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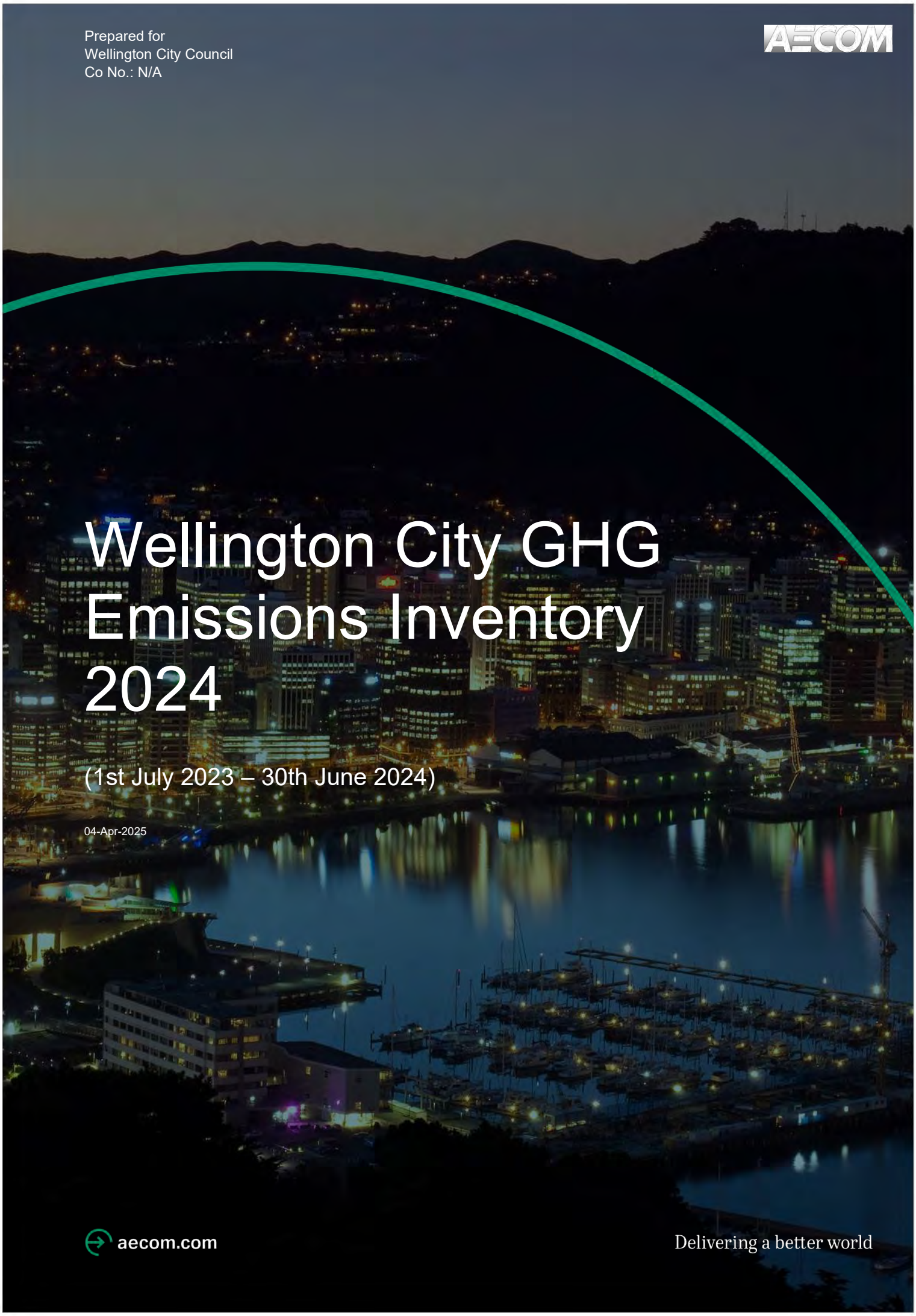

Wellington City GHG Emissions Inventory 2024

(1st July 2023 – 30th June 2024)

04-Apr-2025

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Client: Wellington City Council

Co No.: N/A

Prepared by

AECOM New Zealand Ltd.,

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2	21-March-2025	Second draft for review	Anthony Hume Associate Director - Practice Leader Sustainability & Resilience	
3	04-April-2025	Final	Anthony Hume Associate Director - Practice Leader Sustainability & Resilience	

Table of Contents

Executive Summary

This report details the Greenhouse Gas (GHG) emissions within the geographic boundaries of the Wellington City Territorial Area (administered by the Wellington City Council). The emissions have been measured and reported using the production-based Global Protocol for Community-Scale Greenhouse Gas Emissions Inventory (GPC) methodology. This document reports GHG emissions produced in or from activity or consumption for the FY24 government financial year (1st July 2023 to 30th June 2024).

Wellington City's GHG emissions for FY24 were calculated as part of the Greater Wellington Region's (GWRC) emissions inventory for FY24. For the FY24 inventory, GWRC engaged AECOM to create a streamlined inventory. This involved collecting data for approximately 90% of emissions in Greater Wellington. In comparison, the remaining 10% of emissions were estimated based on Wellington City's FY23 inventory results (either assumed to stay the same or adjusted for population growth where relevant).

As part of this work, the previously published annual emissions inventories for Wellington City from FY19 to FY23 have been updated, and the results presented in this report supersede past results in previous inventories.

Major findings of the FY24 inventory include:

- **Total gross emissions** in Wellington City were 1,010,392 tCO_2e.
- **Transport** (e.g. emissions resulting from road, marine, and air travel) represented 56% of Wellington City's total gross emissions, with on-road petrol and diesel consumption accounting for 33% of total gross emissions.
- **Stationary Energy** (e.g. emissions relating to electricity and natural gas consumption) was the second-highest emitting sector in the city, producing 31% of total gross emissions.
- **Industrial Processes and Product Use** (IPPU) (e.g. emissions from refrigerant gasses and aerosols) represented 7% of Wellington City's total gross emissions.
- **Waste** (e.g.**, landfill and wastewater treatment emissions)** accounted for 4% of Wellington City's total gross emissions.
- **Agriculture** represented 1% of Wellington City's total gross emissions.
- **Net Forestry** emissions totalled -79,908 tCO_2e. This represents that carbon sequestration (carbon captured and stored in plants or soil by forests) was greater than emissions from forest harvesting (e.g., the release of carbon from timber, roots, and organic matter following harvesting). Net Forestry emissions are not included in total gross emissions but in total net emissions. Therefore, the **total net emissions** (gross emissions minus forestry) in Wellington City were 930,484 tCO_2e. Net forestry emissions have not been adjusted since FY22 as they do not significantly vary yearly.

Key changes from FY23 to FY24:

- **Annual total gross emissions increased by 9% from FY23 to FY24**, driven by an increase in the emission intensity of national electricity generation following a particularly low-emission intensity year in FY23. Electricity was more carbon intensive per unit consumed than in FY23 due to low water levels for hydropower generation, requiring additional coal and gas generation to meet demand. Increases in air travel and cruise ship emissions also contributed to this increase.
- On-road transport emissions decreased by 3%.
- Electricity consumption emissions increased by 77%, with consumption unchanged (<0.5%).
- Air travel emissions increased by 28%, primarily due to the increased number of international passengers.
- Cruise ship emissions increased 37% due to an increase in the number of cruise ship visits.
- Waste emissions decreased by 15%, driven by a 17% decrease in emissions from landfill sites.

1.0 Introduction

The Greater Wellington Regional Council (GWRC) commissioned AECOM New Zealand Limited (AECOM) to develop a production-based, community-scale greenhouse gas (GHG) emissions footprint for the Greater Wellington Region for the 2024 financial year (FY24). This report presents the emissions inventory for Wellington City only. The FY24 year covers the period from 1st July 2023 to 30th June 2024 (Government financial year). The study boundary incorporates the jurisdiction of the Wellington City Council. The Wellington City Territorial Area (as shown in **Figure 1**) is hereafter referred to as Wellington City for ease.

The GHG emissions inventory for FY24 estimates the relative scale of GHG emissions produced in the Wellington City area and the relative contribution of different emission sources to Wellington City's total emissions. The results of this inventory can be used to assess trends and changes in Wellington City's emissions over time.

This inventory is part of Wellington City Council's Te Atakura - First to Zero climate action plan[1] regarding measuring the city's emissions and tracking progress towards Wellington City's 2050 net-zero target.

Figure 1 Map of the Wellington City territorial area (sourced from VectorStock)

[1] https://Wellington.govt.nz/climate-change-sustainability-environment/climate-change/what-were-doing-about-climate-change/te-atakura-first-to-zero-climate-action-plan

2.0 Approach

The methodological approach used to calculate emissions follows the Global Protocol for Community-Scale Greenhouse Gas Emissions Inventory v1.1 (GPC) published by the World Resources Institute (WRI) 2021. The GPC methodology follows a production-based approach and allocates emissions to industries as opposed to final users. Production-based approaches exclude global emissions relating to consumption (i.e., embodied emissions relating to products produced elsewhere but consumed within the geographic area, such as imported food products, cars, phones, clothes etc.).

This emissions footprint assesses both direct and indirect emissions sources. Direct emissions are production-based and occur within the geographic area (Scope 1 in the GPC reporting framework). Indirect emissions are produced outside the geographic boundary (Scope 2 and 3) but are allocated to the consumption location. An example of indirect emissions is those associated with electricity consumption, which is supplied by the national grid (Scope 2). All other indirect emissions, such as cross-boundary travel (e.g., flights) and energy transportation and distribution losses, are Scope 3.

Wellington City's GHG emissions for FY24 were calculated as part of the Greater Wellington Region's (GWRC) emissions inventory for FY24. For the FY24 inventory, GWRC engaged AECOM to create a streamlined inventory. This involved collecting data for approximately 90% of emissions in Greater Wellington, while the remaining 10% of emissions were estimated based on Wellington City's FY23 inventory results (either assumed to remain the same or adjusted for population growth where relevant).

As part of this work, the previously published annual emissions inventories for Wellington City from FY19 to FY23 have been updated, and the results presented in this report supersede past results for previous inventories.

The inventory is based on data and reporting guidance available at the time of calculation, using reasonable assumptions in line with the GPC reporting guidance, and may need to be updated in the future to account for changes in data availability or changes to reporting guidance.

Greenhouse gas emissions are generally reported in this document in Carbon Dioxide Equivalent (CO_2e) units and are referred to as 'emissions'.

2.1 Data Collection Approach

The data collection approach for the FY24 GHG emissions inventory is shown in Figure 2. This figure details for each emission source whether data has been collected, adjusted based on a population changed between FY23 and FY24, or not adjusted from FY23.

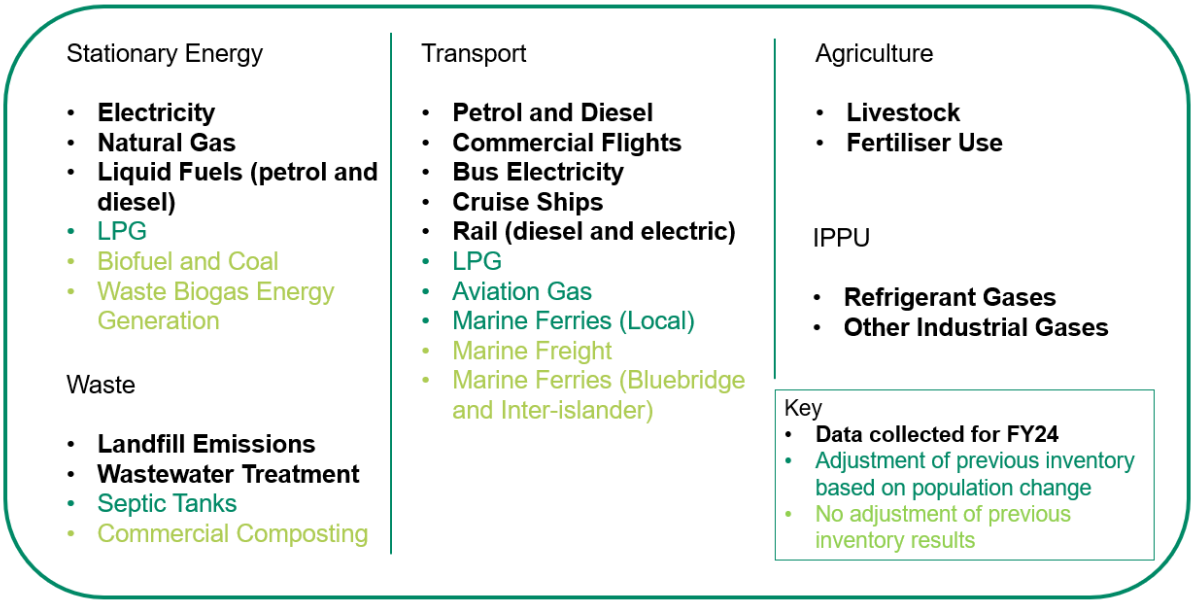

Figure 2 Data collection approach for each emission source.

All major assumptions made during data collection and analysis have been detailed within **Appendix A – Assumptions and Data Sources**.

Considering the uncertainty associated with the results is essential, particularly given the different datasets used. At the national level, in New Zealand's Greenhouse Gas Inventory the estimate of gross emissions uncertainty was ±8.58%, with a net emissions uncertainty estimate of ±24.3%[2].

3.0 Wellington City Emissions Inventory for FY24

Total emissions are reported as gross emissions (excluding forestry harvesting and sequestration) and net emissions (including forestry harvesting and sequestration).

During FY24, Wellington City's total gross emissions were 1,010,392 tCO_2e. Transport and Stationary Energy emissions are the City's most significant contributors to total gross emissions.

The population of Wellington City in FY24 was approximately 216,200 people, resulting in per capita gross emissions of 4.7 tCO_2e/person.

The total net emissions in Wellington City were 930,484 tCO_2e.

Table 1 Total net and gross emissions

Total Emissions	Emissions (tCO_2e)
Total Gross emissions (excluding Forestry)	1,010,392
Total Net Emissions (including Forestry)	930,484

Figure 3 and Table 2 illustrate the six different sectors that comprise the emissions inventory. A discussion of each sector follows in Sections 3.1 through Section 3.6. Section 4.0 details the change in Wellington City's emissions since FY23. Due to rounding, there may be some discrepancy between totals and the sum of results in the tables.

[2] https://environment.govt.nz/assets/publications/GhG-Inventory/GHG-inventory-2024/GHG-Inventory-2024-Vol-1.pdf

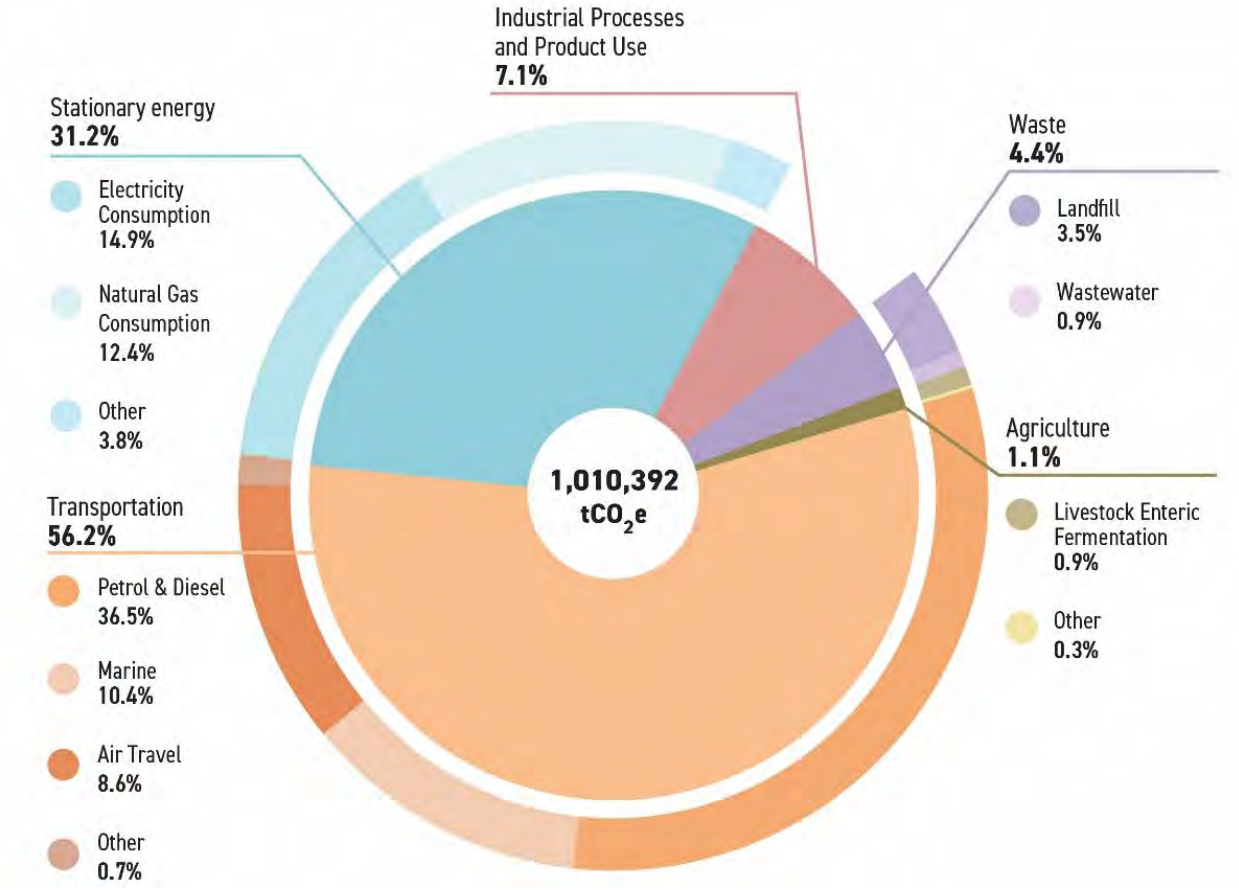

Figure 3: Wellington City's total gross GHG emissions split by sector (tCO_2e)

Table 2 Wellington City FY24 emissions by sector

Emissions Source	Emissions (tCO_2e)	Percentage of Total Gross Emissions (%)
Transportation	567,518	56.2%
Stationary Energy	314,775	31.2%
Industrial Processes and Product Use	72,048	7.1%
Waste (incl. wastewater)	44,560	4.4%
Agriculture	11,491	1.1%
Total Gross Emissions	**1,010,392**	**100%**

Table 3 shows the emission sources from largest to lowest. Appendix B presents full emissions breakdowns.

Table 3 Wellington City FY24 emissions by source

Emissions Source	Emissions (tCO_2e)	Percentage of Total Gross Emissions (%)
On-Road Transport	337,893	33.0%
Electricity Consumption (including transmission and distribution losses)	151,052	14.9%
Natural Gas (including transmission and distribution losses)	125,401	12.4%
Marine Transport	105,393	10.4%
Air Travel	86,389	8.6%
Refrigerant and Air Conditioning Gasses (IPPU)	67,625	6.7%
Off-Road and Other Transport	37,843	3.7%
Solid Waste	35,654	3.5%
Stationary Diesel and Petrol Use	18,001	1.8%
LPG (Stationary Uses)	14,263	1.4%
Enteric Fermentation from Livestock	8,907	0.9%
Wastewater Treatment (incl. household septic tanks)	8,906	0.9%
Other Stationary Energy	6,058	0.6%
Other Industrial Gasses (IPPU)	4,423	0.4%
Other Agriculture Emissions	2,584	0.3%
Total Gross Emissions	**1,010,392**	**100%**

3.1 Transport

Transport was Wellington City's highest emitting sector, producing 567,518 tCO_2e (56% of total gross emissions). Petrol and diesel use represented 65% of the transport emissions in Wellington City (213,791 tCO_2e and 155,197 tCO_2e, respectively).

Diesel and petrol transport emissions are split into on-road and off-road use. On-road transport, consisting of all standard road vehicles (cars, trucks, buses, etc.), was responsible for 60% of transport emissions and 33% of total gross emissions. Off-road transport, consisting of all fuel used for off-road vehicles (agricultural tractors and vehicles, forklifts, etc.), was responsible for 6% of transport emissions. A further breakdown of on-road emissions by vehicle type and class is included in **Appendix C**.

The next largest emission source in the transport sector was marine transport emissions. Marine transport emissions (from freight vessels, cruise ships[3], inter-island ferries, and local ferries) produced 19% of transport emissions and 10% of total gross emissions. Cross-boundary journey emissions (e.g. for marine freight and cruise ships) are calculated based on the fuel consumed during each journey to and from Wellington City, with emissions split equally between the origin and destination location. For marine freight, the emissions related to the journeys to and from Wellington have been split across the territorial authorities in the Greater Wellington Region. This ensures that the emissions are captured as per the GPC requirements. Cruise ship emissions have not been split across the region as the benefits

[3] cruise ships have been included in Wellington City's emissions inventory for the first time. Previously, they were excluded due to a lack of data and a developed method. AECOM developed the method used here for Wellington City Council in 2024.

of cruise ships are focussed in the Wellington City area. In FY24, cruise ships produced 6% of total gross emissions.

Air travel contributed 15% of the sector's emissions and 9% of total gross emissions. As with cross-boundary marine journeys, cross-boundary air travel emissions are split equally between the origin and destination location. Wellington Airport is a regional airport, so emissions from air travel have been split between all territorial authorities in the Greater Wellington Region based on population. It is acknowledged that marine transport and air travel hubs in Wellington City support an area wider than the immediate Wellington Region.

Rail emissions produced 1% of the sector's emissions. Rail emissions were calculated from both national freight and public commuter electric trains.

3.2 Stationary Energy

Electricity consumption (including transmission and distribution losses) accounted for 48% of stationary energy emissions and 15% of Wellington City's total gross emissions. Electricity consumption emissions depend upon the amount of consumption (in kWh) and the emissions intensity of the national grid (tCO2e/kWh), which changes annually. The grid's emissions intensity in FY24 was higher than in FY23, increasing emissions from this source regardless of consumption.

Natural gas consumption, including transmission and distribution losses from the reticulated gas system, accounted for 40% of stationary energy emissions (12% of total gross emissions) and was Wellington City's third-highest emission source, behind on-road transport and electricity consumption.

LPG, petrol, diesel, coal, biofuels, and landfill biogas produced the remaining stationary energy emissions.

Biogenic CO_2 emissions from biofuels and landfill gas flaring have not been included in these totals and are reported separately in section 3.8.

3.3 Industrial Processes and Product Use (IPPU)

IPPU includes emissions associated with the consumption of industrial products and synthetic gases containing GHGs for refrigerants, foam blowing, fire extinguishers, aerosols, metered dose inhalers and Sulphur Hexafluoride for electrical insulation and equipment production. No known industrial processes (as defined in the GPC requirements) are present in Wellington City (e.g., aluminium manufacture).

IPPU contributed 7% to total gross emissions. The most significant contributor to IPPU emissions was refrigerant gasses, which produced 94% of IPPU emissions.

IPPU emissions do not include energy use for industrial manufacturing, which is included in the relevant Stationary Energy sub-category (e.g., coal, electricity and/or petrol and diesel). These emissions are based on nationally reported IPPU emissions and apportioned based on population due to the difficulty of allocating emissions to geographic locations.

3.4 Waste

Waste processed in Wellington City (solid waste, wastewater, and compost) comprised 4% of Wellington City's total gross emissions.

Solid waste produced the bulk of waste emissions, making up 78%. Solid waste emissions include emissions from open (operating) landfill sites (5,165 tCO_2e) and closed landfill sites (29,644 tCO_2e). Both open and closed landfills emit landfill (methane) gas from the breakdown of organic materials disposed of in the landfill for many years after waste enters the landfill.

The reported solid waste emissions relate to all waste-related emissions produced in FY24 from historic waste produced in Wellington City that has entered landfill sites over the last 50+ years, per the GPC guidance for city-level reporting. This approach differs from other reporting methods used for different purposes. For example using a unique emissions factor, the method used to calculate Wellington City Council's own emissions, estimates future emissions related to solid waste entering landfill sites owned by WCC during the reporting year. The city-level reporting approach ensures that all emissions from

waste are included in the inventory, regardless of ownership or whether the landfill is open or closed, and accounts for the gradual release of emissions from historic waste.

Open landfill emissions relate to waste produced in Wellington City and sent to Southern Landfill and Spicer Landfill. Both Southern and Spicer Landfill have landfill gas capture systems that reduce emissions being released into the atmosphere. The Southern Landfill gas capture system was upgraded in FY23, leading to further emissions capture and use of landfill gas for energy production.

Owing to the lack of gas capture systems at closed landfill sites, emissions from closed landfill sites were greater than those from currently open sites. However, the annual emissions from closed landfill sites will continue to decrease over time as no new waste enters these sites.

Wastewater treatment (treatment plants and individual septic tanks) accounted for 20% of total waste emissions. Most households in Wellington City (94%) are connected to wastewater treatment plants, which resulted in emissions of 6,466 tCO_2e from wastewater treatment and processing. Households not connected to wastewater treatment plants (i.e., using individual septic tanks) produced 2,440 tCO_2e in wastewater emissions. Due to methane production, septic tanks have a higher emissions intensity per quantity of wastewater compared to the wastewater treatment plants in Wellington City.

Waste diverted from landfills for composting in Wellington City includes horticultural, animal waste products, green waste, bark, and sawdust. Composting this organic waste produces lower emissions than sending it to a landfill. Diverted organic waste composted at Southern Landfill produced 845 tCO_2e.

3.5 Agriculture

Agricultural livestock and crop farming emissions were responsible for 1% of Wellington City's total gross emissions. Enteric fermentation represented 78% of agricultural emissions. Enteric fermentation is the methane (CH_4) released from the digestive process of cattle and sheep. The second highest source of agricultural emissions was produced from nitrous oxide (N_2O) released by unmanaged manure from grazing animals on pasture.

It is important to note that these agricultural results do not include emissions related to the consumption of agricultural products supplied to Wellington City as per the GPC methodology.

3.6 Forestry (Net Emissions)

Native forests (e.g., mānuka and kānuka) and exotic forests (e.g. pine) sequesters (capture) carbon from the atmosphere while the trees are growing to maturity. Harvesting of forests emits emissions via the release of carbon from organic matter and soils following harvesting. When forest sequestration exceeds emissions from harvesting in a particular year, forestry is a net-negative source of emissions, resulting in the area's total net emissions being lower than their total gross emissions. Conversely, when emissions from harvesting exceed the amount of carbon sequestered by native and exotic forests, forestry is a net-positive source of emissions, resulting in the area's total net emissions being higher than their total gross emissions. Harvesting of exotic forests can be cyclical in nature. Some years will have higher sequestration, and others will have higher harvesting emissions determined by the age of forests, commercial operators, and the global market.

In FY24, Forestry in Wellington City was a net negative source of emissions. These results have not been updated since the FY22 inventory as they do not impact Wellington City's gross emissions and are unlikely to have changed significantly since FY22.

Table 4 Forestry emissions by emission source (including sequestration)

Sector / Emissions Source	tCO_2e
Harvest Emissions	5,531
Native Forest Sequestration	-62,707
Exotic Forest Sequestration	-22,733
Total	**-79,908**

3.7 Total Gross Emissions by Greenhouse Gas

Each greenhouse gas has a different impact on climate change, which is accounted for when converting quantities of each gas into units of carbon dioxide equivalent (CO_2e). This assessment uses conversion figures (i.e. global warming potentials with climate change feedback) from the IPCC 6th Assessment Report (2021).

Table 5: Wellington City's total gross emissions by greenhouse gas

Greenhouse Gas	Tonnes	Global Warming Potential (GWP)	Tonnes of CO_2e
Carbon Dioxide (CO_2)	852,419	1	852,419
Biogenic Methane (CH_4)	1,848	27.2	50,269
Non-biogenic Methane (CH_4)	520	29.8	15,486
Nitrous Oxide (N_2O)	73	273	19,988
Other / Unknown Gas (in CO_2e)	72,230	1	72,230
Total	**927,090**	**-**	**1,010,392**

3.8 Biogenic Emissions

Biogenic CO_2 emissions result from the combustion of biomass materials that store and sequester CO_2, including materials used to make biofuels (e.g., trees, crops, vegetable oils, or animal fats). Biogenic CO_2 emissions from plants and animals are excluded from gross and net emissions as they are part of the natural carbon cycle.

Table 6: Biogenic Carbon Dioxide in Wellington City in FY24 (Excluded from gross emissions)

Biogenic Carbon Dioxide (CO_2) (Excluded from gross emissions)		
Biofuel	30,456	tCO_2
Landfill Gas (Biogas)	15,499	tCO_2
Total Biogenic CO_2	**45,955**	**tCO_2**

Biogenic CH_4 emissions (e.g., produced by farmed cattle via enteric fermentation) are included in gross emissions due to their relatively large impact on global warming relative to biogenic CO_2. Biogenic methane represents 0.2% of the total gross tonnage of GHG emissions in Wellington City but 5% of total gross GHG emissions when expressed in CO_2e. This is caused by the higher global warming impact of methane per tonne compared to carbon dioxide. Table 7 shows biogenic methane in Wellington City in FY24 in tonnes of methane by emission source.

Table 7: Biogenic Methane in Wellington City in FY24 (Included in gross emissions)

Biogenic Methane (CH_4) (Included in gross emissions)		
Landfill Gas	1,279	tCH_4
Enteric Fermentation and Manure Management	332	tCH_4
Wastewater Treatment	131	tCH_4
Biofuel	91	tCH_4
Composting (Green Waste)	15	tCH_4
Total Biogenic CH_4	**1,848**	**tCH_4**

4.0 Variance Analysis FY23 to FY24

Annual total gross emissions increased by 9% from FY23 to FY24, while total net emissions in Wellington increased by 10%. The increase in both gross and net emissions was driven by the rise in the emission intensity of national electricity generation, which meant that electricity was 77% more carbon-intensive per unit consumed than in FY23. Increases in air travel and cruise ship emissions also contributed to this increase.

The previously published annual emissions inventories for Wellington City from FY19 to FY23 have been updated as part of the Greater Wellington Region FY24 Emissions Inventory, with the results presented in this report superseding past results. The updated FY23 results are presented here. A description of these updates is given in Section 6.0.

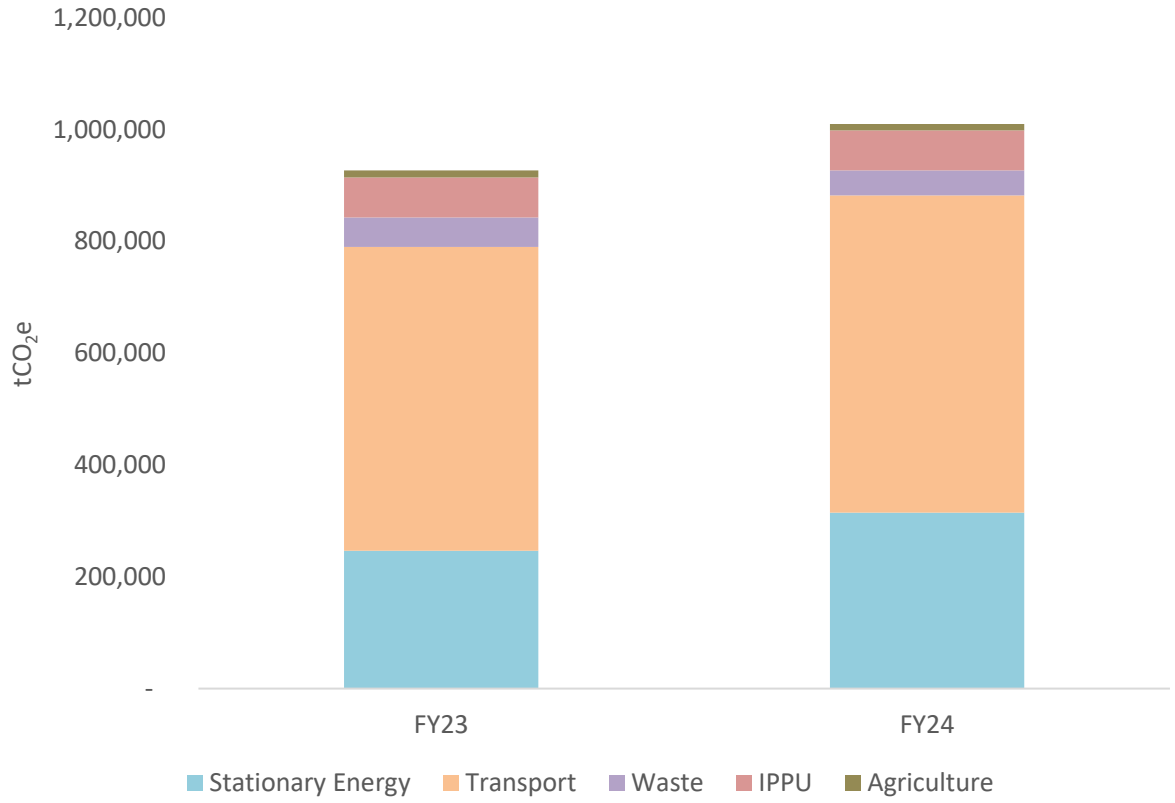

Figure 4 Change in Wellington's total gross GHG emissions from FY23 to FY24

Due to rounding, there may be some discrepancy between totals and the sum of results in the tables.

Table 8 Wellington City - Change in emissions by sector from FY23 to FY24

Sector / Emissions Source	Emissions (tCO_2e)		Percentage Change FY23 - FY24 (%)
	FY23	FY24	
Transport	543,547	567,518	4%
Stationary Energy	246,580	314,775	28%
Waste (incl. wastewater)	52,633	44,560	-15%
Industrial Processes and Product Use (IPPU)	72,048	72,048	0%
Agriculture	12,176	11,491	-6%
Total Gross Emissions	**926,984**	**1,010,393**	**9%**

Table 9 Wellington City - Change in emissions by source from FY23 to FY24

Sector / Emissions Source	Emissions (tCO_2e)		Percentage Change FY23 - FY24 (%)
	FY23	FY24	
On-Road Transport	348,152	337,893	-3%
Electricity Consumption (including transmission and distribution losses)	85,977	151,052	76%
Natural Gas (including transmission and distribution losses)	121,967	125,401	3%
Marine Transport	88,737	105,393	19%
Air Travel	67,404	86,389	28%
Refrigerant and Air Conditioning Gasses (IPPU)	67,625	67,625	0%
Off-Road and Other Transport	39,253	37,843	-4%
Solid Waste	43,009	35,654	-17%
Stationary Diesel and Petrol Use	18,530	18,001	-3%
LPG (Stationary Uses)	14,058	14,263	1%
Enteric Fermentation from Livestock	9,463	8,907	-6%
Wastewater Treatment (incl. household septic tanks)	9,624	8,906	-7%
Other Stationary Energy	6,048	6,058	<1%
Other Industrial Gasses (IPPU)	4,423	4,423	0%
Other Agriculture Emissions	2,712	2,584	-5%
Total Gross Emissions	**926,984**	**1,010,393**	**9%**

4.1 Transport

Transport emissions increased 4% between FY23 and FY24. Air travel emissions increased 28% during this time as international air travel passengers increased. However, these passenger numbers are still below pre-COVID-19 levels, suggesting that annual air travel emissions may continue to increase in the coming years. Cruise ship emissions also increased by 37% as cruise ship visits increased.

On-road fuel emissions decreased by 3%, with fuel sales and the total annual distance travelled by vehicles on roads lower than in FY23.

4.2 Stationary Energy

Stationary energy emissions increased by 28%, driven by an increase in the emission intensity of national electricity generation, which meant that electricity was 77% more carbon intensive per unit consumed than in FY23.

Electricity consumption was relatively unchanged (less than 0.2% different), so emissions from electricity consumption were 76% lower than in FY23. The emissions intensity of national electricity generation increased due to an increase in coal and gas generation as non-renewable generation sources made up a greater proportion of national generation during a drier year, impacting the amount of hydropower generation. It is important to note that the emissions intensity of New Zealand's national grid fluctuates year on year, primarily driven by water levels in the hydropower system.

A 3% reduction in natural gas consumption also decreased Stationary Energy emissions.

4.3 Waste

Waste emissions decreased by 15% between FY23 and FY24, mainly due to reduced open landfill emissions due to increased landfill gas capture at Southern and Spicer Landfill sites. Closed landfill emissions were also reduced as no new waste entered these sites.

At the open landfill sites that process Wellington City's landfill waste (Southern and Spicer landfills), the total landfill gas (CH_4) produced annually increased by 3% between FY23 and FY24 due to increases in annual waste volumes sent to landfill over the last 20 years. However, improvements to landfill gas capture systems have meant that more landfill gas (CH_4) has been captured and flared or used for energy generation, reducing the emissions impact of open landfill sites by 52%.

Annual emissions from closed landfill sites were reduced by 6% between FY23 and FY24. As no additional waste enters these sites, annual emissions from this source will continue to fall.

4.4 Industrial Processes and Product Use (IPPU)

IPPU emissions are unchanged. Data for FY24 was not available at the time of calculation, so the FY23 result has been used for FY24.

4.5 Agriculture and Forestry

Agriculture and Forestry results for FY24 are unchanged from the FY23 inventory, as FY24 data was not collected for this source as part of the streamlined emissions calculation process.

5.0 Gross Emissions Changes

This section presents changes and trends in emissions since Wellington City's baseline year (FY20) and longer-term changes since the FY01 financial year (2000/01).

The previously published annual emissions inventories for Wellington City from FY19 to FY23 have been updated as part of the Greater Wellington Region FY24 Emissions Inventory, with the results presented in this report superseding past results. The updated results are presented here. A description of these updates is given in Section 6.0.

5.1 Changes Since the Baseline Year

Wellington City uses FY20 as its baseline year against which to track emissions and progress towards emission reduction targets. Annual total gross emissions decreased by 1% from FY20 to FY24. This decrease was driven by reduced Waste and Stationary Energy emissions, balanced by increased Transport emissions.

Transport emissions increased 4% between FY20 and FY24 due to an increase in on-road transport emissions (4%) and air travel emissions (13%). These increases are likely due to these travel methods being impacted by COVID-19 travel restrictions in FY20 and subsequent recovery (with emissions for both sources lower in FY24 than in FY19).

Stationary Energy emissions decreased by 5%, with electricity emissions 13% lower than in FY20. Despite an increase in electricity consumption, the emission intensity of electricity per unit generated was reduced. A greater proportion of grid electricity generation from renewable energy sources during this period reduced the emissions intensity of electricity consumption during the reporting period.

Waste emissions were also reduced by 31%, primarily due to improved gas capture methods at open landfill sites and a gradual reduction in emissions from closed landfill sites.

Industrial Processes and Product Use (IPPU) emissions increased by 1%, following nationwide trends, particularly because of an increase in refrigerant and air conditioning gas usage.

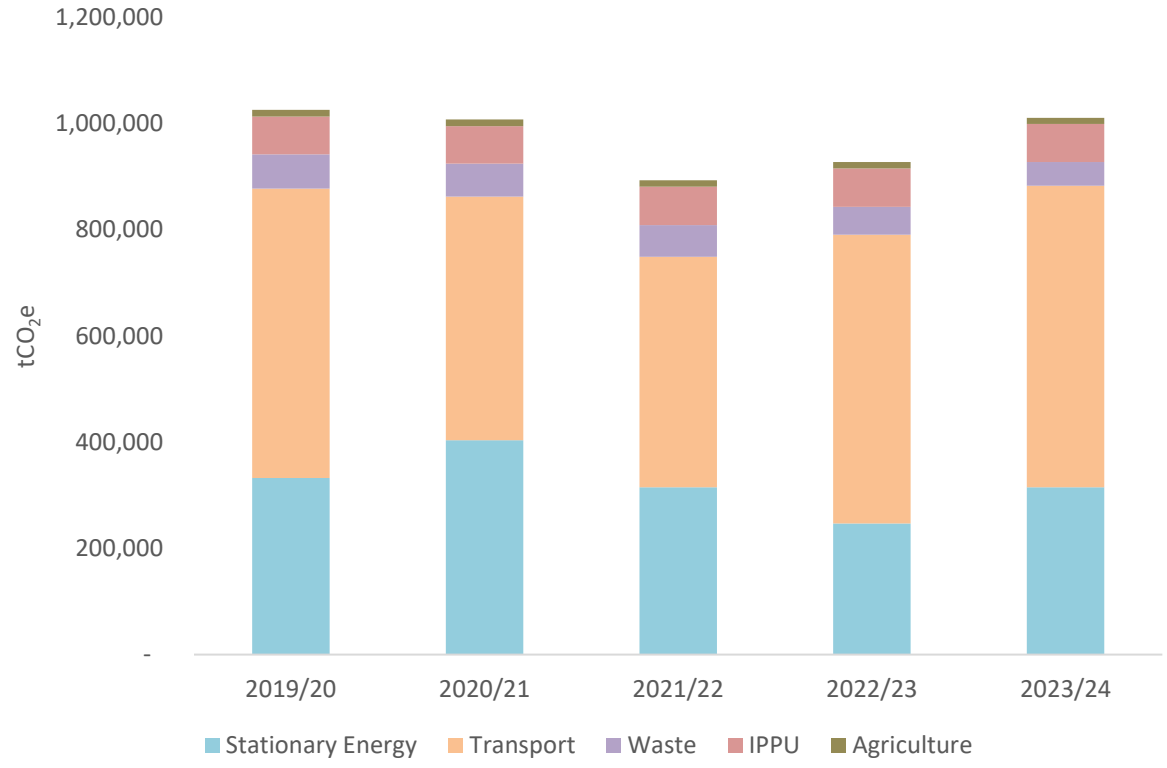

Figure 5 Change in Wellington City total gross emissions from FY20 to FY24

5.2 Longer Term Changes

Wellington City has estimated annual emissions each year from FY01 to FY24. Before the FY19 year, differences in the methodology and data used to calculate emissions exist[4]; however, these differences do not prevent an assessment of trends in emissions over this period.

Annual total gross emissions have decreased by 19% from FY01 to FY24. The decrease has been driven by reductions in Stationary Energy (-32%) and Waste (-70%) emissions. Of note are emissions reductions due to improvements in the emissions intensity of the electricity grid, contributing to a 106,222 tCO2e reduction in electricity emissions, and improvements to landfill emission capture, contributing to a 105,505 tCO_2e reduction in landfill emissions.

These reductions were partially balanced by increased IPPU emissions (495%) and Transport fuel emissions (9%). Note that transport emissions before FY19 do not include cruise ships; if cruise ship emissions are excluded from the FY24 inventory, transport emissions have decreased by 2.8%, including a 9% decrease in on-road vehicle emissions.

As the population has increased (by 27%), and gross emissions have decreased (by 19%), per capita gross emissions have reduced by 36%.

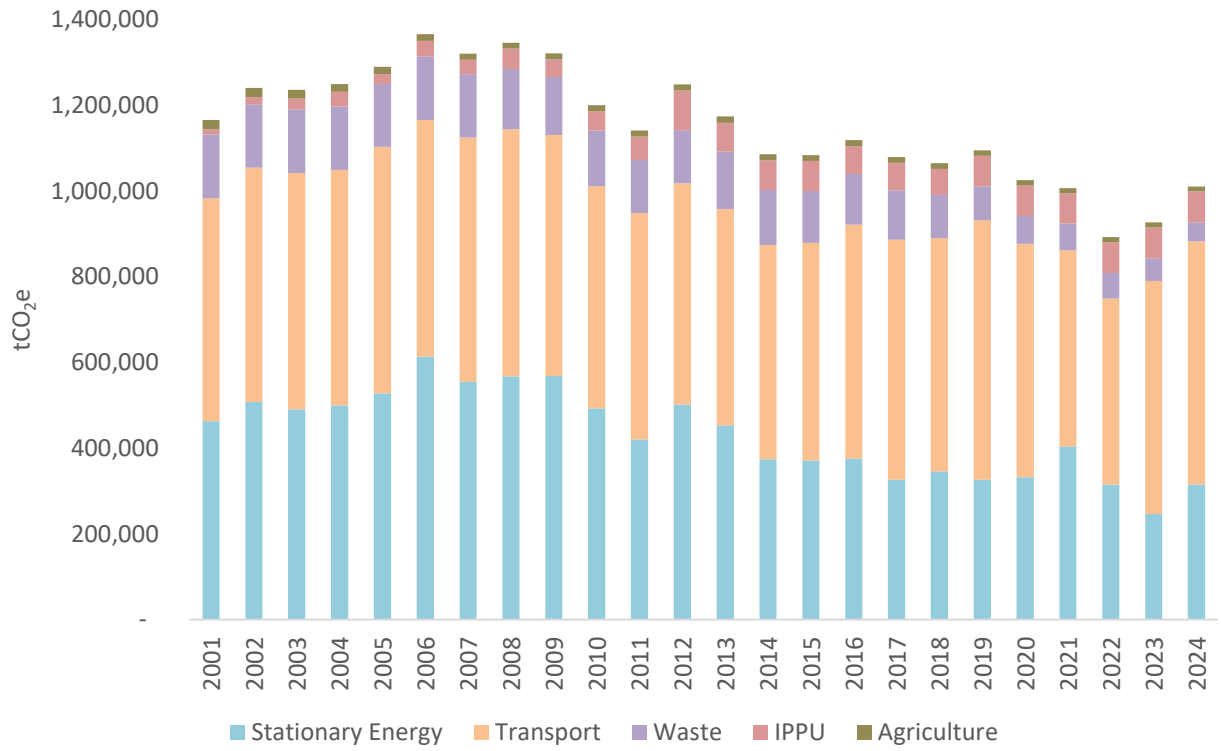

Figure 6 Change in Wellington City total gross emissions from FY01 to FY24

6.0 Update to the FY19 to FY23 Inventory Results

The previously published annual emissions inventories for Wellington City from FY19 to FY23 have been updated as part of the Greater Wellington Region FY24 Emissions Inventory, with the results presented in this report superseding past results. Of note is the inclusion of cruise ships from FY19 onwards and changing the global warming potential values used for methane and nitrous oxide from IPCC AR5 (2014) to IPCC AR6 (2021). Additionally, the emission factors used have been updated from MfE 2022 values to MfE 2024.

Table 10 presents the Wellington City FY19 to FY24 emissions inventory results for reference, this includes the updated FY19 to FY23 results.

Table 10 Wellington City - Change in emissions by sector from FY19 to FY24

Sector / Emissions Source	Emissions (tCO_2e)					
	FY19	FY20	FY21	FY22	FY23	FY24
Transport	605,365	544,411	458,191	434,250	543,547	567,518
Stationary Energy	326,464	332,485	403,679	314,647	246,580	314,775
Industrial Processes and Product Use (IPPU)	71,824	71,435	70,495	72,048	72,048	72,048
Waste (incl. wastewater)	78,655	64,383	62,311	59,513	52,633	44,560
Agriculture	12,282	12,499	12,231	12,176	12,176	11,491
Total Gross Emissions	**1,094,590**	**1,025,213**	**1,006,906**	**892,634**	**926,984**	**1,010,392**
Net Forestry	-67,688	-64,024	-79,908	-79,908	-79,908	-79,908
Total Net Emissions	**1,026,902**	**961,189**	**926,998**	**812,725**	**847,075**	**930,484**

7.0 Closing Statement

Wellington City's GHG emissions inventory provides information for decision-making and action by the council, Wellington City stakeholders, and the wider community. We encourage the council to use the results of this study to update current climate action plans, set emission reduction targets, and track changes in emissions over time.

The emissions footprint developed for Wellington City covers emissions produced in the stationary energy, transport, waste, IPPU, agriculture, and forestry sectors using the GPC reporting framework. Sector-level data allows Wellington City to target and work with the sectors that contribute the most emissions to the footprint.

Understanding of climate change's extensive and long-lasting effects is always improving. It is recommended that this emissions footprint be updated regularly to inform ongoing positive decision-making to address climate change issues.

The availability, quality, and applicability of data limit the accuracy of any emissions footprint. These results may need updating in the future with changes in data and methodology to enable comparable figures to assess trends over time.

8.0 Limitations

Where this Report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information except as expressly stated in the Report. AECOM assumes no liability for any inaccuracies in or omissions to that information. This Report was prepared between **February** and **March 2024** and is based on the information reviewed at the time of preparation. AECOM disclaims responsibility for any changes that may have occurred after this time. This Report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This Report does not purport to give legal advice.

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9.0 Appendix A: Assumptions and Data Sources

Wellington City's GHG emissions for FY24 were calculated as part of the Greater Wellington Region's (GWRC) emissions inventory for FY24. For the FY24 inventory, GWRC engaged AECOM to create a streamlined inventory. This involved collecting data for approximately 90% of emissions in Greater Wellington, where emissions were calculated as per previous inventories. The remaining sources were unchanged from the most recent calculated emissions or adjusted based on population change where this was deemed relevant.

The following table details assumptions, exclusions, and whether data has been collected, adjusted or not adjusted for the Wellington City area in FY24.

Table 11 Wellington City Emissions Inventory 2024 Assumptions and Exclusions

Sector / Category	Assumptions and Exclusions
General	
Geographical Boundary	LGNZ local council mapping boundaries have been applied.
Population	Population figures are provided by StatsNZ. The 2022 calendar year population was used for the 2023 financial year population, with the 2023 calendar year used for the 2024 financial year population.
Global Warming Potential Used	Emissions are expressed as carbon dioxide equivalent (CO_2e) using the 100-year Global Warming Potential (GWP) values from the IPCC 6th Assessment Report (AR6).
Full Inventory	Emissions for all sources broken down by individual main greenhouse gases are provided in the supplementary spreadsheet information supplied with this report.
GPC Production Approach	GPC reporting is predominately production-based (as opposed to consumption-based) but includes indirect emissions from energy consumption. Production-based emissions reporting is generally preferred by policymakers due to robust, established methodologies such as the GPC, which enable comparisons between different studies. Production-based approaches exclude globally produced emissions relating to consumption (e.g., embodied emissions relating to products made elsewhere but consumed within the geographic area, such as imported food products, cars, phones, clothes, etc.). Cross-boundary movements such as air travel and marine freight journeys departing or arriving in Greater Wellington have been included, with emissions related to the journeys split equally between the origin and destination, per GPS requirements, despite the emissions being produced outside the Greater Wellington geographical boundary.
Emission Factors	All emission factors have detailed source information in the calculation tables within which they are used. Where possible, the most up-to-date, NZ-specific emission factors have been applied. This inventory uses applicable emission factors predominantly from the New Zealand Ministry of the Environment Measuring emissions: A guide for organisations: 2024 detailed guide. The emission factors for electricity are obtained from MBIE data for the financial year.
Transport Emissions	
Petrol and Diesel:	The total petrol and diesel consumed in Wellington City was calculated from the total petrol and diesel sold in the Greater Wellington Region, which was then apportioned to the territorial authorities within the region based on the total

	distance travelled by vehicles in each territorial authority in the financial year (known as Vehicle Kilometres Travelled or VKT). Allocating fuel consumption across a region based on VKT does not account for the likely makeup of a particular geographic area's vehicle fleet (e.g., a more rural area may use more diesel, or a more urban area may have more hybrid or electric vehicles travelling). Fuel sold in an area does not always mean that the fuel is used in that area. However, this approach is considered a robust and comparable fuel consumption estimate in a geographic area. Total petrol and diesel fuel use was then divided by likely end use. The division into Transport and Stationary Energy end use (and within Transport, on-road and off-road) was calculated using fuel end-use data provided by the Energy Efficiency and Conservation Authority (EECA) in April 2020. - On-road Transport is defined as all standard transport vehicles used on roads e.g. cars, bikes, buses. - Off-road Transport is defined as machinery for Agriculture, construction and other industries used off-roads. - Stationary Energy petrol and diesel use is defined as fuel not used for transport either on or off roads. Petrol and diesel used for Stationary Energy have been reported in the Stationary Energy sector. This method produces results for off-road and stationary uses of petrol and diesel that are heavily impacted by changes in on-road transport uses of petrol and diesel as this represents the largest proportion of petrol and diesel sales. Better data and understanding of off-road and stationary uses of petrol and diesel are required to improve the applicability of these results. *Data collected for FY24.*
Rail Diesel	Consumption was calculated by Kiwi Rail using the induced activity method for system boundaries. The following assumptions were made: - Net Weight is product weight only and excludes container tare (the weight of an empty container) - The Net Tonne-Kilometres (NTK) measurement has been used. NTK is the sum of the tonnes carried, multiplied by the distance travelled. - National fuel consumption rates have been used to derive litres of fuel for distance. - The type of locomotive engine used, and jurisdiction topography have not been incorporated in the calculations. The transboundary routes were determined using the induced activity method, and the number of stops taken along the way was derived. The total litres of diesel consumed per route was then split between the departure territorial authority, arrival territorial authority and any territorial authority the freight stopped at along the way. No emissions were allocated if the cargo travelled through but did not stop within a territorial authority. This data is subject to commercial confidentiality. Data was not available for FY22; therefore, the FY21 value has been used for FY22. *Data collected for FY24.*
Jet Kerosene	Calculated using the induced activity method as per rail diesel. An estimate of fuel use was calculated for flights arriving and departing from Wellington and Kāpiti Airports:

	- The schedule of flights arriving and departing from the airport, which contains details on the aircraft used for each flight, was used to calculate fuel consumption. - Flight distances and aircraft fuel burn rates were used for these calculations. - As per the induced activity method, only 50% of emissions calculated per one-way arrival and departure were allocated to Greater Wellington. The remaining 50% of each leg was assigned to the originating or destination location. An estimation of fuel use from military, freight, private, and other flights for FY22 has been estimated based on data provided in 2023. Wellington Airport has been treated as a regional airport, so emissions have been split between the territorial authorities in the region on a population basis. *Data collected for FY24.*
Aviation Gas	Aviation gas is mainly used by small aircraft for relatively short flights. Data for Wellington airport was unavailable for the FY22 inventory, so an assumption was made based on similar-sized airports in New Zealand. This is the same assumption used in the FY20 inventory. Wellington Airport has been treated as a regional airport, so emissions have been split between the territorial authorities in the region on a population basis. No estimate of aviation gas usage has been made for aerodromes and other flights outside these two airports. This is expected to be a small emission source. *Adjustment of FY22 results based on population change for FY24.*
Marine Diesel – Freight	Calculated using the induced activity method as per rail diesel and jet kerosene. An estimate of fuel use was calculated for vessels arriving and departing from CentrePort (Wellington Port): - The schedule of vessels arriving and departing from Wellington Port, which contains details on the size of the vessel, was used to calculate fuel consumption. - Shipping distances and vessel fuel burn rates were used for these calculations. - As per the induced activity method, only 50% of emissions calculated per one-way arrival and departure were allocated to Wellington Port. The remaining 50% of each leg was allocated to the originating or destination Port. International shipping passing through CentrePort was split by cargo weight into ‘Logs’ and ‘All other cargo’. Emissions generated by ‘All other cargo’ have been allocated per capita between all territorial authorities in the Wellington Region. Emissions generated by ‘logs’ were split between territorial authorities proportionally by the percentage share of the district forest area of harvest age (>26 years old). *FY23 was calculated for the Wellington City Emissions Inventory 2023—no adjustment of the FY23 results for FY24.*
Marine Diesel (Local)	Port operational vessels: - Fuel use has been provided directly from Wellington Port (CPL) for FY21 - The FY21 figure has also been used for years since.

	- All emissions from this source have been allocated to Wellington City Local ferries: - Diesel fuel use has been provided directly by the ferry operator. - Electricity usage has been provided directly by the ferry operator (beginning in FY22) - All emissions from this source have been allocated to Wellington City Private use, other commercial operators, and commercial fishing: - Most small private boats use fuel purchased at vehicle gas stations, so this consumption will be included in off-road transport, including petrol and diesel emissions. - No data was available to determine emissions from other commercial operators and commercial fishing. *Adjustment of FY22 results based on population change for FY24.*
Marine fuels – Inter-island ferries	Data has been provided by the ferry operators in commercial confidence. Assumptions of fuel use were made where data was not provided. *No adjustment of FY22 results for FY24.*
Cruise Ships	The GHG emissions from cruise ships for FY19 to FY24 have been calculated as part of a separate piece of work for Wellington City Council to understand their impact on the city's emissions inventory profile. Cruise ship emissions have been estimated using the induced activity method similar to rail diesel, jet kerosene, and marine freight. An estimate of fuel use was calculated for each vessel arriving and departing from Greater Wellington based on the estimated fuel consumption of each vessel, the distance travelled to and from Wellington, and while stationary in port. As per the induced activity method, for emissions produced during the journey to/from Wellington the emissions are allocated equally between Greater Wellington and the next/last port. Within Greater Wellington, 100% of Greater Wellington's cruise ship emissions are allocated to Wellington City. *Data collected for FY24.*
LPG	Total North Island consumption data was used and then split per capita to determine the territorial authority's consumption. National LPG end use data has been used to break down consumption into Stationary Energy and Transport usage; these are then reported separately in their respective categories. *Adjustment of FY22 results based on population change for FY24.*
Stationary Energy Emissions	
Consumer Energy End Use	Stationary Energy demand (e.g., electricity use, natural gas, etc.) is broken down by the sector in which it is consumed. We report Stationary Energy demand in the following categories: industrial (which includes Agriculture, forestry, and fishing), commercial, and residential. These sectors follow the definitions of Australia New Zealand Standard Industrial Classification 2006. In addition to Agriculture, forestry and fishing, the industrial sector includes mining, food processing, textiles, chemicals, metals, mechanical/electrical equipment and building and construction activities. Emissions from petrol and diesel used for Stationary Energy are not broken down into these sectors.

	Energy demand for transport is reported in the transport sector.
Electricity Consumption	Electricity demand has been calculated using grid demand trends from the EMI website (www.emi.ea.govt.nz) to obtain raw grid exit point data for Greater Wellington. The reconciled demand has been used per EMI's confirmation. The breakdown into sectors is based on NZ average consumption per sector (residential, commercial, and industrial). *Data collected for FY24.*
Public Transport Electricity	Electricity used in the public transport system is included in the Transport sector (where known). *Data collected for FY24.*
Private Transport Electricity	Electricity used for private transport (e.g., electric cars, bikes, and micro-mobility) has not been separated from other Stationary Energy electricity consumption due to a lack of reliable data.
Coal Consumption	MBIE has provided national coal consumption data for 2022, and EECA has provided regional industrial coal data. National residential and commercial coal consumption has been divided between territorial authorities per capita. Regional industrial coal consumption has been divided between territorial authorities per capita. *No adjustment of FY22 results for FY24.*
Biofuel and Wood Consumption	The Ministry for the Environment (MfE, 2023) has provided national biofuel consumption data for the 2021 year, the most recent year available, for FY24. Biofuel consumption has been divided between territorial authorities on a per capita basis. Biofuel emissions are considered to be biogenic. Biofuel CO_2 emissions are not included in total gross emissions but are reported separately. FY20, FY21, and FY22 use the FY19 figure, adjusted for population change. *No adjustment of FY22 results for FY24.*
LPG Consumption	The LPG Association has provided North Island LPG sales data (tonnes) for 2020 and 2021. Data is interpolated between known data points or copied from the most recent data point where data is not available. 'Auto' and 'Forklift' sales represent Transport uses of LPG. All other sales represent Stationary Energy's use of LPG. Sales have been divided between territorial authorities on a per capita basis. The breakdown into sectors (Residential, Commercial, and Industrial) is based on NZ average consumption per sector per MfE data. *Adjustment of FY22 results based on population change for FY24.*
Petrol and Diesel (Stationary Energy end use)	Total petrol and diesel consumption in Greater Wellington was calculated from total petrol and diesel sold in the Wellington Region, which was then apportioned out to the territorial authorities within the region based on the total distance travelled by vehicles in each territorial authority in the financial year (known as Vehicle Kilometres Travelled or VKT). As most petrol and diesel are used for transport, this provides the most accurate way to calculate this data. Total petrol and diesel fuel use was then divided by likely end use. The division into Transport and Stationary Energy end use (and within Transport, on-road

	and off-road) was calculated using fuel end-use data provided by the Energy Efficiency and Conservation Authority (EECA) in April 2020. - On-road Transport is defined as all standard transport vehicles used on roads e.g. cars, bikes, buses. - Off-road Transport is defined as machinery for Agriculture, construction and other industry used off-roads. - Stationary Energy petrol and diesel use is defined as fuel not used for transport either on or off roads. Petrol and diesel used for Stationary Energy have been reported in the Stationary Energy sector. This method produces results for stationary uses of petrol and diesel that are heavily impacted by changes in transport uses. Better data and understanding of stationary uses of petrol and diesel are required to improve the applicability of these results. *Data collected for FY24.*
Natural Gas Consumption	FirstGas has provided natural gas consumption data. It has also confirmed the Territorial Authorities supplied by gas from each Point of Connection (POC). *Data collected for FY24.*
Biogenic Emissions	Some Carbon Dioxide (CO_2) emissions are biogenic. These are CO_2 emissions where the carbon has recently been derived from CO_2 present in the atmosphere (for example, some agricultural and Waste emissions). These emissions are not included in calculating total CO_2e.
Agricultural Emissions	
Agriculture	Agriculture emissions relate to emissions produced by livestock, crops and fertiliser in the geographic area. They do not relate to imported foods or goods (reported in a consumption-based footprint) or agricultural activities such as farm transport or food processing within the geographic area (these are reported in this inventory under Transport or Stationary Energy, respectively). Regional agricultural data from StatsNZ for 2023 has been used to calculate agricultural emissions, with the 2023 value used for 2024. Territorial authority-level livestock numbers and fertiliser data were taken from the 2017 Agricultural Census (StatsNZ), with the change in regional data used to estimate the change in livestock and fertiliser use in the individual territorial authorities since 2017. *Data collected for FY24.*
Solid Waste Emissions	
Landfill Emissions	Landfill Waste volume and landfill gas capture system information have been provided by the respective council departments. Solid Waste emissions from landfills are measured using the IPCC First Order Decay method, which covers landfill activity between 1950 and the present day, as per the GPC reporting requirements. This method accounts for the gradual release of emissions from waste over a long period of time and calculates the emissions produced per year from waste in landfills (including emissions from closed landfill sites). This approach differs from that used by individual councils for their organisational footprints, which include council-owned landfill sites. The predominant organisational footprint method calculates the likely future emissions from waste entering landfill that year and attributes those emissions to that year (and doesn't include emissions from waste already in the landfill or emissions from closed landfill sites).

	Waste volume: - Where information is unavailable, waste volumes have been estimated based on historical national data on a per capita basis (MfE, 2023). - Contaminated soil has been excluded from the calculation to be consistent with previous years as it is inert for this assessment (this differs from the Council's organisational emissions inventory) Landfill gas capture system efficiency and Landfill gas flaring/burning for energy generation: - Data or assumptions provided directly from council or landfill management contacts Emissions are allocated to territorial authorities based on where the waste was produced, even if the waste is disposed of in a landfill outside the territorial authority. *Data collected for FY24.*
Wastewater Emissions	
Wastewater Treatment Plants	Wastewater Treatment Plants: - Calculation of emissions includes emissions released directly from wastewater treatment, flaring of captured gas (if present) and discharge onto land/water. - Wastewater treatment plant emissions have been calculated following the WaterNZ (2021) guidance based on information provided at the time of calculation. - Where data was unavailable, assumed values were used based on the WaterNZ (2021) guidance. - Emissions relating to the discharge of biosolids sent to landfill have been included in the Solid Waste emissions source. - The results for each treatment plant may differ from emissions calculated for other purposes (e.g. council organisational GHG reporting) due to the different requirements of GHG reporting for various purposes. - Emissions are allocated to territorial authorities based on where the wastewater was produced, even if the wastewater is treated outside the territorial authority. *Data collected for FY24.*
Individual Septic Tanks	Individual Septic Tanks: - Populations not connected to known wastewater treatment plants are assumed to be using septic tanks. - The population not connected to centralised wastewater treatment has been estimated based on the number of rateable properties not connected to sewerage. *Adjustment of FY22 results based on population change for FY24.*
Industrial Processes and Product Use Emissions	
Industrial processes	It is assumed that there are no significant non-energy-related emissions of greenhouse gases from industrial processes in the region (e.g., aluminium manufacturing). *Data collected for FY24.*

Industrial Product Use	National data covering industrial product use (e.g., fire extinguishers, and refrigerants) have been estimated based on data provided in the New Zealand Greenhouse Gas Emissions 1990-2021 report (MfE 2023). Emissions are estimated on a per capita basis, applying a national average per person. *Data collected for FY24 with FY23 as the most recent available data. FY23 results have been used for FY24.*

10.0 Appendix B: Wellington City Emissions Inventory FY24 - Full Inventory Tables

Transport Emissions

Table 12 Wellington City FY24 Transport emissions by emission source

Emissions Source	FY24 Emissions (tCO_2e)	Percentage of Total Gross Emissions in FY24 (%)
Petrol	213,791	21.2%
Diesel	155,197	15.4%
Jet Kerosene (Air Travel)	86,166	8.5%
Marine Freight	22,208	2.2%
Marine (Inter-Island Ferries)	19,421	1.9%
Rail (Diesel)	3,216	0.3%
Marine Diesel (Local)	1,981	0.2%
LPG	1,823	0.2%
Rail (Electric)	1,145	0.1%
Bus (Electric)	564	0.1%
Aviation Gas (Air Travel)	223	<0.1%
Marine (Electric)	7	<0.1%
Total	**567,518**	**56.2%**

Stationary Energy Emissions

Table 13 Wellington City FY24 Stationary Energy emissions by emission source

Emissions Source	FY24 Emissions (tCO_2e)	Percentage of Total Gross Emissions in FY24 (%)
Electricity Consumption	137,763	13.6%
Natural Gas	120,745	12.0%
Stationary Petrol & Diesel Use	18,001	1.8%
LPG	14,263	1.4%
Electricity Transmission and Distribution Losses	13,289	1.3%
Natural Gas Transmission and Distribution Losses	4,656	0.5%
Biofuel	3,048	0.3%
Coal	2,931	0.3%
Landfill Biogas (used for energy generation)	79	<0.1%
Total	**314,775**	**31.2%**

Waste Emissions

Table 14 Wellington City FY24 Waste emissions by emission source

Emissions Source	FY24 Emissions (tCO_2e)	Percentage of Total Gross Emissions in FY24 (%)
Closed Landfill sites	29,644	2.9%
Open Landfill Sites	5,165	0.5%
Wastewater Treatment Plants	6,466	0.6%
Individual Septic Tanks	2,440	0.2%
Composting (Diverted from Landfill)	845	0.1%
Total	**44,560**	**4.4%**

IPPU Emissions

Table 15 Wellington City FY24 IPPU emissions by emission source

Emissions Source	FY24 Emissions (tCO_2e)	Percentage of Total Gross Emissions in FY24 (%)
Refrigerants and air conditioning	67,625	6.7%
Aerosols	3,285	0.3%
SF6 - Electrical Equipment	645	0.1%
Foam Blowing	270	<0.1%
SF6 - Other	122	<0.1%
Fire extinguishers	101	<0.1%
Total	**72,048**	**7.1%**

Agriculture Emissions

Table 16 Wellington City FY24 Agriculture emissions by emission source

Emissions Source	FY24 Emissions (tCO_2e)	Percentage of Total Gross Emissions in FY24 (%)
Enteric Fermentation	8,907	0.9%
Manure from Grazing Animals	1,465	0.1%
Agricultural Soils	901	0.1%
Manure Management	117	<0.1%
Fertiliser used in Horticulture	101	<0.1%
Total	**11,491**	**1.1%**

Forestry Emissions

Table 17 Wellington City FY24 Forestry emissions

Sector / Emissions Source	FY24 Emissions (tCO_2e)
Harvest Emissions	5,531
Native Forest Sequestration	-62,707
Exotic Forest Sequestration	-22,733
Total (Net)	**-79,908**

11.0 Appendix C: Wellington City On-Road Transport Emissions Assessment

11.1 Executive Summary

This section details the additional analysis undertaken to break down further Wellington City's on-road transport Greenhouse Gas (GHG) emissions as reported in the Wellington City Emissions Inventory 2024. On-road transport represented 33% of Wellington City's total gross emissions in the FY24 governmental financial year (1st July 2023 to 30th June 2024). The study boundary incorporates the jurisdiction of the Wellington City Council.

The result supersedes the previously published Wellington City On-Road Transport Emissions for FY23.

This document addresses emissions produced from on-road transport in FY24 and examines trends in on-road transport emissions from FY19 to FY24. Within on-road transport emissions, this assessment looks at the relative contribution of each vehicle type (cars, commercial vehicles, buses, etc.) to Wellington City's transport emissions.

Greenhouse gas emissions are generally reported in this document in Carbon Dioxide Equivalent (CO_2e) units and are referred to as 'emissions'.

Key findings of this analysis include:

FY24 On-Road Transport Emissions by Vehicle Type:

- Cars represented 63% of Wellington City on-road transport emissions and 21% of Wellington City's total gross emissions (214,031 tCO_2e). Cars represented 71% of on-road Vehicle Kilometres Travelled (VKT) in Wellington City.
    - Electric cars represented 0.14% of Wellington City's on-road transport emissions (462 tCO_2e) and 2.0% of Vehicle kilometres travelled (VKT) in FY24.
- Commercial vehicles represented 35% of Wellington City's on-road transport emissions and 12% of Wellington City's total gross emissions (119,166 tCO_2e).
    - Light commercial vehicles (e.g. 'utes' and vans) represented 16% of Wellington City's on-road transport emissions, while heavy commercial vehicles represented 19% of Wellington City's on-road transport emissions.
- Buses represent 1.5% of all on-road transport emissions (this includes public transport, electric buses, school buses, and coaches).
    - Electric buses represented 11% of bus emissions in Wellington City, with diesel buses accounting for 89% of bus emissions in Wellington City.

Changes in On-road Transport Emissions from FY19 to FY24:

- On-road transport emissions decreased by 4% (12,317 tCO_2e).
- Car emissions decreased by 8%, driven by a decrease in petrol and diesel car emissions.
    - During this period, hybrid and electric cars increased, potentially contributing to the reduction in total car emissions.
- Commercial vehicle emissions increased 6%, driven by a 42% increase in heavy commercial vehicle emissions.
    - Light commercial vehicle emissions decreased by 18% during the same period.
- Bus emissions decreased by 14%, from 1.7% to 1.5% of all on-road transport emissions. This is likely due to a transition to electric buses, whose emissions have increased 886% from a very low starting point in FY19.

11.2 Methodology

The basis for this assessment is the results presented in the Wellington City GHG Emissions Inventory 2024. The emissions inventory results for on-road transport are based on fuel sales data for the Greater Wellington Region, which was then apportioned to the territorial authorities within the region based on the total distance travelled by vehicles in each territorial authority in the financial year (with off-road diesel and petrol use accounted for). The emissions for on-road transport were then broken down by vehicle class and type using Vehicles Kilometres Travelled (VKT) emissions data from the New Zealand Transport Agency (NZTA) for FY19[5] and vehicle fleet statistics data from the Ministry of Transport[6]. Changes in the vehicle fleet in Wellington have been used to estimate changes in emissions since FY19. The reported emissions align with the results of the Wellington City GHG Emissions Inventory for FY24.

Emissions related to energy use from electric vehicles (EVs) are included in the stationary energy sector in the Wellingtons City GHG Emissions Inventory 2024 (and not included in transport emissions) due to a lack of appropriate data at the time of calculation. However, the total emissions presented here include the contribution of EV emissions. Due to this, emissions calculated in this study for Wellington City may differ slightly from those reported in the regional inventory report for Wellington City. These emissions have been calculated using an average electricity consumption per km travelled and are based on the carbon intensity of the national electricity grid in FY24.

All calculated GHG emissions have been converted to tonnes of CO_2 equivalent (tCO_2e) to allow direct comparison with the results of the Wellington City GHG Emissions Inventory for FY24. For this assessment, the word ‘emissions’ represents GHG emissions only.

Definition of on-road vehicle categories[7]:

- Light duty vehicles:
    - Cars: passenger cars and sports utility vehicles (SUVs). This includes passenger cars and SUVs for commercial purposes (e.g., taxis).
    - Light commercial vehicles: Utes and vans with gross vehicle mass up to 3.5 tonnes
- Heavy duty vehicles:
    - Heavy commercial vehicles: commercial vehicles with gross vehicle mass higher than 3.5 tonnes
    - Buses with gross vehicle mass higher than 3.5 tonnes

Key Limitations

- The results presented take data provided by Waka Kotahi, which have been adjusted to align with Wellington City’s GHG Emissions Inventory for FY24.
- The on-road transport total displayed in this analysis includes electric vehicles not included in the on-road transport figure in the Wellington City Emissions Inventory, as electricity use is included in the Stationary Energy sector.
- The electricity contribution to plug-in hybrid vehicle emissions has not been calculated for this assessment. However, it is assumed to have a minimal impact on results.
- Data used for this assessment is based on modelling results provided by Waka Kotahi, there are inherent assumptions within all modelling.

[5] Provided directly to AECOM
[6] https://www.transport.govt.nz/statistics-and-insights/fleet-statistics/
[7] https://www.nzta.govt.nz/assets/Highways-Information-Portal/Technical-disciplines/Air-quality/Planning-and-assessment/Vehicle-emissions-prediction-model/VEPM-6.3-technical-report-2023.pdf

11.3 On-Road Transport Emissions in FY24

On-road transport emissions are those relating to cars, commercial vehicles (including utes, trucks, and large commercial vehicles), and buses on-roads. On-road transport is the largest contributor to transport emissions in Wellington City, representing 60% of Transport emissions and 33% of Wellington City's total gross emissions. This is followed by air, marine, and off-road transport.

Table 2 and Figure 7 detail on-road transport emissions per vehicle category and fuel type. Cars in Wellington City tend to be fuelled by petrol while commercial vehicles and buses tend to use diesel (excluding some electric buses in Wellington City). Electric vehicles (EV) represent 0.3% of total on-road emissions in Wellington City but represent approximately 2% of kilometres travelled by vehicles in Wellington City (this includes electric busses).

Of note:

- Cars represent 63% of on-road emissions in Wellington City, and 21% of the City's total gross emissions.
- Commercial vehicles represent 35% of on-road emissions in Wellington City, and 12% of the City's total gross emissions.
- Buses represent 1.5% of on-road emissions in Wellington City. The bus category includes public transport, school buses, and private commercial buses (including tourist coaches).

Table 18 On-road transport emissions by vehicle type and fuel type in FY24 (tCO_2e)

Vehicle Type	Petrol	Diesel	Electric	Total[8]	% of Total
Cars	198,333	15,237	462	**214,031**	**63%**
Commercial Vehicles	13,496	105,668	2	**119,166**	**35%**
Buses		4,595	564	**5,160**	**2%**
Total	**211,828**	**125,500**	**1,028**	**338,357**	
% of Total	**63%**	**37%**	**0.3%**		

[8] The on-road transport total displayed here and in the following tables includes electric vehicles which are not included in the on-road transport figure in the Wellington City Emissions Inventory as electricity use is included in the Stationary Energy sector.

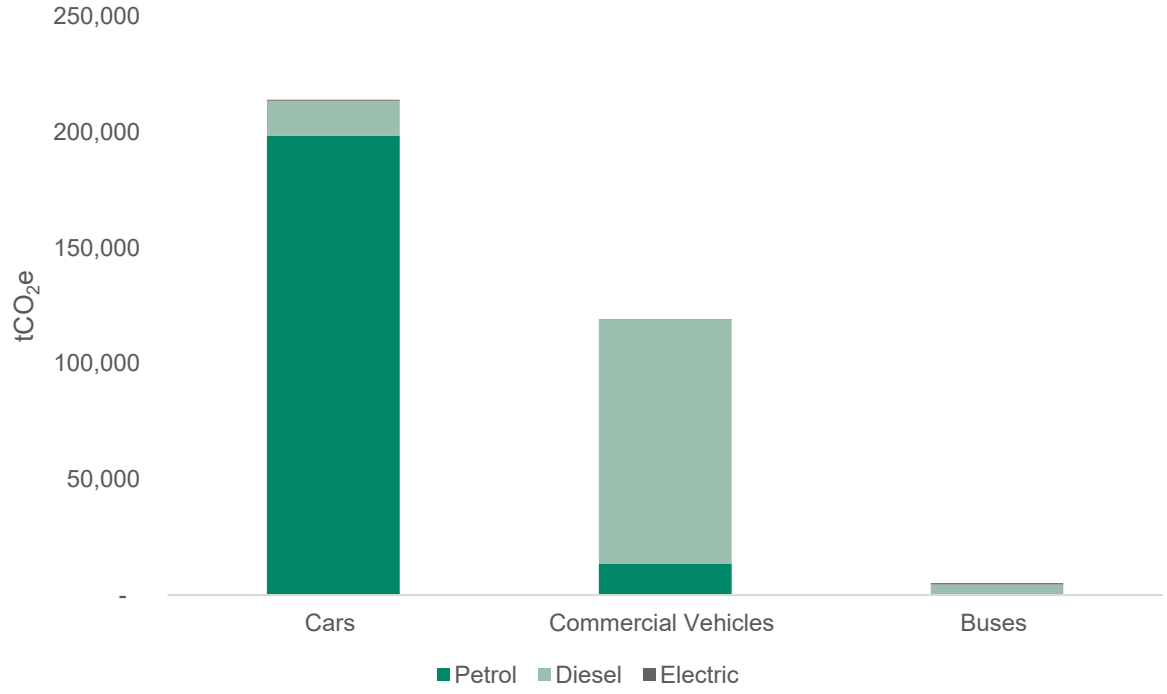

Figure 7 On-road transport emissions by vehicle type and fuel type in FY24

This highlights the impact of private and commercial vehicles on Wellington City's on-road transport emissions. Efforts to reduce emissions from on-road transport need to consider options to address private car emissions, such as mode shifts to active travel and public transport, and options to reduce commercial vehicle emissions, such as incentivising lower-emission commercial vehicles or shifting freight to alternative modes. Traditionally, the focus has often been on private car journeys, and the impact of commercial vehicles hasn't been adequately considered.

Emissions from these vehicle types can be broken down further by vehicle class. Table 19 details on-road transport emissions per vehicle class.

Of note:

- Commercial vehicles lighter than 3.5 tonnes represent 16% of on-road emissions in Wellington City. Many of these will be commercial 'utes' and small vans.
- Commercial vehicles heavier than 25 tonnes represent 15% of on-road emissions in Wellington City. This generally represents vehicles used for freight movement.

Table 19 On-road transport emissions by vehicle class in FY24 (tCO_2e)

Vehicle Class	GHG Emissions (tCO_2e)	% of Total
Cars	214,031	63%
Light Commercial Vehicles <3.5 Tonne	55,304	16%
Heavy Vehicles 3.5-25 Tonne	12,925	4%
Heavy Vehicles 25-50+ Tonne	50,936	15%
Bus Urban 15-18 Tonne	4,733	1%
Bus Coach >18 Tonne	427	<0.1%
Total	**338,357**	**100%**

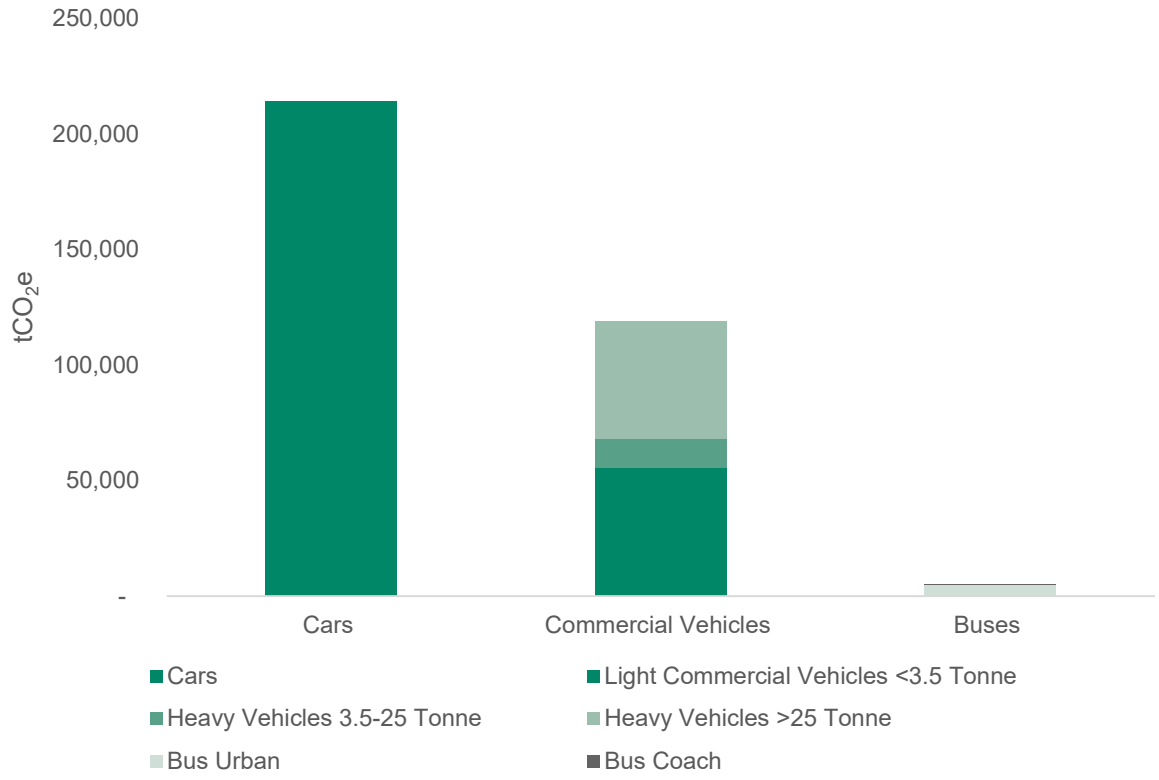

Figure 8 On-road transport emissions by vehicle class in FY24

Alongside total emissions, emissions have also been compared to the distance travelled by different vehicle types. Table 20 shows the emissions per vehicle class as above but also includes the VKT by each vehicle class in Wellington City and the average emissions per VKT for each vehicle class.

Of note:

- Cars represent 71% of all VKT in Wellington City but represent 63% of all on-road emissions in Wellington City. This is due to the relatively low average tCO_2e per VKT of cars compared to heavier vehicles (partly due to the use of petrol rather than diesel for cars).
- 25-50+ tonne commercial vehicles represent 7% of all VKT in Wellington City but represent 15% of all on-road emissions in Wellington City. This is due to heavy vehicles' higher average tCO2e per VKT than lighter vehicles.

These figures do not consider the weight of freight or the number of people being moved per vehicle, where larger vehicles may be more efficient per tonne of freight moved than smaller vehicles or where buses may be more efficient per person than cars.

Efforts to reduce the kilometres travelled by all vehicles should be considered to reduce emissions from on-road transport. This could include enabling and encouraging increased public transport use or diverting freight from roads onto rail and marine transport options. Efforts to improve the fuel efficiency of all vehicles should also be considered.

Table 20 On-road transport vehicle class VKT, emissions, and calculated average emissions per VKT

Vehicle Type	Vehicle Kilometres Travelled (VKT)	GHG Emissions (tCO_2e)	Average tCO_2e per VKT
Cars	838,791,407	214,031	0.0003
Light Commercial Vehicles <3.5 Tonne	215,181,678	55,304	0.0003
Heavy Vehicles 3.5-25 Tonne	44,073,308	12,925	0.0003
Heavy Vehicles 25-50+ Tonne	82,050,579	50,936	0.0006
Bus Urban 15-18 Tonne	6,185,233	4,733	0.0008
Bus Coach >18 Tonne	938,781	427	0.0005
Total	**1,187,220,986**	**338,357**	**0.0003**

11.4 On-Road Transport Emissions Change from FY19 to FY24

This section displays the change in on-road transport emissions from FY19 to FY24. During this period on-road transport emissions decreased by 4% (12,317 tCO_2e).

COVID-19 restrictions impacted the FY20 and FY22 years, decreasing annual emissions from on-road transport by 7% and 9%, respectively, compared to the year before. Emissions from on-road transport rebounded by 4% and 13%, respectively, following these COVID-19-affected years to pre-COVID-19 levels.

Table 21 Change in on-road transport emissions by vehicle type (tCO_2e)[9]

Vehicle Type	FY19	FY20	FY21	FY22	FY23	FY24	% Change (FY19 to FY24)
Cars	232,486	212,403	221,104	199,586	221,920	214,031	-8%
Commercial Vehicles	112,176	108,239	112,528	104,684	121,661	119,166	6%
Buses	6,012	5,359	5,235	4,885	4,960	5,160	-14%
Total	**350,674**	**326,001**	**338,866**	**309,154**	**348,541**	**338,357**	**-4%**

[9] The on-road transport total displayed here and in the following tables includes electric vehicles which are not included in the on-road transport figure in the Wellington City Emissions Inventory as electricity use is included in the Stationary Energy sector.

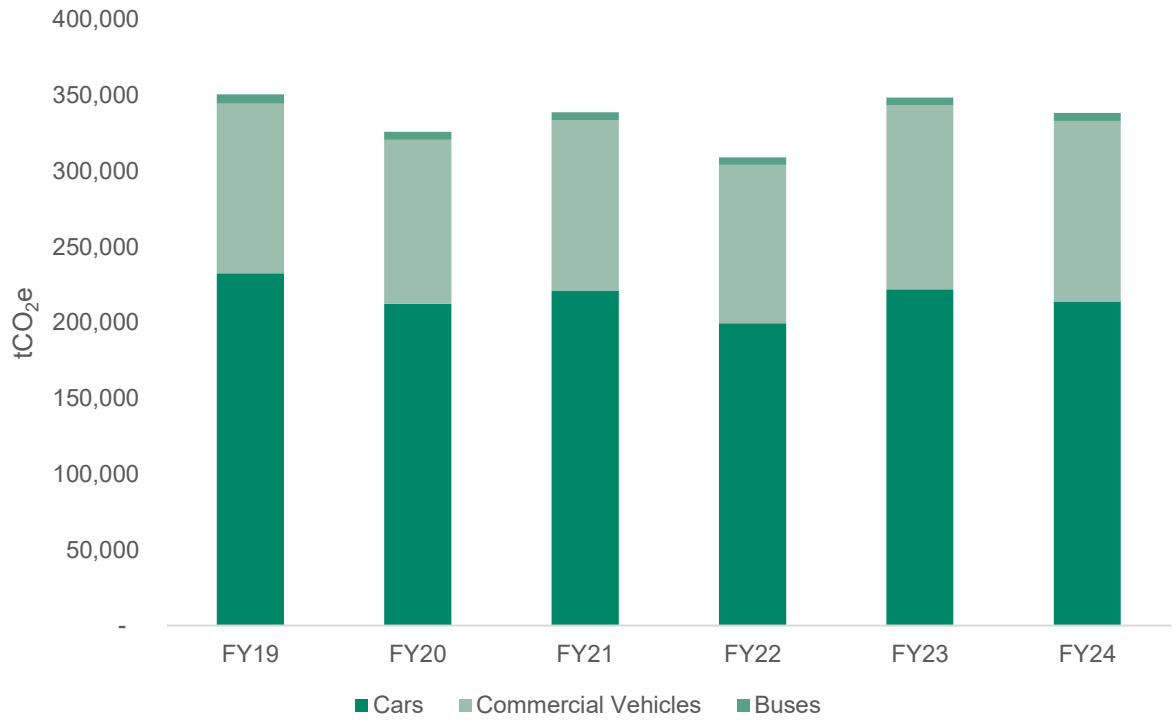

Figure 9 On-road transport emissions by vehicle type FY19-FY24

The results show that the leading cause of decreased on-road transport emissions between FY19 and FY24 is a 9% reduction in car emissions (17,832 tCO_2e). We can see the impact of COVID-19 travel restrictions in Wellington City in FY20 and FY23, particularly affecting car emissions. During these years, there were periods of restricted travel. Commercial vehicle emissions have been less affected by the COVID-19 restrictions.

Overall, there has been a decline in all vehicle types' emissions, except for heavy commercial vehicles and hybrid and electric car emissions. This is likely due to improvements in vehicle efficiency, uptake of EV and hybrid vehicles, and investments in public transport and active modes of transport, reducing reliance on private cars.

Notable changes when examining on-road emissions changes in more detail (Table 22):

- The reduction in on-road transport emissions was driven by a 9% (17,832 tCO_2e) reduction in petrol car emissions. This is followed by light commercial vehicles, where emissions decreased by 18% (11,952 tCO_2e). Car diesel emissions also reduced by 28% (5,873 tCO_2e).
- The most significant emissions increase was a 42% (18,942 tCO_2e) increase in heavy vehicle emissions.
- There was also a proportionally large increase in electric and hybrid vehicles of 540% and 286%, respectively. There has been a large growth in the number of these vehicles in Wellington City, and emissions have grown in line with this increase. However, these vehicles still represent a very small proportion of on-road emissions and are vastly lower-emitting than the equivalent internal combustion engine vehicles. This may have contributed to the reduced car emissions in Wellington City, alongside other changes such as improvements in fuel efficiency and transport mode shift.
- There was a 14% decrease in bus emissions, likely due to a transition from diesel to electric buses in Wellington City.

Table 22 Change in on-road transport emissions by vehicle class (tCO_2e)

Vehicle Type	FY19	FY20	FY21	FY21	FY23	FY24	% Change (FY19 to FY24)
Car Petrol	209,603	192,221	201,398	180,736	200,101	191,771	-9%
Car Diesel	21,110	18,175	17,059	15,474	16,429	15,237	-28%
Car Hybrid	1,701	1,901	2,511	3,183	5,002	6,562	286%
Car Electric	72	105	136	193	388	462	540%
Light Commercial Vehicles	67,257	59,705	58,195	52,718	58,246	55,304	-18%
Heavy Commercial Vehicles	44,919	48,534	54,333	51,965	63,415	63,861	42%
Buses	6,012	5,359	5,235	4,885	4,960	5,160	-14%
Total	**350,674**	**326,001**	**338,866**	**309,154**	**348,541**	**338,357**	**-4%**