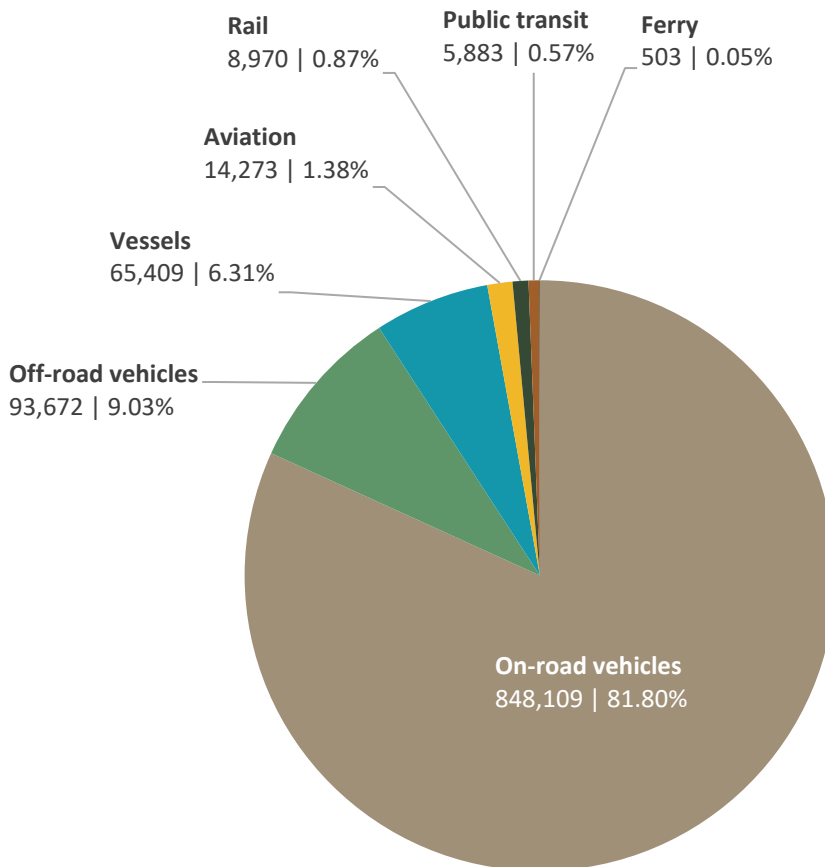
Data on emissions from other processes and fugitive sources—including hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulfur hexafluoride (SF6)—are scarce at county and/or city scales. As such, Cascadia scaled national data from USEPA’s 2017 *Inventory of GHG Sources and Sinks* using Whatcom County’s population as a proxy.

<b>GHG emissions</b>	119,032 MT CO <sub>2</sub> e
<b>Activity data</b>	221,404 people in Whatcom County
<b>Emission factors</b>	▶ USCP Table B.19; B.20
<b>Data sources</b>	▶ USEPA Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2017
<b>Accounting method</b>	▶ USCP BE.7.1.A

## TRANSPORTATION

As shown in Figure 5 below, emissions from on-road vehicles make up over 80% of Whatcom County’s total transportation emissions. Emissions from off-road vehicles and vessels compose the next largest portions of the County’s transportation emissions.

Figure 5. Whatcom County Transportation Emissions (in metric tons of CO<sub>2</sub>e)



## On-Road Vehicles

The Whatcom Council of Governments (WCOG) has developed and maintains a Regional Travel Demand Model (TDM) that simulates automobile and truck flows on regional highways and forecasts future demand. Data from WCOG's TDM were used to estimate on-road vehicle emissions for passenger and freight vehicles using gasoline or diesel fuel.

<b>GHG emissions</b>	848,109 MT CO <sub>2</sub> e
<b>Activity data</b>	1,653,436,860 annual VMT
<b>Emission factors</b>	<ul style="list-style-type: none"> <li>▶ 2017 Factor set (multiple sources)</li> <li>▶ PSE Emission Factor 2017</li> </ul>
<b>Data sources</b>	▶ Whatcom Council of Government's (WCOG) Regional Travel Demand Model
<b>Accounting method</b>	▶ USCP TR.1.B

## Off-Road Vehicles

Cascadia used the USEPA's NONROAD model to estimate county-level fuel combustion emissions for agricultural, construction, commercial and industrial, lawn and garden, and recreational vehicles and equipment.

<b>GHG emissions</b>	93,672 MT CO <sub>2</sub> e
<b>Activity data</b>	N/A – calculated in USEPA NONROAD Model
<b>Emission factors</b>	▶ N/A – calculated in USEPA NONROAD Model
<b>Data sources</b>	▶ USEPA NONROAD Model
<b>Accounting method</b>	▶ USCP TR.8

## Vessels

In the absence of locally sourced data, the Puget Sound Maritime Air Forum's *2016 Puget Sound Maritime Air Emissions Inventory* provided estimated emissions from ocean-going, harbor, and recreational vessels in Whatcom County. The maritime emissions inventory attributed ocean-going vessel emissions to Whatcom County based on routes within the county. Harbor vessel emissions were allocated equally among the four Northwest Clean Air Agency (NWCAA) counties of Island, San Juan, Skagit, and Whatcom. Recreational vessel emissions were attributed to Whatcom County based on data from port-owned marinas, private marinas, and marinas of other non-port, public entities.

<b>GHG emissions</b>	65,409 MT CO <sub>2</sub> e
<b>Activity data</b>	N/A – calculated as part of maritime inventory
<b>Emission factors</b>	▶ N/A – calculated as part of maritime inventory
<b>Data sources</b>	▶ 2016 Puget Sound Maritime Emissions Inventory
<b>Accounting method</b>	▶ N/A – calculated as part of maritime inventory

## Rail

In the absence of local data, Cascadia used information from Puget Sound Maritime Air Forum's 2005 and 2016 *Puget Sound Maritime Air Emissions Inventories* to estimate emissions from freight rail (BNSF) for Whatcom County. Passenger rail (Amtrak) data were not available at the local level and are not included in this inventory; the Lake Whatcom Railway tourist attraction also is not included.

<b>GHG emissions</b>	8,970 MT CO <sub>2</sub> e
<b>Activity data</b>	N/A – used previously calculated CO <sub>2</sub> e
<b>Emission factors</b>	▶ N/A – previously calculated CO <sub>2</sub> e
<b>Data sources</b>	▶ 2005 & 2016 <i>Puget Sound Maritime Air Emissions Inventory</i>
<b>Accounting method</b>	▶ N/A – previously calculated CO <sub>2</sub> e

## Aviation

The Port of Bellingham provided fuel usage information for the Bellingham International Airport (BLI); fuel usage data for Whatcom County's smaller general aviation airports were not available. Command Aviation and Bellingham Aviation Services are BLI's two fuel providers. Cascadia then used the BLI Tourism Survey Report (prepared by the Center for Economic and Business Research) to estimate the local attribution percentage of emissions at 31%, based on the proportion of surveyed passengers who live in Whatcom County. Future GHG inventories conducted by BLI or the Port of Bellingham could be used to calculate aviation emissions for Whatcom County more precisely.

<b>GHG emissions</b>	14,273 MT CO <sub>2</sub> e
<b>Activity data</b>	135,867 gallons aviation gasoline (avgas) 4,646,012 gallons jet kerosene (Jet A)
<b>Emission factors</b>	▶ ClearPath: 8.54 kg CO <sub>2</sub> e/gallon of aviation gasoline ▶ ClearPath: 9.66 kg CO <sub>2</sub> e/gallon of jet kerosene
<b>Data sources</b>	▶ Port of Bellingham
<b>Accounting method</b>	▶ USCP TR.6.B

## Public Transit

Whatcom Transportation Authority (WTA) provides public transportation services throughout the county and reports activity data to the National Transit Database (NTD) for the gasoline and diesel vehicles included in WTA's fixed route, paratransit, and vanpool services. While the Lummi Nation offers transit services, Lummi Transit does not report data to NTD due to its small size and is not included in the inventory.

<b>GHG emissions</b>	5,883 MT CO <sub>2</sub> e
<b>Activity data</b>	3,337,250 revenue miles
<b>Emission factors</b>	▶ 2017 Factor Set (multiple sources)
<b>Data sources</b>	▶ National Transit Database – 2017
<b>Accounting method</b>	▶ USCP TR.4

## Ferry

The County operates the Lummi Island Ferry (Whatcom Chief), travelling between Lummi Island and the mainland.

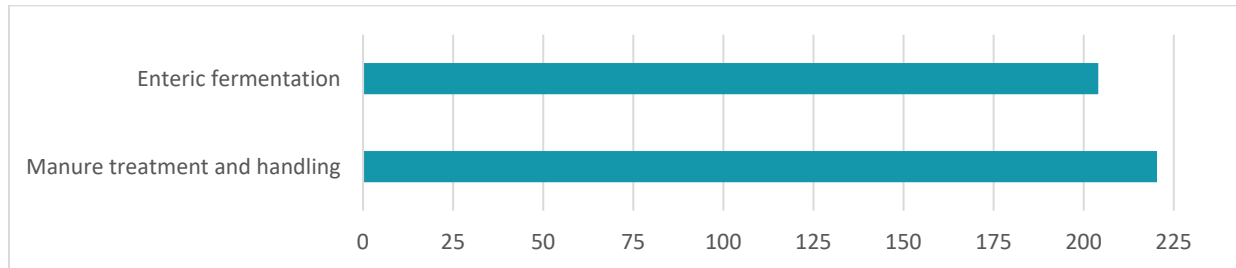
<b>GHG emissions</b>	503 MT CO <sub>2</sub> e
<b>Activity data</b>	48,807 gallons of diesel
<b>Emission factors</b>	▶ PSE Emissions Factor 2017
<b>Data sources</b>	▶ Provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 7.2

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## AGRICULTURAL EMISSIONS

The USCP includes methodologies for estimating emissions from manure management and enteric fermentation, as described below and shown in Figure 6.<sup>1</sup>

Figure 6. Whatcom County Emissions from Agricultural Activities (in thousands of MT CO<sub>2</sub>e)



### Manure Treatment & Handling

Domestic animal production is part of Whatcom County's local economy. Manure from these livestock creates methane and nitrous oxide emissions as it biodegrades. Cascadia calculated emissions based on the type of livestock and manure management system to stabilize or store livestock manure.

<b>GHG emissions</b>	220,318 MT CO <sub>2</sub> e
<b>Activity data</b>	140,134,200 kg volatile solids / year
<b>Emission factors</b>	▶ USCP Tables A.2.1.1; A.2.1.2; A.2.1.3
<b>Data sources</b>	▶ Livestock populations provided by Washington State University Extension
<b>Accounting method</b>	▶ USCP A.2.1.3; A.2.3.3

### Enteric Fermentation

Methane is produced during animal digestion through enteric fermentation. Ruminant livestock such as cattle, sheep, and goats produce higher levels of methane because of the fermentation that occurs in their specialized digestive systems. Cascadia calculated emissions from enteric fermentation based on livestock types and the emissions factor associated with their digestive systems.

<b>GHG emissions</b>	204,062 MT CO <sub>2</sub> e
<b>Activity data</b>	52,868 heads of livestock
<b>Emission factors</b>	▶ USCP Tables A.1.1 and A.1.2
<b>Data sources</b>	▶ Livestock populations provided by Washington State University Extension
<b>Accounting method</b>	▶ USCP A.1.3

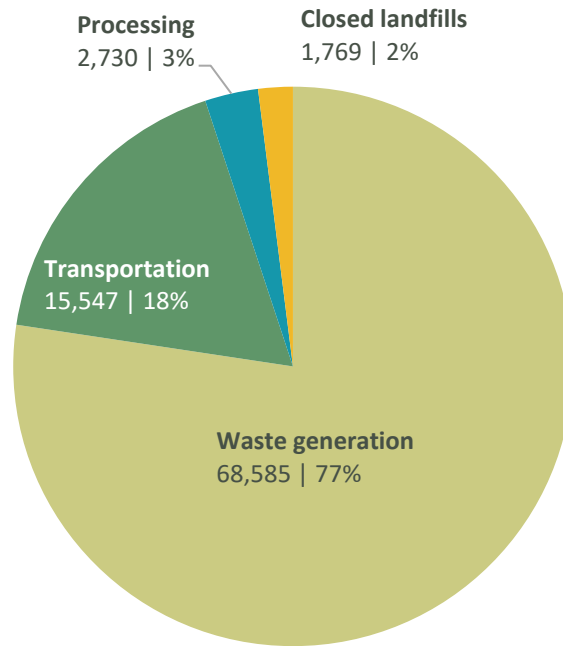
<sup>1</sup> If Whatcom County seeks to include additional emissions from other agricultural activities, such as fertilizer and pesticide application, they can be added through the agricultural process dropdown menu. However, all the calculations would need to be done manually outside of ClearPath and entered directly as emissions of CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O.



## SOLID WASTE

As shown in Figure 7 below, emissions from waste generation make up nearly 80% of Whatcom County’s total solid waste-related emissions. Emissions from transporting waste contributes the next largest portion of the county’s solid waste emissions.

Figure 7. Whatcom County Solid Waste Emissions (in metric tons of CO<sub>2</sub>e)



### Waste Generation

Cascadia used 2017 county waste generation data (reported to the Washington State Department of Ecology) to estimate current and future methane emissions attributed to this inventory year. Emissions are calculated based on the type and mass of waste sent to landfill and landfill gas capture rate.

Only organic waste types were included in these estimates (municipal/commercial solid waste and wood waste) because they generate methane (CH<sub>4</sub>)—a potent greenhouse gas—as they decompose. Inert wastes are not expected to product significant greenhouse gas emissions when landfilled, though emissions could be generated if these wastes were combusted in the future.

<b>GHG emissions</b>	68,585 MT CO <sub>2</sub> e
<b>Activity data</b>	166,489 tons of waste
<b>Emission factors</b>	▶ Washington State Department of Ecology 2015-2016 – Overall
<b>Data sources</b>	▶ Washington State Department of Ecology – Solid Waste Disposal Annual Summary, Recoverable and Non-Recoverable Wastes Generated in Washington State, 1994-2017
<b>Accounting method</b>	▶ USCP SW.4.1

## Transportation

Whatcom County’s municipal/commercial waste is transported to the Columbia Ridge Landfill (Arlington, Oregon); Cowlitz County Headquarters Landfill (WA); Greater Wenatchee Regional Landfill (WA); Roosevelt Regional Landfill MSW in Klickitat County (WA); and Spokane Regional Waste-to-Energy Facility (WA). Wood waste from Whatcom County is sent to the Columbia Ridge Landfill. Cascadia estimated emissions from the transportation of this waste based on tonnage and distance to receiving landfills and other waste facilities.

<b>GHG emissions</b>	15,547 MT CO <sub>2</sub> e
<b>Activity data</b>	166,489 wet short tons; 667 round-trip miles
<b>Emission factors</b>	▶ ClearPath: 0.00014 MTCO <sub>2</sub> e/wet short ton-mile
<b>Data sources</b>	▶ Washington State Department of Ecology, Solid Waste Disposal Annual Summary, Recoverable and Non-Recoverable Wastes Generated in Washington State, 1994-2017
<b>Accounting method</b>	▶ USCP SW.6

## Processing

Process emissions come from powering the equipment necessary to manage the waste facility. Since all of Whatcom County’s waste is sent to facilities outside of the county, these process emissions are included in the communitywide inventory.

<b>GHG emissions</b>	2,730 MT CO <sub>2</sub> e
<b>Activity data</b>	166,489 wet short tons
<b>Emission factors</b>	▶ ClearPath: 0.0164 MTCO <sub>2</sub> e per wet short ton
<b>Data sources</b>	▶ Washington State Department of Ecology – Solid Waste Disposal Annual Summary, Recoverable and Non-Recoverable Wastes Generated in Washington State, 1994-2017
<b>Accounting method</b>	▶ USCP SW.5

## Closed Landfills

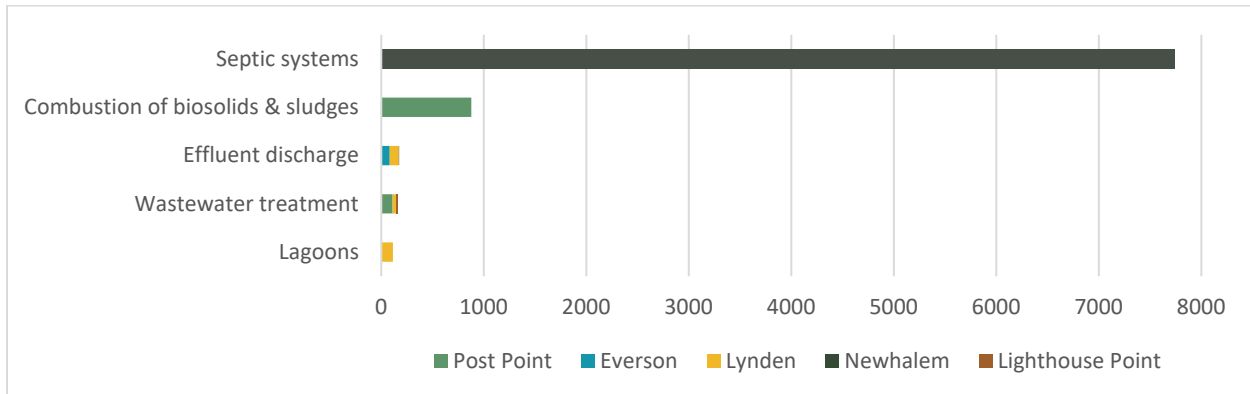
While Whatcom County does not maintain any active landfills, it does manage six closed landfills: Cedarville, Birch Bay, Point Roberts PW, Point Roberts Park, Y Road Landfill I, and Y Road Landfill II. These closed landfills continue to emit a small amount of methane, which Cascadia estimated using a USEPA model based on the waste in place and landfill gas collection systems at each landfill.

<b>GHG emissions</b>	1,769 MT CO <sub>2</sub> e
<b>Activity data</b>	310,616 tons of waste in place
<b>Emission factors</b>	▶ Built into USEPA FOD Model
<b>Data sources</b>	▶ Whatcom County Department of Health
<b>Accounting method</b>	▶ USEPA First Order Decay (FOD) Model

## WATER & WASTEWATER

As shown in Figure 8 below, fugitive emissions from septic systems make up the majority (85%) of Whatcom County’s wastewater emissions. Emissions from combustion of biosolids and sludges is the next largest portions of the County’s wastewater emissions.

Figure 8. Whatcom County Emissions from Wastewater Treatment Activities (MT CO<sub>2</sub>e)



### Fugitive Emissions from Septic Systems

Septic tanks collect and process wastewater in underground tanks usually owned by private, residential owners. The sewage in the system is not exposed to air, but some methane is produced and escapes from the septic systems when microorganisms biodegrade the soluble organic material found in waste. Cascadia estimated fugitive methane emissions from septic systems based on the population served (derived from the total number of septic systems in the county multiplied by average Whatcom County household size).

<b>GHG emissions</b>	7,736 MT CO <sub>2</sub> e
<b>Activity data</b>	28,340 septic systems
<b>Emission factors</b>	▶ ClearPath: 0.048213 MT CH <sub>4</sub> /daily kg BOD <sub>5</sub>
<b>Data sources</b>	▶ Whatcom County Health Department
<b>Accounting method</b>	▶ USCP WW.11(alt)

### Emissions from Wastewater Treatment Lagoons

Lagoons treat wastewater through a combination of biological, physical, and chemical processes. Methane is produced during the anaerobic phase of this process. Cascadia calculated emissions from lagoons for the Lynden Wastewater Treatment based on the site-specific data biochemical oxygen demand (BOD<sub>5</sub>) load.

<b>GHG emissions</b>	113 MT CO <sub>2</sub> e
<b>Activity data</b>	2,300 kg BOD <sub>5</sub> /day
<b>Emission factors</b>	▶ ClearPath: 1.7532 MT CH <sub>4</sub> / daily kg BOD <sub>5</sub>
<b>Data sources</b>	▶ Lynden Wastewater Treatment Plant
<b>Accounting method</b>	▶ USCP WW.6

## Process N<sub>2</sub>O from Effluent Discharge to Rivers & Estuaries

The Everson, Newhalem, and Lynden Wastewater Treatment Plants discharge treated wastewater into water bodies, such as lakes, rivers, and Puget Sound. Cascadia used the population-based method to calculate associated nitrous oxide (N<sub>2</sub>O) emissions.

<b>GHG emissions</b>	175 MT CO <sub>2</sub> e
<b>Activity data</b>	18,710 people served
<b>Emission factors</b>	▶ ClearPath: 0.005 kg N <sub>2</sub> O / kg N in effluent
<b>Data sources</b>	▶ Everson Wastewater Treatment Plant ▶ Newhalem Wastewater Treatment Plant ▶ Lynden Wastewater Treatment Plant
<b>Accounting method</b>	▶ USCP WW.12(alt)

## Emissions from Combustion of Biosolids & Sludges

Wastewater treatment processes generate sludges, which are concentrated and collected in settling basins. Plants often use anaerobic digesters to stabilize the sludges, producing a final product called biosolids. Anaerobic digestion of sludges and other organic wastes also produces biogas containing methane. Biosolids leaving the digester contain organics that may be combusted, and organics in undigested sludges may also be combusted. The Post Point Wastewater Treatment Facility reported combusting these biosolids and sludges.

<b>GHG emissions</b>	879 MT CO <sub>2</sub> e
<b>Activity data</b>	3,678 MT biosolids/sludges incinerated
<b>Emission factors</b>	▶ ClearPath: 9.7 g/MT CH <sub>4</sub> ; 900 g/MT N <sub>2</sub> O
<b>Data sources</b>	▶ Post Point Wastewater Treatment Plant
<b>Accounting method</b>	▶ USCP WW.4; WW.5

## Emissions from Wastewater Treatment

The removal of nitrogen by biological nitrification and denitrification is a two-step treatment process that results in GHG emissions: 1) ammonia is converted aerobically to nitrate (nitrification); and 2) nitrates are converted to N<sub>2</sub>O (denitrification). Cascadia used the population-based method to calculate emissions.

<b>GHG emissions</b>	157 MT CO <sub>2</sub> e
<b>Activity data</b>	124,536 people served
<b>Emission factors</b>	▶ ClearPath: 3.2 g N <sub>2</sub> O / person
<b>Data sources</b>	▶ Everson Wastewater Treatment Plant ▶ Newhalem Wastewater Treatment Plant ▶ Lynden Wastewater Treatment Plant ▶ Lighthouse Point Wastewater Treatment Plant ▶ Post Point Wastewater Treatment Plant
<b>Accounting method</b>	▶ USCP WW.7; WW.8

## EMISSIONS & REMOVALS FROM TREES

Trees and land conversion contribute to net GHG flux—that is, the difference in removals versus emissions. GHG inventories for lands are reported in six land use categories: forest land, grassland, cropland, wetland, settlement, and other land coverage such as barren, snow, or ice. Whatcom County has large areas of forests and tree cover that both emit and remove, or sequester, carbon.

In August 2019, ICLEI unveiled new guidance in the form of “Appendix J: Forest Land and Trees” to the U.S. Community Protocol. This protocol was developed in partnership with the Woods Hole Research Center and World Resources Institute and piloted using data from three U.S. counties, including Whatcom County.<sup>2</sup>

Cascadia included calculations from ICLEI’s analysis to complete Whatcom County’s 2017 communitywide inventory. Two slightly different time periods were used based on available data: 2001-2011 for trees within forests; and 2000-2010 for trees outside of forests. Cascadia applied the estimated GHG values for the entire land base of Whatcom County (the county boundaries, or “Whatcom total”) as part of the inventory.

As shown in Table 3, the net flux is -3,964,569 MT CO<sub>2</sub>e, with forest sequestration as the largest source of removals and forest harvest as the largest source of emissions.

**Table 3. Summary of Whatcom County Greenhouse Gases from Forests and Trees**

IPCC Reporting Categories	MT CO <sub>2</sub> e
<b>Forests Remaining Forests</b>	-3,955,881
<i>Forest sequestration</i>	-5,122,273
<i>Forest harvest</i>	1,393,897
<i>Harvested Wood Products</i>	-599,387
<i>Other forest disturbance</i>	371,882
<b>Non-forest Converted to Forests</b>	-7,214
Non-forest → Forest	-7,214
<b>Forests Converted to Non-Forest</b>	162,676
Forest → Grassland	122,188
Forest → Other lands	27,096
Forest → Settlement	13,392
<b>Non-Forest Land Use Categories/Transitions</b>	-164,150
Trees outside forest (emission)	301,981
Trees outside forest (removals)	-466,131
<b>Net Emissions</b>	<b>-3,964,569</b>

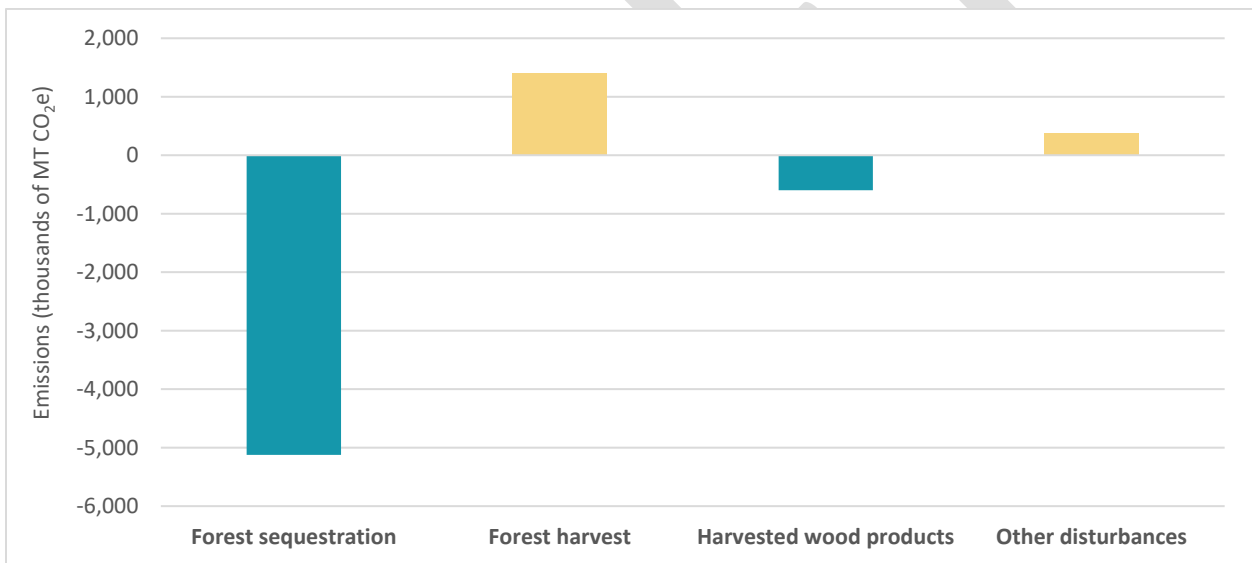
<sup>2</sup> ICLEI, [Communities Now Better Equipped to Include Trees in Climate Action Planning](#), August 19, 2019.

## Forests Remaining Forests

As shown in Figure 9, the “Forests Remaining Forests” category includes 1) emissions from forest harvest and other “natural” disturbances, such as insects and weather; and 2) removals from forest sequestration (undisturbed forest remaining forest) and harvested wood products. Although harvest emissions from the forest are substantial during the inventory period, they are partially offset by carbon storage in long-lived wood products—that is, wood used for materials and not fuel. The net flux is presented below.

<b>GHG emissions</b>	(3,955,881) MT CO <sub>2</sub> e
<b>Activity data</b>	356,206 hectares
<b>Emission factors</b>	▶ Multiple emissions factors—see detailed workbook
<b>Data sources</b>	▶ ICLEI Pilot
<b>Accounting method</b>	▶ USCP L.4

Figure 9. Emissions and Removals from Forest Remaining Forest (in thousands of MT CO<sub>2</sub>e)



## Non-Forests Converted to Forests

“Non-Forests Converted to Forests” includes conversion from grassland, cropland, wetland, settlement, and other land (with lower carbon stocks than forests) to forest land.

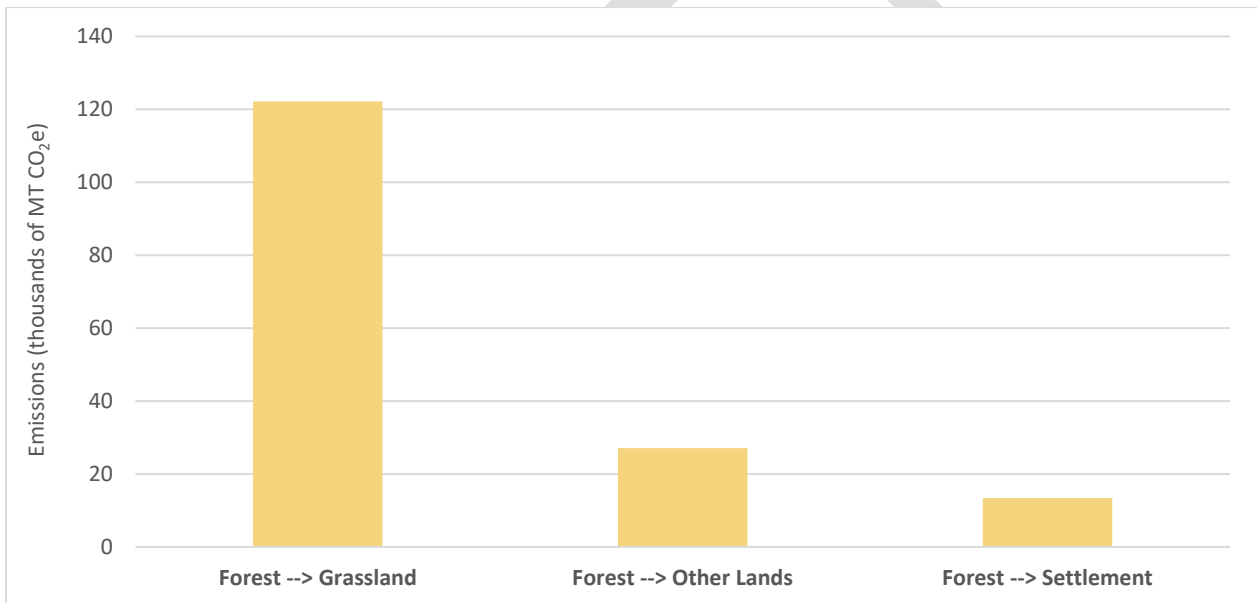
<b>GHG emissions</b>	(7,214) MT CO <sub>2</sub> e
<b>Activity data</b>	2,694 hectares
<b>Emission factors</b>	▶ Multiple emissions factors—see detailed workbook
<b>Data sources</b>	▶ ICLEI Pilot
<b>Accounting method</b>	▶ USCP L.4

## Forests Converted to Non-Forest

As shown in Figure 10, “Forests Converted to Non-Forest” includes emissions and removals related to forests converted to grasslands, settlement, and other lands that have lower carbon stocks than forests. The net flux is presented below.

<b>GHG emissions</b>	162,676 MT CO <sub>2</sub> e
<b>Activity data</b>	9,066 hectares
<b>Emission factors</b>	▶ Multiple emissions factors—see detailed workbook
<b>Data sources</b>	▶ ICLEI Pilot
<b>Accounting method</b>	▶ USCP L.4

Figure 10. Emissions from Forest Converted to Non-Forest (in thousands of MT CO<sub>2</sub>e)



## Non-Forest Land Use Categories / Transitions

This category includes carbon sequestration from individual trees or trees in small patches outside of forested areas. The net flux from tree cover lost, remaining, and new trees (outside of forests) is presented below.

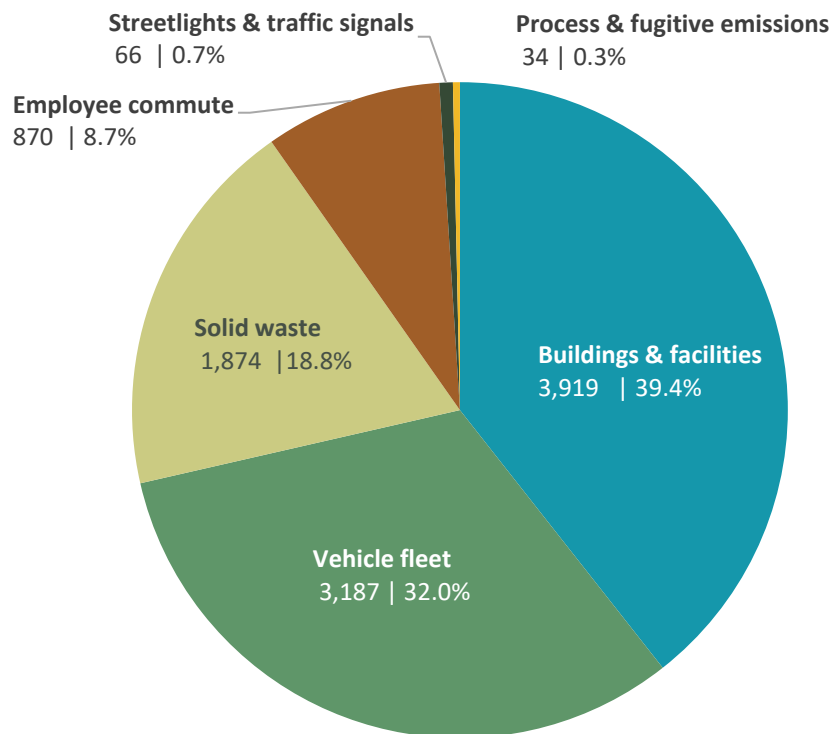
<b>GHG emissions</b>	(164,150) MT CO <sub>2</sub> e
<b>Activity data</b>	47,245 hectares
<b>Emission factors</b>	▶ Multiple emissions factors—see detailed workbook
<b>Data sources</b>	▶ ICLEI Pilot
<b>Accounting method</b>	▶ USCP L.5

## 4. Local Government Operations Inventory

### OVERVIEW

Whatcom County's local government operations were estimated to contribute 9,950 metric tons of carbon dioxide equivalent (CO<sub>2</sub>e) emissions in 2017. As shown in Figure 11 below, emissions from operating buildings and facilities and the County's vehicle fleet together make up over 70% of greenhouse gas emissions from local government operations. Emissions from Whatcom County's closed landfills and County employee commuting contribute the next largest portions of the County's emissions.

Figure 11. Whatcom County Government Operations GHG Emissions (in metric tons of CO<sub>2</sub>e)



### Excluded from Government Operations Inventory

The following components were not included in this inventory:

- ▶ **Electric power production:** Whatcom County does not own or operate any power generation facilities.
- ▶ **Transit fleet:** Public transit in Whatcom County is managed independently by Whatcom Transportation Authority, which is included in the Communitywide inventory.
- ▶ **Water & wastewater treatment:** Whatcom County does not own or operate any water/wastewater treatment facilities.



## BUILDINGS & FACILITIES

### Grid Electricity

Puget Sound Energy provides electricity to Whatcom County facilities. Figure 12 shows the amount of kilowatt-hours consumed by the top 15 County buildings, and Figure 13 shows total electricity consumption by department.

<b>GHG emissions</b>	2,859 MT CO <sub>2</sub> e
<b>Activity data</b>	5,841,174 kWh
<b>Emission factors</b>	▶ PSE Emissions Factor 2017
<b>Data sources</b>	▶ Average kWh by meter, per 2017 Puget Sound Energy – Voluntary Long-Term Renewable Energy Service Agreement (contract #201705023). ▶ Additional electricity usage data provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 6.2.1

Figure 12. Whatcom County Electricity Use: Top 15 Buildings by Usage (in thousands of kWh)

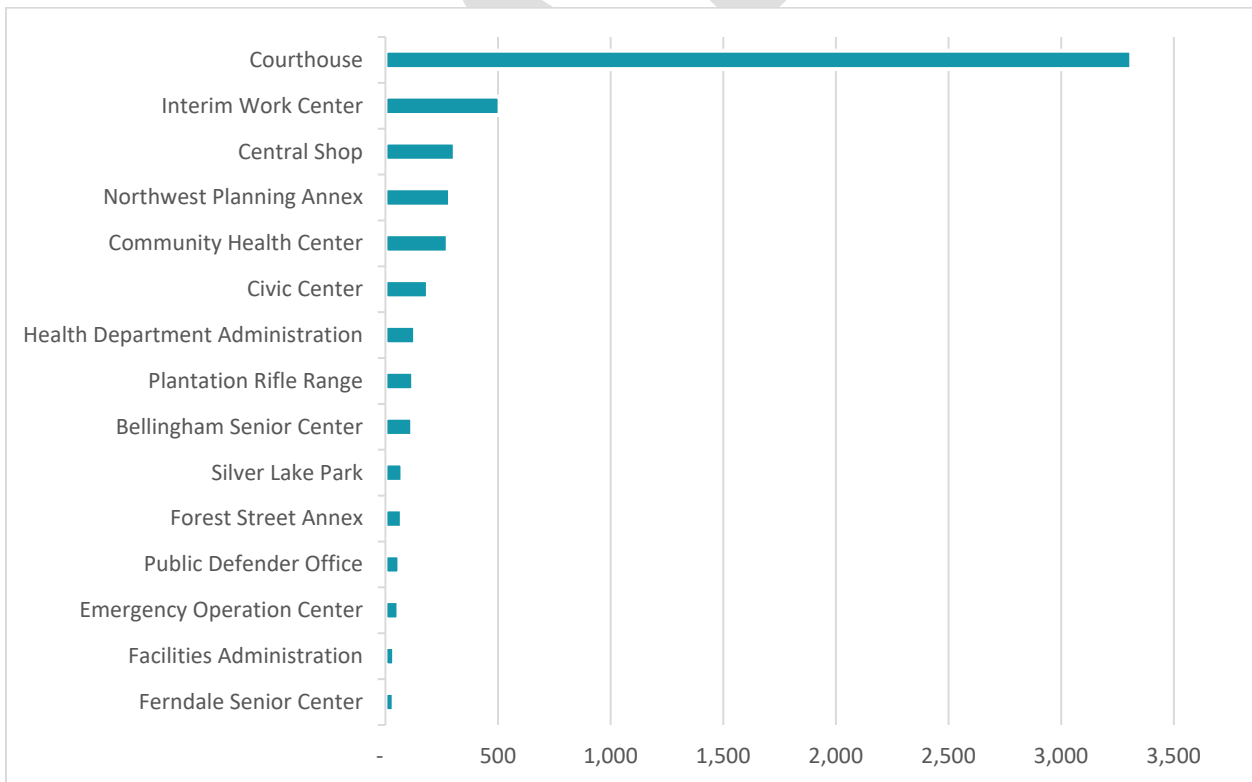
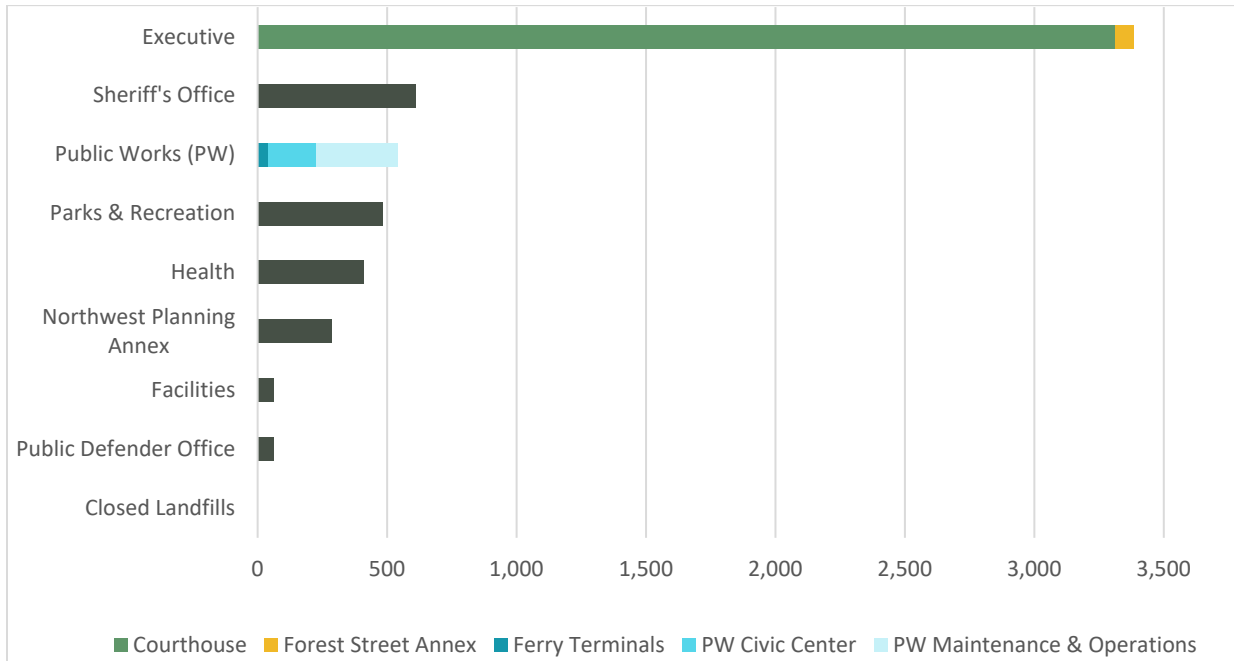


Figure 13. Whatcom County Electricity Use, by Department (in thousands of kWh)



## Natural Gas

Cascade Natural Gas Corporation (Cascade or CNGC) provides natural gas within Whatcom County. Government operations represent an estimated 1,060 MT CO<sub>2</sub>e emissions.

<b>GHG emissions</b>	1,060 MT CO <sub>2</sub> e
<b>Activity data</b>	199,2019 therms
<b>Emission factors</b>	▶ ClearPath: 0.053020 MT CO <sub>2</sub> /MMBtu; 0.000005 MT CH <sub>4</sub> /MMBtu; 0.0000001 MT N <sub>2</sub> O/MMBtu
<b>Data sources</b>	▶ Natural gas data provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 6.1.1

## STREETLIGHTS & TRAFFIC SIGNALS

Puget Sound Energy provides electricity to Whatcom County facilities, including streetlights and traffic signals.

<b>GHG emissions</b>	66 MT CO <sub>2</sub> e
<b>Activity data</b>	134,388 kWh
<b>Emission factors</b>	▶ PSE Emissions Factor 2017
<b>Data sources</b>	▶ Average kWh by meter, per 2017 Puget Sound Energy – Voluntary Long-Term Renewable Energy Service Agreement (contract #201705023) ▶ Additional electricity usage data provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 6.2.1

## VEHICLE FLEET

### On-Road Vehicles

Cascadia used fuel consumption (in gallons of gasoline/diesel) and mileage totals to calculate emissions from the County's vehicle fleet.

<b>GHG emissions</b>	2,684 MT CO <sub>2</sub> e
<b>Activity data</b>	190,205 gallons gasoline; VMT = 2,296,392. 98,707 gallons diesel; VMT = 114,264
<b>Emission factors</b>	<ul style="list-style-type: none"> <li>▶ 2017 Factor Set (multiple sources)</li> <li>▶ PSE Emissions Factor 2017</li> </ul>
<b>Data sources</b>	▶ Whatcom County staff provided fuel usage report and mileage.
<b>Accounting method</b>	▶ LGOP 7.1.1.1

### Ferry

The Lummi Island Ferry (Whatcom Chief) operates in Whatcom County, traveling between Lummi Island and the mainland.

<b>GHG emissions</b>	503 MT CO <sub>2</sub> e
<b>Activity data</b>	48,807 gallons of diesel
<b>Emission actors</b>	▶ LGOP Table G.14
<b>Data sources</b>	▶ Whatcom County staff provided fuel usage report
<b>Accounting method</b>	▶ LGOP 7.2

## EMPLOYEE COMMUTE

In the absence of employee commute survey data, Cascadia estimated employee commute emissions using 1) employee counts, and 2) round-trip distances between employee homes and office. American Community Survey data were used to estimate the percentage of employees who drove alone, carpooled, and took public transit (assumed to be traveling by bus).

### Passenger Vehicles

<b>GHG emissions</b>	866 MT CO <sub>2</sub> e
<b>Activity data</b>	1,850,716 employee VMT
<b>Emission factors</b>	<ul style="list-style-type: none"> <li>▶ 2017 Factor Set (multiple sources)</li> <li>▶ PSE Emissions Factor 2017</li> </ul>
<b>Data sources</b>	▶ Employee counts and commute data provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 12.2.1

## Transit

<b>GHG emissions</b>	4 MT CO <sub>2</sub> e
<b>Activity data</b>	61,834 employee passenger miles
<b>Emission factors</b>	▶ 3.5991 kg/passenger mile
<b>Data sources</b>	▶ Employee counts and commute data provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 12.2.1

## SOLID WASTE FACILITIES

### Closed Landfills

While Whatcom County does not maintain any active landfills, it does manage six closed landfills: Cedarville, Birch Bay, Point Roberts PW, Point Roberts Park, Y Road Landfill I, and Y Road Landfill II. These closed landfills continue to emit a small amount of methane, which was estimated based on the waste in place and landfill gas collection systems at each landfill using a USEPA model.

<b>GHG emissions</b>	1,771 MT CO <sub>2</sub> e
<b>Activity data</b>	310,616 tons of waste in place
<b>Emission factors</b>	▶ Built into USEPA FOD Model
<b>Data sources</b>	▶ Whatcom County Department of Health
<b>Accounting method</b>	▶ USEPA First Order Decay (FOD) Model

### Waste Generation

In the absence of waste tonnage data, Cascadia used monthly volumes of waste disposed by Whatcom County facilities to estimate tonnage disposed. Composition of waste is assumed to resemble the “commercial” waste stream.

<b>GHG emissions</b>	103 MT CO <sub>2</sub> e
<b>Activity data</b>	244.54 tons
<b>Emission factors</b>	▶ Washington State Department of Ecology 2015-2016 – Commercial
<b>Data sources</b>	▶ Waste information provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 12.2.2

## PROCESS & FUGITIVE EMISSIONS

### Refrigerant Use

Installation, use, and disposal of refrigeration systems (e.g., air conditioners, chillers, refrigerators) can leak refrigerants that contain or consist of hydrofluorocarbons (HFC) compounds with high global warming potentials. Cascadia used the mass-balance method to calculate emissions related to Whatcom County's use of R-22 (Freon) and R-410a (Puron).

<b>GHG emissions</b>	34 MT CO <sub>2</sub> e
<b>Activity data</b>	42 lbs fugitive gas released
<b>Emission factors</b>	▶ Global Warming Potential; IPCC 5th Assessment Report, 2014 (AR5)
<b>Data sources</b>	▶ Refrigerant data provided by Whatcom County staff
<b>Accounting method</b>	▶ LGOP 6.6.1

## 5. Projected and Targeted Emissions

To guide Whatcom County’s work in reducing greenhouse gas emissions over time, the Climate Impact Advisory Committee established the following targets:

- ▶ Whatcom County communitywide targets will follow state-mandated targets:
  - 45% reduction below 1990 levels by 2030.
  - 95% reduction below 1990 levels by 2050 and net-zero emissions.
- ▶ Whatcom County government operations targets:
  - 85% reduction below 2001 levels by 2030.
  - 100% reduction below 2001 levels by 2050.

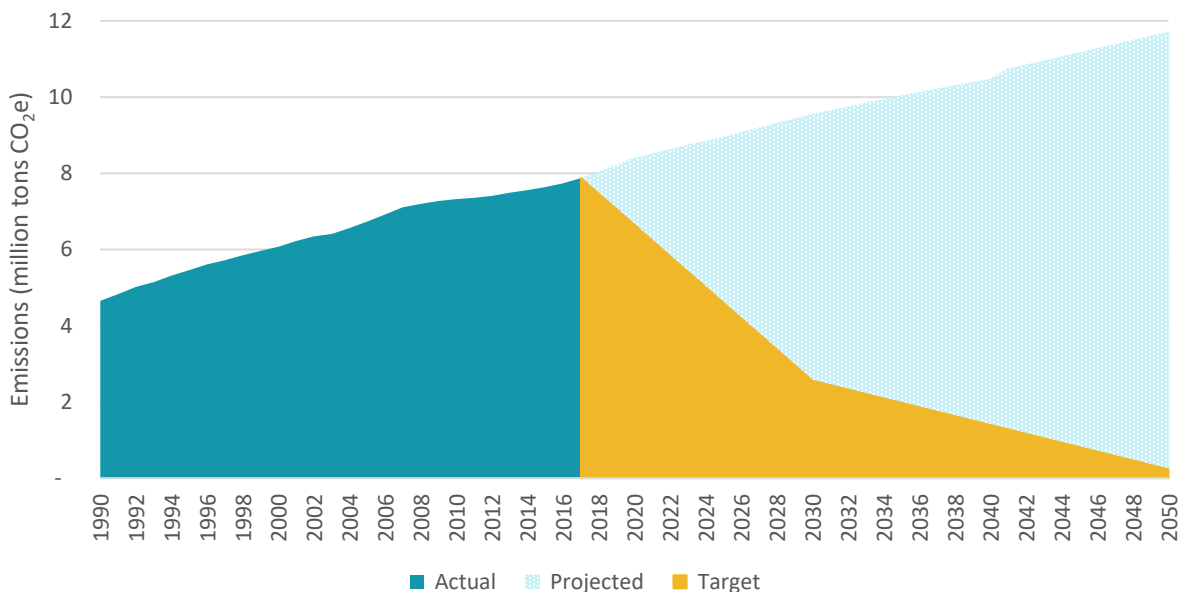
Cascadia used these targets and timelines, combined with inventory data, to prepare the figures shown below.

### COMMUNITY EMISSIONS

Cascadia used Whatcom County population figures as a proxy to model estimated community emissions back to 1990 based on 2017 emissions. Note that this figure does not include the 2000/2001 baseline or 2005 inventory totals due to significant variances in methodology, including data sources and coverage.

The light blue “Projected” wedge in Figure 14 indicates the amount of emissions currently projected based on a Business-as-Usual scenario that will need to be avoided—through a range of strategies—to achieve the 2030 and 2050 targets, as shown in yellow. The darker blue “Actual” wedge shows inventoried emissions in 2017 and estimated levels back to 1990.

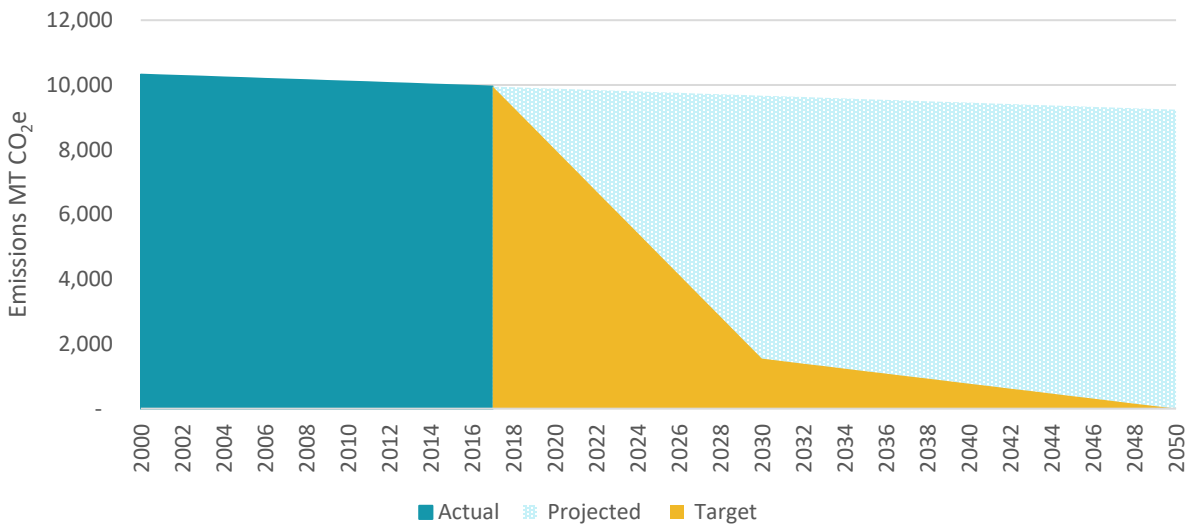
Figure 14. Projected vs. Target Levels of Community GHG Emissions (MT CO<sub>2</sub>e), 1990-2050



## LOCAL GOVERNMENT OPERATIONS EMISSIONS

Cascadia applied Whatcom County’s total emissions as calculated for the 2000 baseline and 2017 inventories to estimate greenhouse gas emissions for local government operations through 2050. The light blue “Projected” wedge in Figure 15 indicates the amount of emissions currently estimated in a Business-as-Usual scenario that will need to be avoided in order to achieve the County’s reduction targets for 2030 and 2050, as shown in yellow.

Figure 15. Projected vs. Target Levels of Government Operations GHG Emissions (MT CO<sub>2</sub>e), 2000-2050



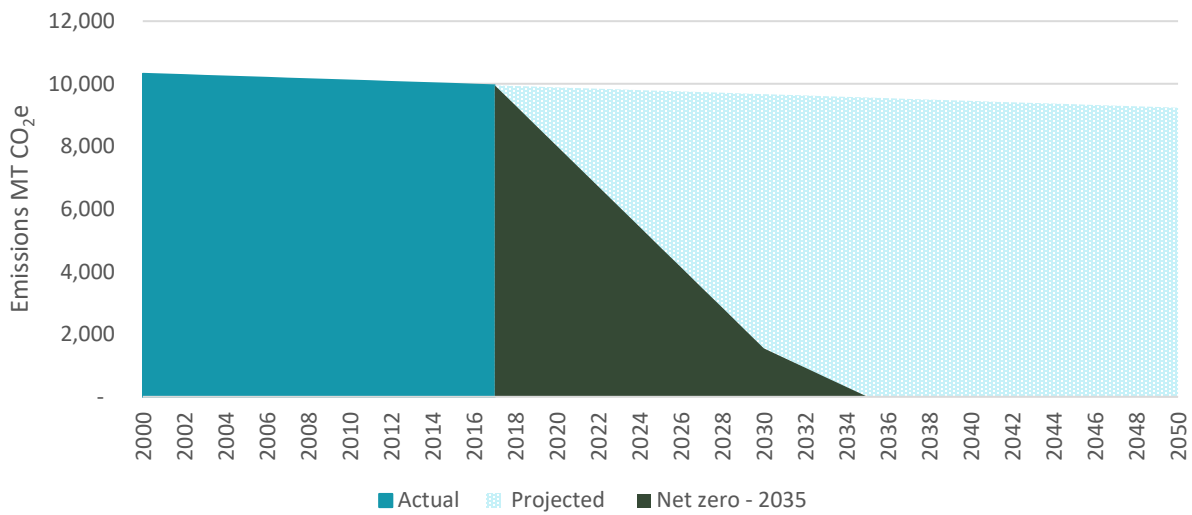
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# WHATCOM COUNTY GREENHOUSE GAS INVENTORY REPORT

## PROJECTED AND TARGETED EMISSIONS

Additionally, the Committee requested a trendline based on 100% reduction (net zero) below 2001 by 2035, as shown in Figure 16. The light blue “Projected” wedge indicates the amount of emissions estimated based on a Business-as-Usual scenario that will need to be avoided in order to achieve the net-zero emissions target, shown in dark green, by 2035.

Figure 16. Projected vs. Net-Zero 2035 Government Operations GHG Emissions (MT CO<sub>2</sub>e), 2000-2050





# 6. Summary Table

[forthcoming summary to ensure ICLEI-compliant report]

EXAMPLE ONLY:

Emissions Type		Source or Activity?	FINAL REPORTING - SUMMARY TABLE				Emissions (MTCO <sub>2</sub> e)	
			Included, Required Activities	Included, under reporting frameworks:		Excluded (IE, NA, NO, or NE)		Explanatory Notes (optional)
			SI	CA				
<b>Built Environment</b>								
	Use of fuel in residential and commercial stationary combustion equipment	Source AND Activity	•	•	•			77,664
	Industrial stationary combustion sources	Source				NO	No industrial facilities in the community	
Electricity	Power generation in the community	Source		•			Municipally-owned utility	68,795
	Use of electricity by the community	Activity	•					68,198
District Heating/Cooling	District heating/cooling facilities in the community	Source				NE	This is a very small source here	
	Use of district heating/cooling by the community	Activity				NE	This is not a common activity here	
	Industrial process emissions in the community	Source				NO	No industrial facilities in the community	
	Refrigerant leakage in the community	Source				NE	No data available	
<b>Transportation and Other Mobile Sources</b>								
On-road Passenger Vehicles	On-road passenger vehicles operating within the community boundary	Source				IE	Obtained data for preferred activity-based method instead	
	On-road passenger vehicle travel associated with community land uses	Activity	•	•	•			255,407
On-road Freight Vehicles	On-road freight and service vehicles operating within the community boundary	Source				NE		
	On-road freight and service vehicle travel associated with community land uses	Activity	•		•			45,234
	On-road transit vehicles operating within the community boundary	Source				NE		

## ABBREVIATIONS USED IN THIS REPORT

BPA	Bonneville Power Administration
BTU	British thermal unit
CH <sub>4</sub>	Methane
CNGC	Cascade Natural Gas Corporation
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	Carbon dioxide equivalent
EIA	Energy Information Agency
g, kg	Gram, kilogram
HFC	Hydrofluorocarbon
IPCC	Intergovernmental Panel on Climate Change
kWh	Kilowatt-hour
mi	Mile
MWh	Megawatt-hour
N <sub>2</sub> O	Nitrous oxide
PSE	Puget Sound Energy
USCP	United States Community Protocol
USEPA	United States Environmental Protection Agency