Kenmore 2023 Inventory of Communitywide and Government Greenhouse Gas Emissions

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Prepared by City of Kenmore Environmental Services
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Credits and Acknowledgments

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Key Findings

Communitywide greenhouse gas (GHG) emissions were calculated at **144,491** MT CO_2e for 2023. This is a reduction of 25,465 MT CO_2e from 2019's 169,956 MT CO_2e[1] or 15%. While population growth often brings an increase in emissions, that has not been the case for Kenmore. Between 2019 and 2023, Kenmore saw population growth of an estimated 910 residents or 3.9%. However per capita emissions decreased from 7.29 MT CO_2e to 5.96 MT Co_2e or 18.2%. As stated in the Climate Action Plan and Climate Action Element, Kenmore's goals are to see a 50% reduction in emissions by 2030, a 75% reduction by 2040, and a 95% reduction and net zero by 2050.

Figure 1 shows communitywide emissions by sector. The largest contributor is Buildings & Energy with 57% of emissions. This can be broken down, with Residential Energy responsible for 43% overall and Commercial Energy contributing 13% overall. The next largest contributor is Transportation & Mobile Sources (31%). Process & Fugitive Emissions, Solid Waste, and Wastewater were responsible for the remaining 12% of emissions.

Figure 2 shows Kenmore's government operations emissions. These emissions make up a fraction of communitywide emissions at 742 MT CO_2e (0.5%). Buildings & Energy accounts for a vast majority (76%) of these emissions, with a relatively even split between emissions from Facilities and emissions from Street Lights & Traffic Signals. The next largest contributor is Transportation & Mobile Sources, including Vehicle Fleet & Equipment (12%) and Employee Commute (10%) for a 22% overall contribution. Solid Waste was responsible for the remainder (less than 2%) of local government operations emissions.

Figure 3 shows a comparison of communitywide emissions between 2019 and 2023 by sector. The highest emitting sectors saw reductions between 2019 and 2023, but there were modest increases in three sectors: Non-Road Vehicles & Equipment, Solid Waste, and Wastewater.

Puget Sound Energy (PSE) has increased their portfolio of renewables, helping to drive emissions reductions alongside localized actions. While the decreased emissions since 2019 are encouraging, the rate of reduction will need to increase in order to meet the goal of a 50% reduction by 2030. That can only be achieved if PSE stays on target to reduce fossil fuel-based energy sources and if local programs and policies are ramped up. Thus, it will be critical to continually fund climate action to move the needle in a significant way.

[1] 2019 emissions were previously calculated and reported at 170,255 MT CO_2e. This metric has been recalculated using updated calculators and the IPCC 6th Assessment Report to more accurately compare across years. More information can be found in Inventory Methodology.

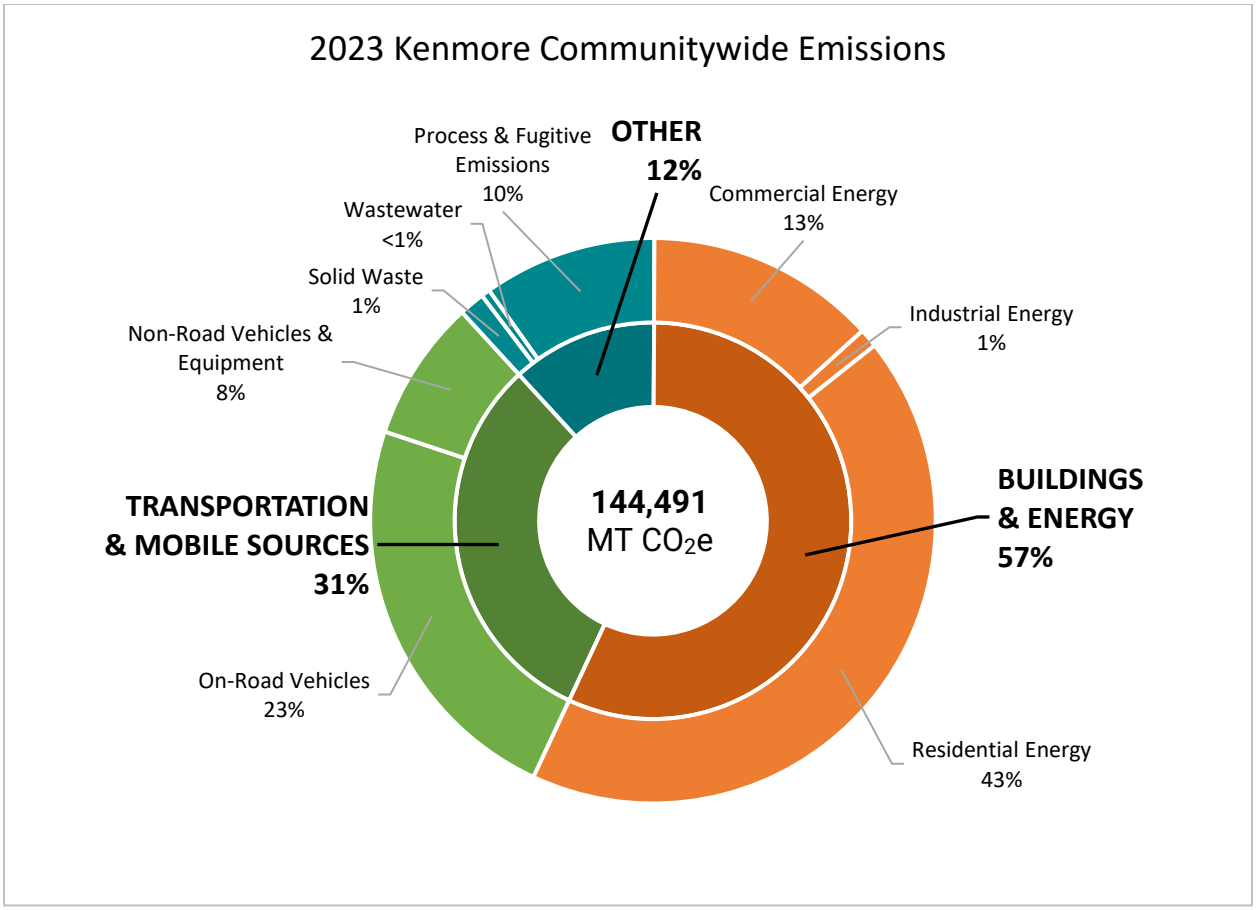

Figure 1: 2023 Kenmore Communitywide Emissions

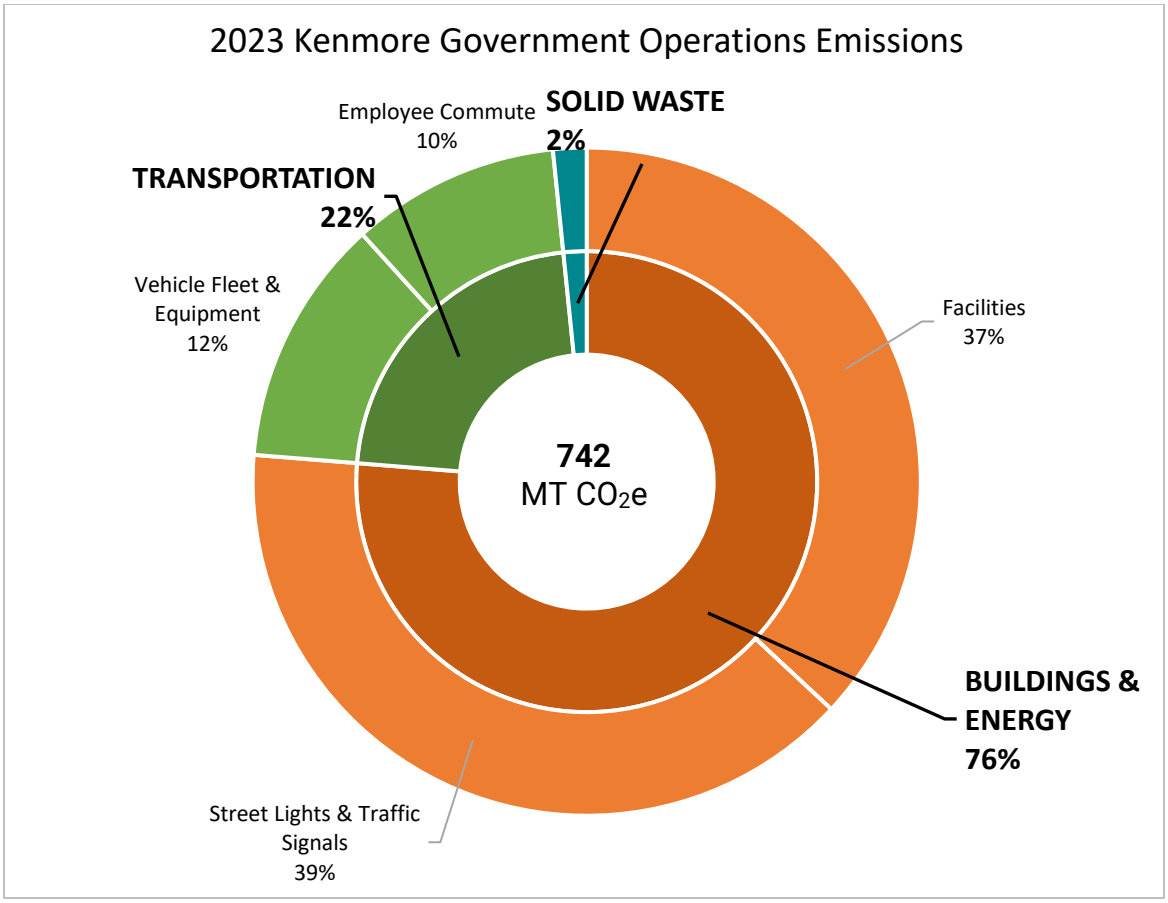

Figure 2: 2023 Kenmore Government Operations Emissions

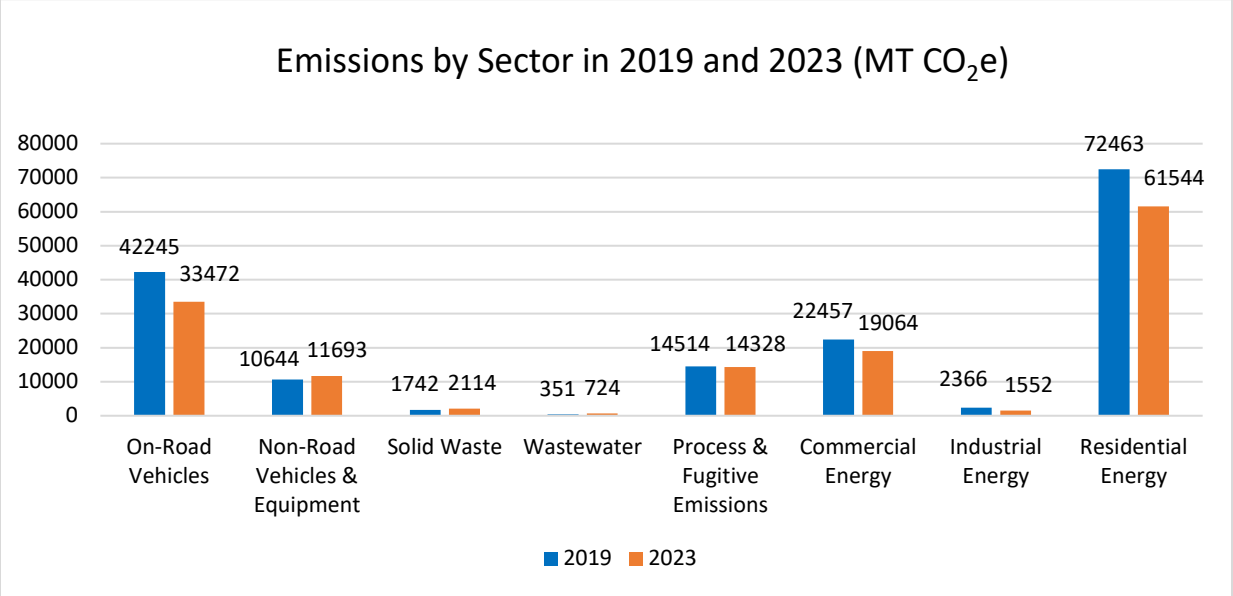

Figure 3: Emissions by Sector in 2019 and 2023

Introduction

An updated greenhouse gas inventory has been completed for 2023. The purpose of this update is to provide data on the City of Kenmore's progress toward emissions reduction goals. In this report, emissions data from 2023 is compared against 2019 data to evaluate progress. The 2023 inventory will also be used to inform future workplans and strategies for localized climate action.

2021 Inventory

While a GHG inventory was planned to be completed every two years, the COVID-19 pandemic raised questions about the accuracy of results in 2021. A 2021 update was started but not completed in full. PSRC did not feel comfortable providing traffic data, as the models would not reflect the decrease in vehicle miles traveled (VMT) as observed and more accurate data would still not provide a true trend of emissions reductions. Given the time required to update a GHG inventory, a determination was made to focus on the 2023 inventory as it would be the best indicator of current progress.

Inventory Methodology

Understanding a Greenhouse Gas Emissions Inventory

The first step toward measuring greenhouse gas emission reductions requires identifying baseline emissions levels along with sources and activities generating emissions in the community. 2019's inventory served to act as that baseline, with subsequent updates providing a snapshot of progress from the baseline.

This report presents emissions from both the Kenmore community as a whole, and from operations of the City of Kenmore government. The government operations inventory is a subset of the communitywide inventory, as shown in **Figure 4**.

Figure 4: Government Operations Emissions as a Subset of Community Emissions

Three primary greenhouse gases are included in this inventory: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Many of the tables and figures in this report represent emissions in "carbon dioxide equivalent" (CO_2e) values, calculated using the Global Warming Potentials

(GWP) for methane and nitrous oxide from the IPCC 6th Assessment Report, as seen below in **Table 1**:

Table 1: Global Warming Potential Values (IPCC, 2020)

Greenhouse Gas	Global Warming Potential
Carbon Dioxide (CO_2)	1
Methane (CH_4)	27
Nitrous Oxide (N_2O)	273

This means that while carbon dioxide has a certain potential to heat the Earth, methane is 27 times more potent than carbon dioxide and nitrous oxide is 273 times more potent than carbon dioxide for warming. CO_2e is derived from these separate values to provide one unit of measurement.

Beyond these three primary gases, four additional GHGs are assessed solely for refrigerants due to their prominence. They include hydrofluorocarbons (HFCs) related to the substitution of ozone-depleting substances, HFCs related to fluorochemical production, perfluorocarbons (PFCs) related to the substitution of ozone-depleting substances, and sulfur hexafluoride (SF_6).

This inventory uses the U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions (Community Protocol) and the Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions (LGO Protocol), both of which are described below. These protocols provide a standardized approach to quantifying GHG emissions.

Community Protocol

The U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions[2] represents a national standard in guidance to help U.S. local governments develop effective community GHG emissions inventories. It establishes reporting requirements for all community GHG emissions inventories and provides detailed accounting guidance for quantifying GHG emissions associated with a range of emission sources and community activities.

The communitywide inventory in this report includes emissions from the five Basic Emissions Generating Activities required by the Community Protocol. These activities are:

[2] ICLEI. 2012. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Retrieved from http://www.icleiusa.org/us-community-protocol/

- Use of electricity by the community
- Use of fuel in residential and commercial stationary combustion equipment (e.g., natural gas for boilers and furnaces)
- On-road passenger and freight motor vehicle travel
- Use of energy in wastewater treatment and distribution
- Generation of solid waste by the community

The communitywide inventory also includes the following activities:

- Transportation of solid waste to landfills, process emissions from landfill activities
- Non-road vehicles and equipment (e.g., motorized lawn equipment, construction vehicles)
- Process emissions from wastewater treatment
- Fugitive emissions from natural gas leakage (e.g., unburned gas leaked from appliances or services lines)
- Fugitive emissions from refrigerant leakage (e.g., leaked refrigerants from heat pumps or other equipment)

Local Government Operations (LGO) Protocol

The LGO Protocol[3] serves as the national standard for quantifying and reporting greenhouse gas emissions from local government operations. It provides the principles, approach, methodology, and procedures needed to develop a local government operations greenhouse gas emissions inventory.

The following activities are included in the LGO inventory:

- Energy and natural gas consumption from buildings & facilities
- On-road transportation from employee commute and vehicle fleet
- Generation of solid waste from local government operations

Quantifying Greenhouse Gas Emissions

Sources and Activities

Communities contribute to greenhouse gas emissions in many ways. Two central categorizations of emissions are used in communitywide inventorying: 1) GHG emissions that are produced by "sources" located within the community boundary, and 2) GHG emissions produced from community "activities". Examples of sources include power plants and freight rail. Activity examples include use of electricity and solid waste generation. Some emissions are categorized as produced by both a source and an activity.

[3] ICLEI. 2008. Local Government Operations Protocol for Accounting and Reporting Greenhouse Gas Emissions. Retrieved from https://icleiusa.org/ghg-protocols/

Source	Activity
Any physical process inside the jurisdictional boundary that releases GHG emissions into the atmosphere.	The use of energy, materials, and/or services by members of the community that result in the creation of GHG emissions.

Figure 5: Source vs. Activity

A purely source-based emissions inventory could be summed to estimate total emissions released within the community's jurisdictional boundary. In contrast, a purely activity-based emissions inventory could provide perspective on the efficiency of the community, even when the associated emissions occur outside the jurisdictional boundary. The division of emissions into sources and activities replaces the scopes framework that is used in government operations inventories, as the scopes framework does not have a clear definition for application to community inventories.

This inventory relies largely on activity data for the purposes of emissions calculations.

Baseline Year

The inventory process requires the selection of a baseline year with which to compare current emissions. Kenmore's communitywide greenhouse gas emissions inventory utilizes 2019 as its baseline year, as it was the first year in which data was collected to measure existing emissions. Using the 2019 numbers, a wedge analysis was created to project emissions reductions needed over time to reach City and regional goals. This update provides the first step in assessing progress from the baseline year.

Quantification Methods

Greenhouse gas emissions can be quantified in two ways:

- Measurement-based methodologies refer to the direct measurement of greenhouse gas emissions (from a monitoring system) emitted from a flue of a power plant, wastewater treatment plant, landfill, or industrial facility.
- Calculation-based methodologies calculate emissions using activity data and emission factors. To calculate emissions accordingly, the basic equation below is used:

Activity Data x Emission Factor = Emissions

Activity data refers to the relevant measurement of energy use or other greenhouse gas-generating processes such as fuel consumption by fuel type, metered annual electricity consumption, and annual vehicle miles traveled. See Appendix A for a detailed listing of the activity data used in composing this inventory.

Known emission factors are used to convert energy usage or other activity data into associated quantities of emissions. Emissions factors are usually expressed in terms of emissions per unit of activity data (e.g., lbs. CO_2/kWh of electricity). For this inventory, calculations were made using ICLEI's ClearPath tool.

All emissions sources in this inventory are quantified using calculation-based methodologies.

Table 2 shows the inputs used from each sector and the methodology to calculate emissions.

Table 2: Inputs and Calculation Methodologies

Sector	Input	Unit of Measurement	Source or Activity[4]	Data Type	Process to Get MT CO_2e
Communitywide Emissions					
Residential Energy	Electricity Usage	kWh	Activity	Recorded	PSE provides emissions factors (emissions per kWh) based on production and distribution. Factor accounts for different sources (23% coal, 27% hydro, 23% natural gas, 16% wind, primarily) as well as both PSE-owned electric operations and electricity purchases. Multiplied by total residential usage as reported by PSE.
	Natural Gas Usage	Therms	Source & Activity	Recorded	Usage multiplied by emissions factor for natural gas provided through ClearPath.
Commercial Energy	Electricity Usage	kWh	Activity	Recorded	PSE provides emissions factors (emissions per kWh) based on production and distribution. Factor accounts for different sources (23% coal, 27% hydro, 23% natural gas, 16% wind, primarily) as well as both PSE-owned electric operations and electricity purchases. Multiplied by total commercial usage as reported by PSE.
	Natural Gas Usage	Therms	Source & Activity	Recorded	Usage multiplied by emissions factor for natural gas provided through ClearPath.
Industrial Energy	Electricity Usage	kWh	Activity	Recorded	PSE provides emissions factors (emissions per kWh) based on production and distribution. Factor accounts for different sources (23% coal, 27% hydro, 23% natural gas, 16% wind, primarily) as well as both PSE-owned electric operations and electricity purchases. Multiplied by

[4] Categorization of source or activity is determined through the U.S. Community Protocol.

					total industrial usage as reported by PSE.
	Natural Gas Usage	Therms	Source	Recorded	Usage multiplied by emissions factor for natural gas provided through ClearPath.
On-Road Vehicles	In-Boundary Travel	Vehicle Miles Traveled (VMT)	Source & Activity	Modeled, Scaled	Modeled county data that takes into account vehicle type, fuel type, and fuel economy. Scaled to Kenmore. Provides data inside Kenmore boundaries only. More detail on vehicle breakdown can be found in **Table 8**.
Non-Road Vehicles	N/A	N/A	Source	Modeled, Scaled	A direct estimate of emissions is output through EPA's MOVES model. Data is derived from the county level and scaled to Kenmore. The model uses a complex set of calculations to provide scenario- and location-specific modeling.
Solid Waste	Waste Generated	Tons	Activity	Recorded	Tonnage is paired with information on the landfills (methane collection scenario and landfill moisture content) to determine emissions as calculated through ClearPath. Waste characterization percentage data is provided from King County to provide a more accurate account of disposal.
	Transportation to Landfills	Tons	Source & Activity	Estimated	Estimated emissions based on amount of waste generated, fuel type used to transport emissions, and distance to landfills. Accounts for disposal at both Cedar Hills and Columbia Ridge landfills.
	Landfilling Process	Tons	Source	Scaled	ClearPath estimates operational emissions for landfilling based on the assumption of diesel heavy-duty equipment in use. Emissions are scaled based on tonnage disposed.
Wastewater	Wastewater Treated	Gallons (in millions)	Activity	Recorded, Scaled	Process emissions from treatment are assessed through a standard multiplier provided by ClearPath. Emissions related to discharge to rivers and streams is calculated through inputting associated daily nitrogen load provided by the treatment plant.
	Electricity Usage	kWh	Activity	Recorded, Scaled	Electricity usage in operations is provided for the whole facility. Data is scaled to Kenmore based on volume of wastewater treated.
	Digester Gas	Standard cubic feet (scf)/day	Source	Recorded, Scaled	Digester gas produced during treatment is calculated through

					ClearPath. Emissions vary based on if the gas is combusted and used for energy or flared into the air as excess. This is scaled from total operations based on volume of wastewater from Kenmore.
Process & Fugitive Emissions	Natural Gas Distribution	Therms	Source	Recorded	ClearPath applies a leakage rate to the quantity of natural gas used to calculate emissions.
	Refrigerants	N/A	Source & Activity	Estimated, Scaled	Refrigerant emissions are directly estimated through national modeling. 4 gases (2 HFCs, PFC, SF_6) are assessed due to their common usage. This data is then scaled.
Government Operations Emissions					
Buildings & Facilities	Electricity Usage	kWh	Activity	Recorded	PSE provides emissions factors (emissions per kWh) based on production and distribution. Factor accounts for different sources (23% coal, 27% hydro, 23% natural gas, 16% wind, primarily) as well as both PSE-owned electric operations and electricity purchases. Multiplied by total municipal facility usage as reported by PSE.
	Natural Gas Usage	Therms	Source & Activity	Recorded	Usage multiplied by emissions factor for natural gas provided through ClearPath.
Street Lights & Traffic Signals	Electricity Usage	kWh	Activity	Recorded, Estimated	Unmetered street light energy usage is estimated by PSE. PSE provides emissions factors (emissions per kWh) based on production and distribution. Factor accounts for different sources (23% coal, 27% hydro, 23% natural gas, 16% wind, primarily) as well as both PSE-owned electric operations and electricity purchases. Multiplied by total street light & traffic signal usage as reported by PSE.
Vehicle Fleet	In-Boundary Travel	VMT	Source & Activity	Recorded	Mileage was used to determine emissions from gas, diesel, and other fueled vehicles.
Non-Road Equipment	Fuel Usage	Gallons	Source	Recorded	Fuel volume for construction and other equipment was totaled to determine emissions.
Contracted Vehicles		VMT		Estimated	Emissions are estimated based on number of trips to Kenmore for service requests, distance traveled, and fuel type. For 2023, this section was estimated due to time constraints.

Employee Commute	To/From Work Travel	VMT	Source & Activity	Surveyed, Estimated	Employees were surveyed, taking into account distance, travel method, vehicle type, fuel economy, and frequency at work/in office.
Solid Waste	Waste Generation	Tons	Activity	Estimated	Waste generation is approximated by assessing frequency of pick ups and size of bins. Tonnage is paired with information on the landfills (methane collection scenario and landfill moisture content) to determine emissions as calculated through ClearPath. Waste characterization percentage data is provided from King County to provide a more accurate account of disposal.

Calculation Review

As part of the inventory process, the inputs and calculations were reviewed by ICLEI staff for completeness, accuracy, and adherence to the Community and LGO Protocols.

Assumptions & Caveats

This inventory provides an update of emissions as accurately as allowable given the data available. Some emissions sources are not able to be accounted for or are estimated. This inventory relies on a mix of modeled, recorded, estimated, and scaled data to calculate emissions. In addition, certain calculations such as transportation data and refrigerant trends rely on 2022 inputs, due to the unavailability of 2023 data at the time of reporting. See Appendix A for a full list of data assumptions, gaps, and caveats.

Communitywide Emissions Inventory Results

The total communitywide emissions for the 2023 inventory are shown in **Table 3**.

Table 3: Communitywide Emissions Inventory

Sector	Fuel or Source	2023 Usage	Usage Unit	2023 Emissions ($MTCO_2e$)	2019 Emissions ($MTCO_2e$)	% Change

Residential Energy	Electricity (Puget Sound Energy)	95,302,324	kWh	37,096	47,342	-21.6%
	Natural Gas	4,596,972	Therms	24,448	25,121	-2.7%
Residential Energy Total				**61,544**	**72,463**	**-15.1%**
Commercial Energy	Electricity	33,509,942	kWh	13,044	17,501	-25.5%
	Natural gas	1,131,908	Therms	6,020	4,956	21.5%
Commercial Energy Total				**19,064**	**22,457**	**-15.1%**
Industrial Energy	Electricity	2,511,794	kWh	978	1,235	-20.8%
	Natural gas	108,177	Therms	574	1,131	-49.3%
Industrial Energy Total				**1,552**	**2,366**	**-34.4%**
On-Road Transportation	Gasoline (passenger vehicles)	84,327,154	Annual VMT	30,148	35,887	-16%
	Diesel (passenger & freight vehicles)	7,290,954	Annual VMT	3,324	6,358	-47.7%
Non-Road Vehicles & Equipment	Gasoline	55,154.75	MMBtu	3,957	3,646	8.5%
	Diesel	79,296	MMBtu	5,868	5,415	8.4%
	Compressed Natural Gas (CNG)	2,948	MMBtu	179	159	12.6%
	Liquefied Petroleum Gas (LPG)	27,439	MMBtu	1,689	1,424	18.6%
Transportation Total				**45,165**	**52,889**	**-14.6%**
Solid Waste	Waste Generated (sent to Cedar Hills Landfill)	4648	Tons	1,351	1,108	21.9%
	Waste Generated (sent to Columbia Ridge Landfill)	1898	Tons	472	357	32.2%
	Transportation Emissions	6546	Wet Short Tons	184	173	6.4%
	Process Emissions Associated with Landfilling	6546	Wet Short Tons	107	104	2.9%
Solid Waste Total				**2,114**	**1,742**	**21.4%**
Wastewater	Wastewater Treatment Energy Usage	1,453,717	kWh	566	277	104.3%
	Wastewater Treatment	0.09692	N_2O	26	9	188.9%
	Nitrogen Discharge	0.36270	N_2O	99	64	54.7%
	Digester Gas Flared	24,683.56	Standard Cubic Feet (Scf)/day	31	0	--
	Digester Gas Combusted (used for boiler operations)	24,683.56	Scf/day	2	1	100%
Wastewater Total				**724**	**351**	**106.3%**

Process & Fugitive Emissions	Fugitive Emissions from Natural Gas Distribution	5,837,057	Therms	1,078	1,084	-0.6%
	Fugitive Emissions from Refrigerants	N/A	N/A	13,250	13,430	-1.3%
Process & Fugitive Total				**14,328**	**14,514**	**-1.3%**
Upstream Impacts of Activities	Transmission and Distribution Losses	131,324,060	kWh	0	3,174	-100%
Upstream Impacts of Activities Total				**0**	**3,174**	**--**
Total Community-Wide Emissions				**144,491**	**169,956**	**-15%**
Per Capita Emissions				5.96	7.29	-18.2%

Figure 6 shows Buildings & Energy emissions by source, totaled across residential, commercial and industrial usage.

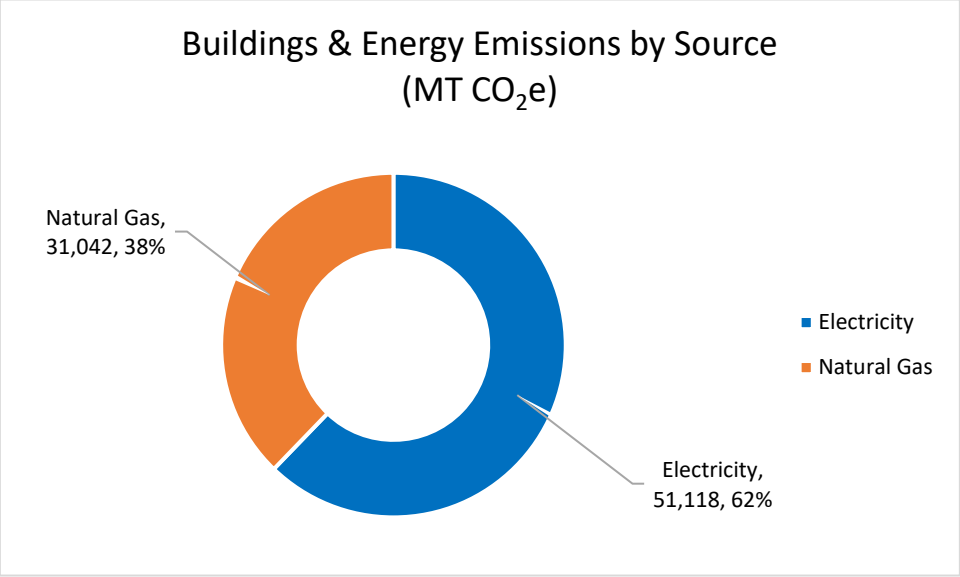

Figure 6: Buildings & Energy Emissions by Source

Understanding the Results

Energy
Emissions from energy usage decreased significantly in 2023. This was due in large part to two factors. First, usage (kWh) was reduced overall across sectors. Secondly, Puget Sound Energy's (PSE) energy source makeup improved. More renewables in PSE's portfolio means less CO_2 and CH_4 per MWh generated.

Transportation
On-road transportation also showed a decline in emissions due to a decrease in vehicle miles traveled (VMT) as modeled by Puget Sound Regional Council (PSRC). This may be due to the staying power of a hybrid work environment in certain industries resulting in fewer cars on the road. This reduction could also be the result of the uptick of electric vehicles in the region as well as improved fuel efficiency for newer vehicles. Data from Washington State estimates registrations of electric vehicles rose from approximately 13% of all registrations to 28% of registrations in Kenmore between 2019 and 2023[5]. Non-road vehicles and equipment, on the other hand, resulted in a slight increase in emissions. This could be due to an increase in construction activities or recreational activities. However, because this data is modeled and scaled, it is difficult to assign

Solid Waste
Solid waste estimates increased due to population growth, but no significant changes occurred.

Wastewater
Wastewater emissions increased due to population growth and also due to a change in West Point Treatment Plant operations. While the plant used to use all digester gas as an energy source to send back to the grid, this practice has since declined. The plant now flares roughly half of digester gas, resulting in higher emissions.

Process & Fugitive
These emissions resulting from escaped natural gas and refrigerants remained largely the same.

Upstream Impacts
Upstream impacts refer to transmission and distribution losses of electricity from the source to the consumer. This is primarily due to resistance in the wires and transformers, leading to wasted heat energy during transmission and distribution stages. These losses were calculated separately in 2019 but were included in 2023's overall energy numbers. This makes it appear that upstream impacts have completely dissolved over time. In reality, the reporting has changed and all future reports from PSE will have integrated line losses and upstream impacts will not be calculated separately.

Results Summary
Over the course of four years, Kenmore has managed to reduce emissions by 15% from the baseline year (2019). This is a step in the right direction to meet the upcoming goal of 50% reduction by 2030. However, at the current rate of change, it would not be enough to meet the milestone goal. More drastic emissions reduction measures are needed to achieve a 50% reduction. This is largely dependent on factors outside of the City's control as well. Puget Sound Energy's compliance with Washington's Clean Energy Transformation Act (CETA) is a critical factor in this change.

Next Steps

The inventory should be used to further focus and prioritize actions to reduce emissions. Based on the inventory results, the following areas have the greatest potential for emissions reduction:

[5] https://data.wa.gov/Transportation/Electric-Vehicle-Share-of-New-Registrations/wzin-vviu

- Residential Energy
- On-Road Vehicles
- Commercial Energy

Government Operations Emissions Inventory Results

Government operations emissions for 2023 are shown in **Table 4**.

Table 4: Local Government Operations Inventory

Sector	Fuel or source	2023 Usage	Usage unit	2023 Emissions ($MTCO_2e$)	2019 Emissions ($MTCO_2e$)	% Change
Buildings & Facilities	Electricity	564,432	kWh	219	286	-23.4%
	Natural Gas	10,372	Therms	55	51	7.8%
Buildings & Facilities Total				**274**	**337**	**-18.7%**
Street Lights & Traffic Signals	Electricity	750,449	kWh	309	230	34.4%
Street Lights & Traffic Signals Total				**309**	**230**	**34.4%**
Vehicle Fleet & Equipment	Gasoline	37,796.4	Annual VMT	32	29	10.3%
	Diesel	10,032	Annual VMT	25	32	-21.9%
	Diesel (construction)	306	Gallons	3	2	50%
	Gasoline (equipment)	247.8	Gallons	2	3	-33.3%
	Diesel (equipment)	193.7	Gallons	2	--[6]	--
Contracted Vehicles	Diesel	4292	Annual VMT	25	25	0%
Vehicle Fleet Total				**89**	**91**	**-2.2%**
Employee Commute	Gasoline	193,816.36	Annual VMT	73	112	-34.8%
	Electric	5,494.34	Annual VMT	1	0	--
	Diesel	1,432.92	Annual VMT	1	0	--
	Transit	468	Annual VMT	0	0	0%

[6] Diesel used for equipment was combined with on-road diesel use or construction in 2019 and therefore cannot be compared with 2023 diesel equipment use.

Employee Commute Total				**75**	**112**	**-33%**
Solid Waste	Waste Generation	42.1	Tons	12	9	33.3%
Solid Waste Total				**12**	**9**	**33.3%**
Total Government Emissions				**742**	**779**	**-4.7%**

Figure 7 shows the breakdown of emissions by City facility.

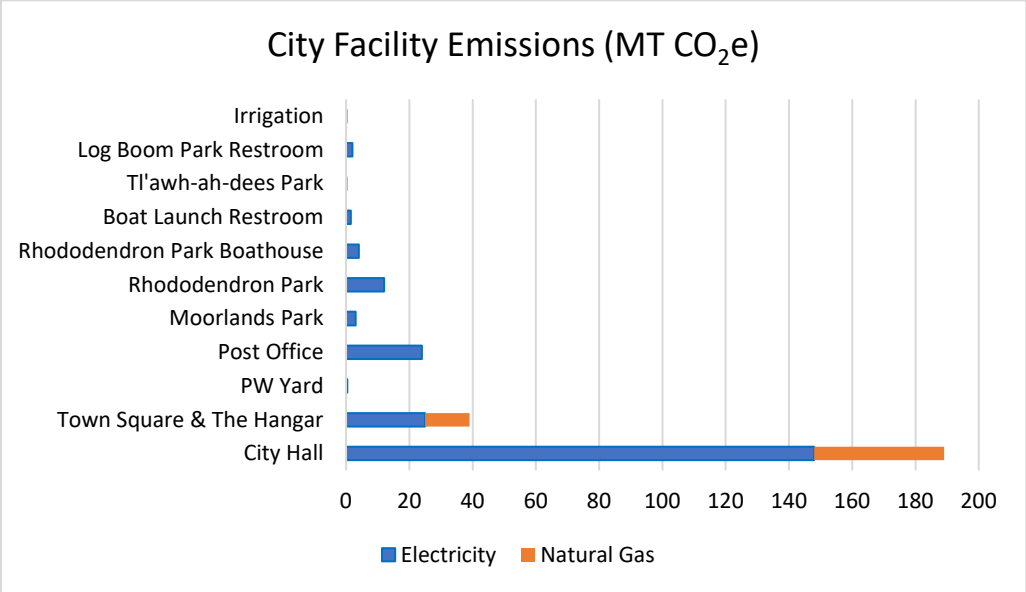

Figure 7: City Facility Emissions

Understanding the Results

Buildings & Facilities
While energy usage increased, the associated emissions decreased from 2019. This is likely due to PSE's increased renewable portfolio.

Street Lights & Traffic Signals
Street light energy usage increased, however the data provided is an estimate of use due to the nature of PSE's data request system. Unmetered street light data cannot be pulled retroactively, resulting in estimates based on when the data was acquired. For 2023, street light data was received in June 2024. PSE used the June count of streetlights paired with average daily hours operating to estimate yearly energy usage. Any changes between inventories are therefore difficult to assess for accuracy.

Vehicle Fleet
Vehicles used by City staff also saw a reduction. This is likely due to a handful of electric vehicles and hybrids being added to the fleet and the disuse or reduced use of older vehicles with lower fuel efficiency.

Employee Commute
Employee commute had reduced emissions despite a growing employee count. Hybrid work schedules after COVID-19 have made it possible for the City to reduce on-road tailpipe emissions. Commuting emissions fell from approximately 1.8 MT CO_2e annually to 1.4 MT CO_2e annually per employee.

Solid Waste
Waste generation is estimated for City facilities, as actual numbers are not tracked on such a granular scale. The increased waste generation reflects added bins or frequency of pickups due to construction projects, facility needs, or other needs.

The emissions reductions from government operations were less stark than communitywide reductions, but the share of communitywide emissions resulting from government operations is minimal. However, this does not mean that government emissions can be ignored. It may be more challenging to find areas for quick reductions given budget constraints.

Next Steps

The City will continue to prioritize energy efficiency measures, use of renewables, and improved policies and procedures to make progress toward emissions goals.

Conclusion

2023 GHG emissions were calculated at 144,491 MT CO_2e, resulting in a reduction of 25,456 MT CO_2e or 15% from 2019 baseline measurements. Buildings & Energy and Transportation & Mobile Sources continue to be the dominant sources of emissions in the City at 57% and 31%, respectively. The City's 2030 Climate Action Plan goal is to reach 50% of 2019 baseline GHG emissions or 84,978 MT CO_2e. **Figure 8** below charts the City's progress towards this goal as of this update. As the graph shows, a higher emissions reduction will need to be realized in future GHG emissions inventories to meet the 2030 reduction target. The trendline shows the needed reduction year over year, however, annual progress is not expected to follow a linear path.

Completion of another GHG inventory in two years is recommended to further assess progress resulting from actions implemented. The software used for calculating emissions is also expected to be overhauled and refined before the next update, which will likely result in more robust reporting. Staff continue to improve methodologies over time to provide a more accurate

account of emissions. Forecasts may also be updated regularly based on how the region is performing.

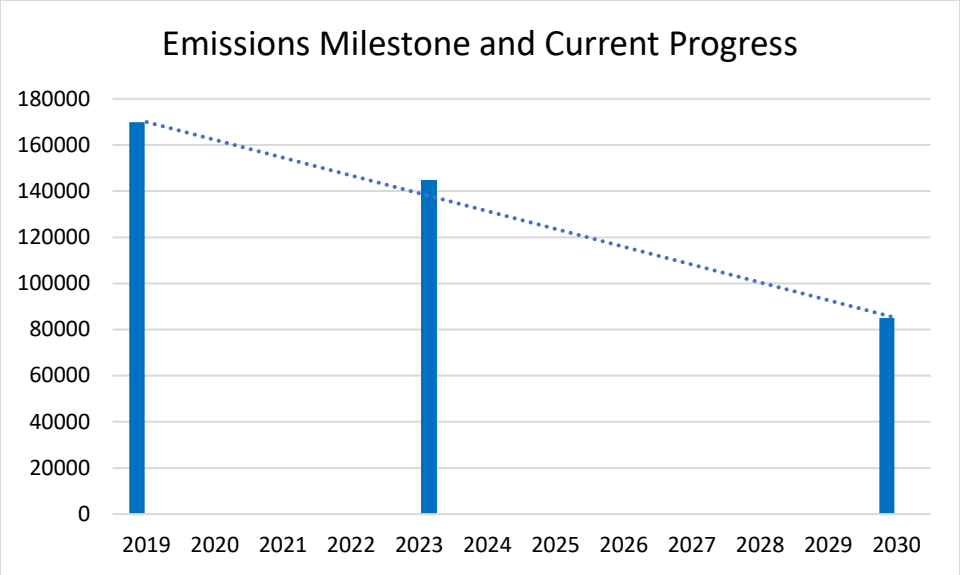

Figure 8: Emissions Milestone and Current Progress

Appendix A: Methodology Details

Energy

The following tables show each activity, related data sources, and notes on data gaps.

Table 5: Energy Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Residential, commercial, and industrial electricity consumption	PSE	N/A
Residential, commercial, and industrial natural gas consumption	PSE	N/A
Local Government Operations		
Electricity consumption	PSE	Unmetered street light energy usage is estimated. PSE process does not allow retroactive data pull, resulting in data representing the time at which it was requested. Any major changes in number of streetlights operating throughout the year will not be reflected in the estimate provided.
Natural gas consumption	PSE	N/A

Table 6: Emissions Factors for Electricity Consumption[7]

Year	CO_2 (lbs./MWh)	CH_4 (lbs./GWh)	N_2O (lbs./GWh)
2023	853.82	65.79	9.30

Transportation

Table 7: Transportation Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Vehicle miles traveled	PSRC, WSDOT	Data is for 2022; 2023 data was not available from WSDOT at time of

[7] The factor set utilizes AR4 global warming potentials, while the rest of the report utilizes AR6. This may lead to emissions factors that are understated.

		reporting. Data is modeled, then scaled from observed county-level data.
Local Government Operations		
Government vehicle fleet & equipment	Northshore Utility District (NUD)	NUD logs fuel use for gas cans (both gasoline and diesel). These quantities are assumed to be used for both small and large equipment not related to construction, as construction fuel is logged separately.
Contracted vehicles		Exact contractor calculations were determined to be too time intensive for the purposes of this report. Because government operations are a small portion of emissions, VMT was estimated to be similar to that of 2019. Estimate includes vactor work and street sweeping but does not account for other general contracting that requires travel.
Employee commute	City of Kenmore staff (surveyed)	Survey captures general commuting habits but does not fully take into account sick time, extended leaves, or changes in habits throughout the year. Survey was administered in 2024 and relies on accurate reporting from staff.

For vehicle transportation, it is necessary to apply average miles per gallon and emissions factors for CH_4 and N_2O to each vehicle type. The factors used are shown in **Table 7**.

Table 8: MPG and Emissions Factors by Vehicle Type[8]

Fuel	Vehicle type	MPG	CH_4 g/mile	N_2O g/mile
Gasoline	Passenger car	24.8	0.0078	0.0061
Gasoline	Light truck	18.1	0.011	0.0073
Gasoline	Heavy truck	7.3	0.032	0.0041
Gasoline	Motorcycle	44	0.0672	0.0069
Diesel	Passenger car	24.8	0.0302	0.0192
Diesel	Light truck	18.1	0.029	0.0214
Diesel	Heavy truck	7.3	0.0095	0.0431

[8] MPG and emissions factors utilize 2022 national defaults, as 2023 defaults were not available at the time of reporting.

Solid Waste

Table 9: Solid Waste Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Waste generation	Republic Services	King County sends waste to two landfills with different characteristics and distances. Calculations assume waste landfilled is distributed to these landfills at the same percentage as county-wide. Percentages of waste sent to each landfill is from 2021, as no more recent data is available.
Waste characterization	King County	Waste characterization is assessed on a county scale. More granular data in unavailable requiring scaling down. Assumed that Kenmore's waste characterization is similar to King County as a whole.
Local Government Operations		
Waste generation	Republic Services	Waste hauler is not able to assess waste generation specifically from government operations. This data is estimated based on number of bins, frequency of pick-ups, and a 70% full estimation at time of pick up.

Wastewater

Table 10: Wastewater Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide & Local Government Operations		
Nitrogen Discharge	King County	Treatment plant serves several communities; data is scaled to Kenmore's population.
Digester Gas Combustion/Flaring		
Energy used in wastewater facilities		

Process & Fugitive Emissions

Table 11: Process & Fugitive Emissions Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Natural Gas Distribution	PSE	Calculation utilizes PSE's reported emissions and scales data to Kenmore's population.
Refrigerants	PSE, EPA	Data represents 2022 trends, as 2023 has not been released. Global warming potentials of gases utilize

		AR5 as a standard. The rest of the calculations in this report use AR6 unless where noted. Data comes from national trends reported by EPA that are then scaled to Kenmore's population. Calculations assume Kenmore's refrigerant emissions are similar to national trends.

Upstream Impacts of Activities

Table 12: Upstream Impacts of Activities Data Sources

Activity	Data Source	Data Gaps/Assumptions
Communitywide		
Transmission & Distribution Losses	PSE	PSE updated their reporting between 2019 and 2023. Transmission and distribution losses have since been included and will continue to be integrated in future reports. Line losses are estimated by PSE to be 5.1% of distribution volume. In 2019 line losses were calculated in ClearPath separately, making comparison across years unrealistic.

Inventory Calculations

The 2023 inventory was calculated following the U.S. Community Protocol and ICLEI's ClearPath software. As discussed in Inventory Methodology, the IPCC 6th Assessment was used for global warming potential (GWP) values to convert methane and nitrous oxide to CO_2 equivalent units. ClearPath's inventory calculators allow for input of the sector activity (i.e. kWh or VMT) and emission factor to calculate the final CO_2e emissions.

Additional Gaps, Caveats, & Assumptions

This inventory employs the use of a combination of recorded, modeled, and scaled data. Due to this, the inventory should be assumed to be the best estimate of local emissions given the available data. It should not be viewed as a precise, exacting account. This inventory is also not intended to provide an assessment of local air quality or particulate matter concentrations.

This inventory accounts for certain activities from the community but does not wholly incorporate consumption habits and other choices made by residents that have impacts on emissions. A consumption-based inventory would take into consideration food, services, construction materials, and goods consumed. However, the data to inform a consumption-based inventory is not readily available and would likely require substantial research or consultant assistance for future implementation.

Additionally, there are several sources of emissions that are not accounted for and similarly were not accounted for in the 2019 inventory. Unaccounted for sources of emissions are listed below.

Local Aviation
The emissions from Kenmore Air operations are not included in this report. Kenmore Air has expressed unease with providing information that would be used to calculate emissions. Additionally, air travel from Kenmore residents is unaccounted for as this data is difficult to collect on a small scale. It's possible that in future air travel is modeled and included across inventories.

Transit
Emissions associated with transit ridership from Kenmore residents are not included. This data is not available since Kenmore does not operate its own transit system. It is difficult to assume that Kenmore ridership looks similar to that of other cities, considering much fewer routes are offered which may greatly impact ridership.

Industrial Operations on Lake Washington
Kenmore's industrial neighbors have also refrained from providing data on any direct emissions into the air from operations. While the inventory does account for electricity and natural gas use and the emissions associated therein, any additional emission data is considered private and is not required to be provided. The EPA assumes that GHG emissions from the production of asphalt are negligible.[9]

Waterborne Activities
Any recreational, industrial, or other emitting activities on Lake Washington are not included. This data is unfeasible to collect. Future consumption-based inventories may be better suited to capture some of this information.

Potable Water
Emissions from energy related to potable water supplied are not separated out in this inventory. NUD operates in Kenmore, so its electricity and natural gas use is accounted for in the Energy sector. Future updates may add in the emissions associated with the treatment of water across inventories.

Small Sources
Small sources such as generators and other emitting sources within the community are not taken into account due to lack of information available. Non-Road Vehicles & Equipment captures much of the fuel-based equipment but is likely not comprehensive.

Other Contracted Services
As a small city, contracted services are a regular part of business. However, this also makes it challenging to record and estimate emissions associated with every contract or work order. For purposes of this report, vactoring and street sweeping were estimated to be similar to 2019 numbers. Future updates may add in a more robust accounting of contracted service emissions across more departments.

Embedded Carbon, Construction Materials

[9] https://www.epa.gov/sites/production/files/2016-03/documents/warm_v14_construction_demolition_materials.pdf

A full life cycle assessment of emissions related to new builds, remodels, and construction materials has not been conducted for this report. A future consumption-based inventory would be better suited to track more holistic emissions such as embedded carbon.

Carbon Sinks
This inventory also does not assess areas where the City may be removing carbon out of the atmosphere. Current urban forestry efforts may provide a better look at how the canopy is contributing to carbon sequestration. Future calculations of the impacts of wetlands may provide a more thorough understanding as well.

Unknowns
Lastly, this inventory may be missing several unknown factors that have not been thought of during the calculation process. Because they are unknowns, they may only be included and fixed by comparing to other jurisdictions' inventories or if other emitting sources in the city become apparent at a later date. Because of this, any cascading impacts of unaccounted for data are also unknown.