# Greenhouse Gas Emissions Inventory Report

**2021/2022 Financial Year**

***(Technical Report)***

**25 July 2023**

**Environmental Planning Division**

**Southland District Council**

**15, Forth Street, Invercargill**

***Disclaimer:***

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Southland District Council's gross GHG emissions for the 2021/ 2022 financial year were 16,758.38 $tCO_2$-e. Council also owns 116.8 ha of post-1989 forests, currently registered in the Emissions Trading Scheme (ETS). In 2021/2022 financial year, Council received 2,044 NZUs[1] for its post 1989 forests in the ETS. Therefore, Council's net emissions were 14,714.38 $tCO_2$-e during the financial year.

Table below provides a summary of GHG emissions inventory, including percentage contribution of each emissions source to the total emissions.

Table 1: GHG Emissions inventory summary

| Emissions Source | Total Emissions ($tCO_2$-e) | % |
|---|---|---|
| Wastewater Treatment Plants | 1,758.30 | 10.5 |
| Vehicle Fleet | 292.55 | 1.7 |
| Stationary Fuel Combustion | 1,291.17 | 7.7 |
| Forestry Sinks | -2,044 | |
| Purchased Electricity | 641.18 | 3.8 |
| Freight | 0.172 | 0.0 |
| Business Travel | 18.01 | 0.1 |
| Waste Collection & Transportation | 63.26 | 0.4 |
| Employee Commuting | 118.12 | 0.7 |
| Purchased Goods & Services | 4,354.68 | 26.0 |
| Capital goods | 6,377.12 | 38.1 |
| Landfill disposal and office waste | 1,768.25 | 10.6 |
| Transmission & Distribution Losses of purchased electricity | 58.77 | 0.4 |
| Work from Home | 7.55 | 0.0 |
| Water supply and wastewater services | 9.23 | 0.1 |
| Net Emissions | **14,714.38** | |
| Gross Emissions | **16,758.38** | |

[1] Equivalent to one tonne of $CO_{2\text{-}e}$

# 1 INTRODUCTION

This report is the first annual greenhouse gas (GHG) emissions inventory report of Southland District Council (SDC). SDC has initiated a number of activities to increase Council's ability to respond to climate change effectively. In 2022, Council commissioned Great South to downscale flood and coastal inundation risks identified in the 2018 NIWA Study to develop more fine-tuned model outputs on communities and assets at risk of climate change induced hazards. Great South has also been tasked with building the awareness of council staff on greenhouse gas (GHG) emissions measurement and reporting. In parallel to these activities, Council initiated developing its corporate GHG emissions profile for 2021/2022 financial year, aiming to set a baseline for future emissions reduction (climate change mitigation). Council will identify emissions reduction strategies and integrate such strategies into the next Long Term Plan (LTP) cycle, infrastructure strategy, and activity management planning. SDC will play a leading role in promoting green, resilient, and low carbon development in the district in line with Aotearoa New Zealand's climate change objectives.

## 1.1 OBJECTIVES OF THE ASSESSMENT:

- Measure GHG emissions within the organizational boundary for Category 1, 2, 3, & 4 emissions sources (alternatively Scope 1, 2, 3)
- Set corporate GHG emissions baseline to measure future performance against
- Identify key emissions sources and highlight high-level actions to reduce GHG emissions
- Identify and document data gaps for the improvement of emissions data collection and management

This report illustrates the demarcation of organizational and operational boundary for emissions calculation, data collection methods, data analysis, and recommendations to improve emissions data management.

# 2 METHODOLOGY

This assessment follows the Ministry for the Environment's Guideline "Measuring Emissions: A Guide for Organisations" (MfE, 2022) (Figure 01). The MfE Guideline was also used to identify emissions sources and emissions factors. Further, Green House Gas Protocol: A Corporate Accounting and Reporting Standard (Revised Edition) (World Resources Institute and World Business Council for Sustainable Development, 2004) was used as a guide in setting organizational boundary and operational boundary. ISO 14064-1:2018 guideline was also used in determining emissions categories to ensure consistency and enable comparisons with other councils in the region.

Given the MfE guidance note does not cover the full spectrum of Scope 3 emissions that councils usually dealing with, several alternative sources were also used to identify relevant emissions factors for this assessment. These include Motu working paper (Romanos, C., et al., 2014), Water NZ guidelines, and emissions factors published by the Department for Business, Energy & Industrial Strategy, Government of United Kingdom. Table 4 below summarises the sources of emissions factors.

Various data sources were used for the assessment. Council is maintaining its electricity consumption data in Council's energy data management system, known as 'e-Bench'. As such, e-Bench was used for purchased electricity data. Service providers' invoices and Council's CAPEX/OPEX report were used in most cases, while two companies (ie, NZ Courier and Orbit World Travel) provided custom-generated reports to support data collection. Data from Activity Management Teams, sample surveys, and assumptions-based estimates were used in other cases. Section 2.4 explains data sources and data collection methods for different categories of emissions.


Figure 1: Steps for corporate GHG emissions calculations and reduction (MfE, 2022)

## 2.1 Organisational Boundary

SDC used an operational control approach to demarcate its organisational boundary for GHG emissions inventory. Therefore, this assessment accounts for 100 percent of the GHG emissions from any operations over which Council has full operational control and authority to introduce and implement operating policies. Council has a number of joint initiatives within the Southland district and beyond to collaborate with other councils to implement shared services. This includes emergency management, economic development, tourism etc. However, Council does not have any operational control or authority to introduce operating policies and procedures for these operations, as such these joint ownership initiatives were not included in the organisational boundary. Figure 1 below shows the Council's organizational boundary.

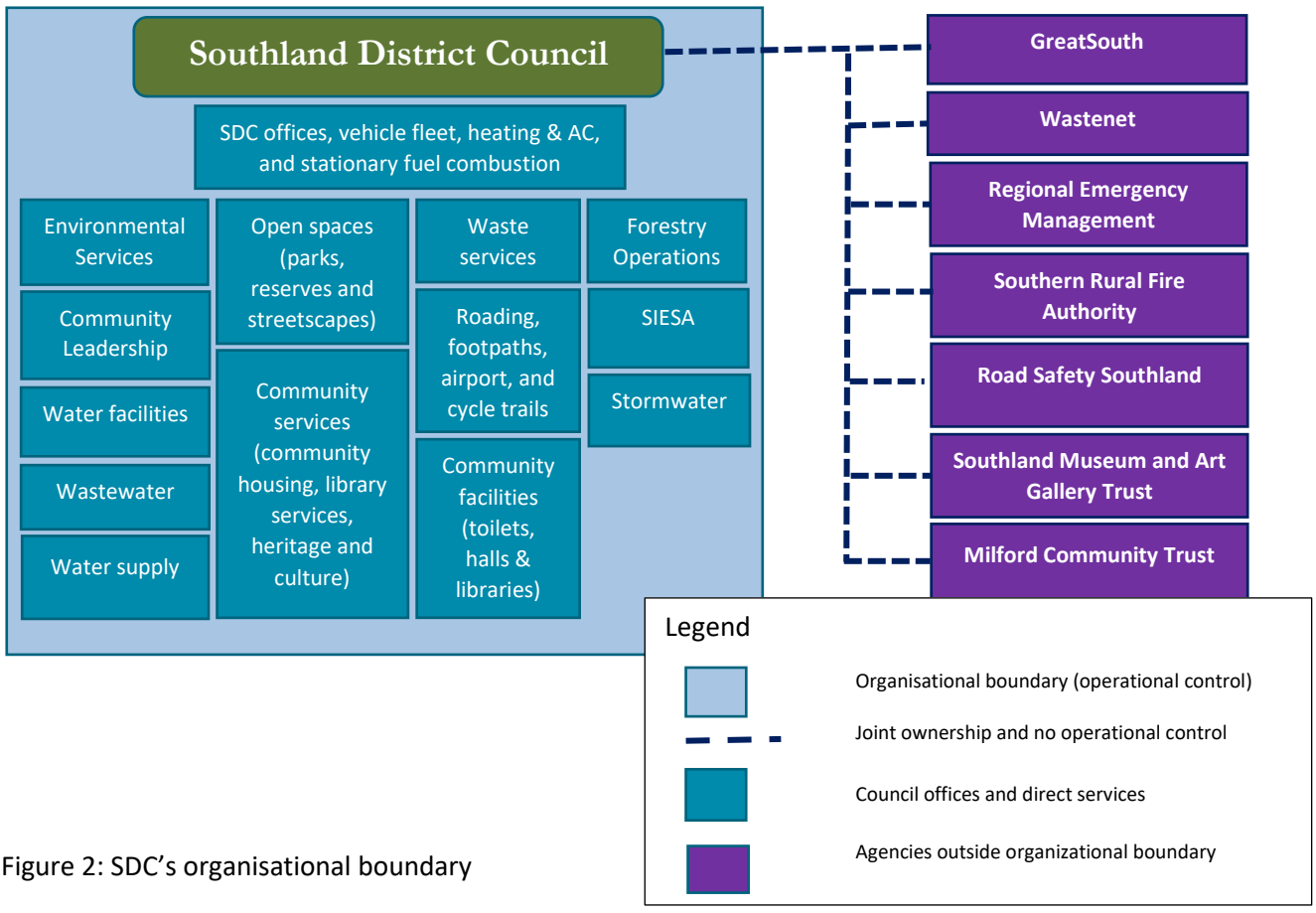


Figure 2: SDC's organisational boundary

Given the complex nature of Council's operations and importance of accounting all relevant emissions, following have been considered as the emissions within the Council's boundary.

Table 2: Emissions sources within Council's organizational boundary

| No | Activity / Description | Location |
|---|---|---|
| 01 | SDC Offices and other buildings | 31 buildings, including 10 offices, libraries, halls, sports pavilions, and grandstands and a museum. Offices include: 15, Forth Street, Invercargill; 20, Don Street, Invercargill (leased from ICC); 42, Don Street, Invercargill; 18, Diana Street, Lumsden; 176, Main Street, Otautau; 10, Ayr Street, Halfmoon Bay, Oban; 117, Palmerston Street, Riverton; 116, Town Centre, Te Anau; 182, Great North Road, Winton; 41 Balaclava Street, Wyndham |
| 02 | Transport | 4,961 km roads, footpaths, bridges, Te Anau/Manapouri Airport, Around the Mountain Cycle Trail |
| 03 | Wastewater | 19 schemes, 8200 properties, 245 km of reticulations |
| 04 | Water supply | 21 schemes (10 urban, 11 rural stock water), 6,900 connections, 718 km of reticulation |
| 05 | Stormwater | 25 schemes, 113km of reticulation |
| 06 | Water structures | 5 jetties, 8 boat ramps, wharves, and viewing platform at Riverton |
| 07 | Public toilets | 67 public toilets - Human excreta generated in some public toilets connected to reticulation system of community wastewater treatment plants. In all other locations, waste is pumped, transported and treated in Council's wastewater treatment plants. Therefore, not covered separately. |
| 08 | Cemeteries | 22 Cemeteries (15 in operation) |
| 09 | Community housing | 69 individual units in 10 townships |
| 10 | Vehicle fleet | 61 vehicles in Council's vehicle fleet, including one electric car, and four hybrid SUVs |
| 11 | SIESA | Power generation and distribution to 427 consumers. Five diesel generators at a central power station and the power is delivered by 30km of overhead lines, 10km of underground cables and 35 distribution transformers. |
| 12 | Forestry | Out of 1,839 Ha of Council owns forest in Dipton, Gowan Hill, Ohai (2 sites), and Waikaia, approx. 1,484 Ha are covered by tree crop. The age of tree crop ranges from one year to 39 years. Out of the tree crop area, 93% of land is pre-1990 forests (1384 Ha). In 2021/2022 financial year Council harvested 30.8 Ha of pre-1990 forestry. |
| 13 | Parks and reserves | 159 district reserves and park operations |
| 14 | Waste service | Operation and maintenance of seven waste transfer stations; 11 recycling only drop-off centres; and two green waste only sites |

## 2.2 EXCLUDED SOURCES WITHIN ORGANISATIONAL BOUNDARY

Certain emissions were excluded from the Assessment due to lack of data, difficulties in accessing data, or emissions are too minor to consideration (less than 1%). Further, category 5 (ie, indirect emissions associated with the use of products from the organization) and Category 6 (indirect emissions from other sources) were considered not relevant to SDC, thus excluded. Table 3 below provides a detailed account of exclusions.

Table 3: Exclusions from the emissions profile

| Emission source | Reasons for exclusion |
|---|---|
| Leakage of Refrigerant | No expenses on refrigerant found in invoices. An alternative methodology was not adopted either as a full inventory of equipment was not available |
| Upstream leased assets (ie, assets leased by third parties) | No operational control |
| Upstream transportation and distribution | Direct services obtained by the Council have been captured. The remaining transportation and distribution emissions are assumed as included in supplier invoices. |
| Use of personal vehicles for business travel | Use of personal vehicles for business travel which had not been reimbursed by the Council has been excluded due to lack of data. |
| Business Travel organised by other entities | Not included as data were not available |
| Imported electricity for EVs | EV charging data not available. Based on the industry specifications and manufacturer's specifications on energy efficiency, emissions from imported electricity for EV was estimated as 17g CO2-e/km and considered negligible. |
| Use of sold products and end of life stage of sold products | Not relevant |
| Upstream Freight paid by suppliers | No data available |

## 2.3 Operational Boundary

As per the GHG Protocol, an operational boundary defines the scope of direct and indirect emissions for operations that fall within a company's established organisational boundary. This assessment uses ISO 14064-1:2018 classification of emissions. The following table summarises different Categories of emissions based on ISO 14064-1:2018 Categories. This assessment covers Category 1, 2, 3, and 4 emissions. GHG Protocol scopes were also provided for better clarity.

Table 4: Emissions by scope, category, and source

| Scopes used in the GHG Protocol | Categories used in ISO 14064-1:2018 | Direct/indirect emissions and removals | Source |
|---|---|---|---|
| Scope 1 | Category 1 | Direct GHG emissions and removals from sources owned and controlled by SDC | Mobile fuel combustion |
| | | | Wastewater treatment |
| | | | Stationary fuel combustion |
| | | | Forestry |
| Scope 2 | Category 2 | Indirect emissions from imported energy | Purchased Electricity |
| Scope 3 | Category 3 | Indirect emissions from transportation | Business travel |
| | | | Freight, including kerbside collection and transportation of waste |
| | | | Staff commuting |
| | Category 4 | | Transmission and distribution losses of purchased electricity |

| | | | |
|---|---|---|---|
| | | Indirect GHG emissions from products that Council uses | Landfill disposal (community and office waste) |
| | | | Water supply and wastewater treatment (services obtained by Council) |
| | | | Purchased goods and services |
| | | | Capital goods |
| | | | Work from home |

## 2.4 EMISSIONS FACTORS

This Assessment primarily uses emissions factors presented in the MfE Guidance[2]. Further, as discussed above, the Assessment also uses Motu Working Paper 14-5 (Romanos, C., et al., 2014), Water NZ guidance on measuring emissions of wastewater and water supply, and UK Department for Business, Energy and Industrial Strategy (BEIS)'s Greenhouse gas reporting: conversion factors 2021, for areas where MfE emissions factors were not available. The emissions factors and sources are discussed in details in the next Chapter.

Table 5: Summary of sources of emissions factors and data sources

| ISO Category | Emissions Source | Source of Emissions Factor | Data Source |
|---|---|---|---|
| Category 1 | Vehicle fleet | MfE, 2022 | SDC Finance Division |
| | Stationary Fuel Combustion | MfE, 2022 | Invoices from service providers (Allied Petroleum, Rodgers Garage, Transport Services Southland Ltd.), Data from Community Facilities Team (SDC) |
| | Wastewater treatment | Water NZ, 2021 | SDC Data from Water & Waste Team |
| | Forestry | MfE, 2022 | SDC Commercial Infrastructure Team / Annual Report 2021/2022 |
| Category 2 | Purchased energy | MfE, 2022 | e-Bench data / Supplier invoices from Meridian and Genesis |
| Category 3 | Business travel | MfE, 2022, BEIS, UK, 2022 | Orbit World Travel Ltd, Service provider invoices from Stewart Island Flights, Real Journey, OPEX report for personal mileage reimbursement |
| | Freight | MfE, 2022 | NZ Couriers |
| | Waste collection and transportation | MfE, 2022 | Wastenet data, supplier invoices from Rakiura Shipping, Bond Contracts, Wastenet, Allwaste, KIWI Skips Ltd., Southern Transport Co. Ltd., and Easy Bins Southland Ltd. |
| | Staff commuting | MfE, 2022 | Sample staff survey |
| Category 4 | Transmission and distribution losses of purchased energy | MfE, 2022, BEIS, UK, 2022 | e-Bench data / Supplier invoices from Meridian and Genesis, Invoices from service providers (Allied Petroleum, Rodgers Garage, Transport Services Southland Ltd.). |
| | Waste disposal | MfE, 2022 | Wastenet data, SDC Data from Water & Waste Team |
| | Water supply and wastewater treatment (services obtained by Council) | MfE, 2022 | Payroll records from People and Capability Division |

[2] https://environment.govt.nz/publications/measuring-emissions-a-guide-for-organisations-2022-summary-of-emission-factors/

| | | | |
|---|---|---|---|
| | Other purchased goods and services | Romanos,C., et al., 2014 | CAPEX/OPEX Reports |
| | Capital goods | Romanos,C., et al., 2014 | CAPEX/OPEX Reports |

# 3 DATA ANALYSIS AND RESULTS

This Chapter explains data analysis and emissions calculations of each emissions source and results. The Chapter also discusses data gaps and recommendations to improve data collection and management for future reporting.

## 3.1 CATEGORY 1

Under Category 1, the study assesses emissions related to mobile fuel combustion, stationary fuel combustion, wastewater treatment, and carbon sequestration from forestry.

### 3.1.1 Mobile Fuel Combustions

Council owns 61 vehicles including, one electric car, and four hybrid SUVs. Council is tracking fuel usage and mileage of its vehicle fleet and maintaining records. These data were used as primary data source for this assessment. The following Table shows the fuel usage and emissions associated with the vehicle fleet.

Table 6: Emissions from mobile fuel combustion

| Fuel type | Unit | Quantity | Conversion factor (kg $CO_2$-e/unit) | Emissions (kg CO2-e) | Source of the Conversion Factor |
|---|---|---|---|---|---|
| Regular petrol | litre | 29,439.03 | 2.46 | 72,420.01 | MfE, 2022 |
| Premium petrol | litre | 1,383.97 | 2. 48 | 3,432.25 | MfE, 2022 |
| Diesel | litre | 80,558.56 | 2.69 | 216,702.53 | MfE, 2022 |
| Total | | | | 292,554.79 | |

*Numbers are rounded to two decimal places
There is a small difference between the calculated values and values generated using interactive workbook of the MfE.

Council's electric car has done 8,971.7km during 2021/2022 financial year. For the purpose of this assessment upstream emissions related to electricity usage of electric car was excluded and the vehicle will be considered as carbon neutral. Three Council vehicles did not have either fuel usage or mileage data and excluded from this analysis. These are CSJ 1698 (Nissan Atlas Fuel Tanker), EPU357 (Subaru Forester XS), and HYK434 (Toyota Dyna – Rubbish Truck). Whether these vehicles are still in use or not is unclear.

Council's four Hybrid SUVs (2021 Toyota RAV4) on average emit 149g CO2-e per km, compared to 185g CO2-e per km by Petrol SUVs (2020 Toyota RAV4 and Mitsubishi Outlander). In contrast, diesel Utes (2021 Toyota Hilux was used for comparison) on average emit 287g CO2-e per km. Based on the manufacturer's specifications on energy efficiency, emissions from electric car for purchased energy was estimated as 17g CO2-e/km. While the engine capacity, road conditions, and driving efficiency affect the fuel efficiency and GHG emissions, it is clear that hybrid vehicles have less GHG footprint compared to other vehicles types in the vehicle fleet. Even though electric vehicles have much less emissions footprint, converting Council's fleet to 100% EV may not be feasible due to the nature of Council's operations, road conditions of the Southland district, and insufficiency of EV infrastructure throughout the district. Further, Council should be able to mobilise teams even during a power outage or other emergencies, making full EV transition is less feasible.

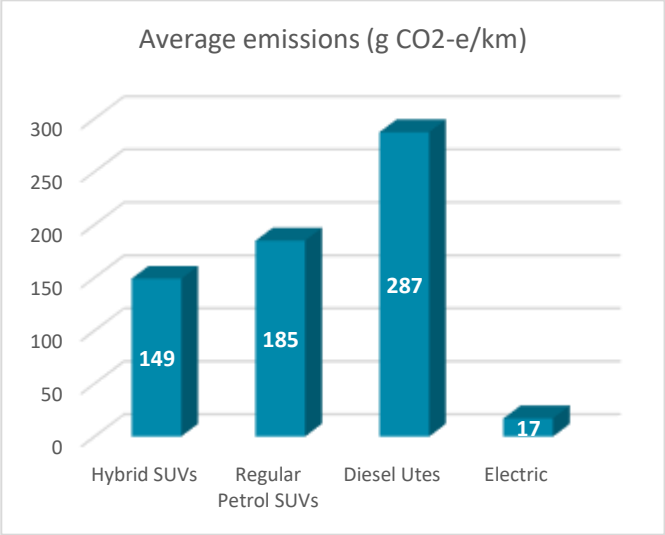


Figure 3: Comparison of emissions from different vehicle types

Recommendations: The quality of available data can be considered high. However, some vehicles do not have mileage and fuel usage records and it is important to improve maintaining these records. e-Bench, Council's energy data management platform is capable of maintaining fuel usage data and current vehicle list has already been uploaded in to the system. It is important to maintain these data in a centralized location for future analysis.

### 3.1.2 Stationary Fuel Combustion

Council maintains a number of conventional heating units in community centres and other facilities. Council's only coal burner is located at Ohai Community Hall. Council receives approx. one tonne of sub-bituminous coal every year from a close-by mine at free of charge. Due to the nature of this transaction, records are not being maintained for quantity of coal used for the boiler. An estimation was obtained from Community Facilities staff and verified using the approximate volume received (0.75m3) and industry statistics of the density of coal. Density of sub-bituminous coal was considered 1.30g/cm3 based on Gray,V.R. & Macknight,F.J., 2012[3].

In addition, Council also owns four diesel powered heating units and several facilities where LPG is used for cooking or water heating purposes. Invoices from the service providers were analysed to obtain fuel usage data in these cases.

Further, Council has two generators currently being used in 15, Forth Street and Winton Medical Centre. Separate fuel usage records are not maintained for these facilities. It is assumed that these are already included in fuel invoices of the three main service providers of Council.

Stewart Island Energy Supply Authority (SIESA) is the main contributor for Council's annual diesel budget. The SIESA is responsible for the generation and supply of electricity to around 405 permanent electricity consumers on Stewart Island. This is powered by five diesel generators at a central power station located at Hicks Road and diesel for these plants being provided by Allied Petroleum.

- 1 x CAT 3406 320kW prime output diesel generator
- 2 x CAT 3408 208kW prime output diesel generators
- 1 x Detroit Diesel Series 60 360kW prime output generator
- The standby generator (+1) is a 550kW Detroit Diesel generator capable of supplying the entire island load when necessary

[3]https://www.tandfonline.com/doi/pdf/10.1080/00288306.1986.10422167#:~:text=In%20contrast%20to%20the%20recommendations,of%201.20%20for%20all%20coals

The Table below summarises the total fuel consumptions at each plant/ location.

Table 7: Stationary fuel combustion

| # | Purpose | Address of the location | Fuel type | Total | Remarks |
|---|---|---|---|---|---|
| 1 | Heater | District Library, Brandon Street, Winton | LPG (kg) | 90 | Rockgas Ltd., Sydenham, Christchurch |
| 2 | Water Heating | Limehills Community Centre | LPG (kg) | 180 | Rockgas Ltd., Sydenham, Christchurch |
| 3 | Cooking | Athol Community Hall | LPG (kg) | 90 | Rockgas Ltd., Sydenham, Christchurch |
| 4 | Water Heating | Orawia Community Hall | LPG (kg) | 90 | Rockgas Ltd., Sydenham, Christchurch |
| 5 | Water Heating | Manapouri Community Hall | LPG (kg) | 135 | Rockgas Te Anau 2018, Snodgrass Road, Te Anau |
| 6 | Cooking | Airport, Te Anau | LPG (kg) | 90 | Rockgas Te Anau 2018, Snodgrass Road, Te Anau |
| 7 | Heater | Otautau Office and Library, 174, Main Street | Diesel (litre) | 9,174 | Allied Petroleum |
| 8 | Heater | Edendale - Wyndham Community Hall | Diesel (litre) | 340 | Rodgers Garage Ltd |
| 9 | Heater | Winton Medical Centre | Diesel (litre) | Data not available | |
| 10 | Heater | Nightcaps Hall | Diesel (litre) | Data not available | |
| 11 | Power Generation | SIESA | Diesel (litre) | 472,552.8 | Allied Petroleum (this is based on invoices issued within the financial year. Actual usage of diesel in the plant during the year can be slightly different) |
| 12 | Heating | Ohai Community Centre | Coal (kg) | 1,000 | Estimation from SDC staff |
| Total Coal (kg) | | | | **1,000** | |
| Total LPG (kg) | | | | **675** | |
| Total Diesel (litre) | | | | **482,066.80** | |

These stationary fuel combustion values were converted to emissions, using MfE emissions factors and the results are given below.

Table 8: Emissions from stationary fuel combustion

| No | Fuel type | Unit | Quantity | Conversion factor (kg $CO_2$-e/unit) | Emissions (kg $CO_2$-e) | Source of the Conversion Factor |
|---|---|---|---|---|---|---|
| 1 | Coal (sub-bituminous) | kg | 1000 | 2.01 | 2,010.00 | MfE, 2022 |
| 2 | LPG | kg | 675 | 3.03 | 2,045.25 | MfE, 2022 |
| 3 | Diesel | litre | 482,066.80 | 2.67 | 1,287,118.36 | MfE, 2022 |
| | Total | | | | 1,291,173.61 | |

*Numbers are rounded to two decimal places

There is a small difference between the calculated values and values generated using interactive workbook of the MfE.

It is important to improve data management and maintain records for fuel usage in each location. There are a few data gaps in this area, in terms of fuel usage data and those should be addressed as soon as possible. e-Bench is capable of managing stationary fuel combustion data and it is highly recommended to maintain such data in the central energy data management system.

### 3.1.3 Emissions from Refrigerant Leakages

Council owns a number of heat pumps in various locations, including community housing (45 units), Council offices, community halls etc. Council uses the services of three service providers to maintain these systems. Those are Inside Systems Ltd., Fiordland Electricals, and Rayner's Ltd. The most common refrigerants used in Council's heat pumps are R32 (HFC 32) and 410A (Zeotrope blends). These have comparatively higher Global Warming Potential (GWP)[4] compared to $CO_2$. For instance, R32 is 675 times more powerful than $CO_2$ (ie, GWP is 675), while 410A is 2088 times higher than $CO_2$. Council does not currently maintain refrigerant usage data. Any expenses over refrigerants top-up not found in invoices. According to the contacted service providers, refrigerant top-ups do not occur as a regular practice in service and maintenance of air conditioners. Lack of inventory for air conditioners /heat pumps equipment has also made it difficult to adopt an alternative methodology (Methodology B or C in the MfE Guidance) to estimate emissions related to refrigerant leakages.

It is therefore important that the Council maintains a full inventory of air conditioners, heat-pumps, refrigerators used in council properties. The inventory should also capture the type of refrigerant used in each of these equipment, service records, including refrigerant fill-ups for future emissions calculations. Refrigerant usage data too can be maintained in e-Bench.

### 3.1.4 Wastewater Treatment

Council owns 20 wastewater treatment plants serving around 8,200 households and an estimated 13,806 permanent population. Southland district has a number of tourist destinations, and the population of these places is usually 3-4 times higher during holiday season than resident population. Such population peaks were excluded from calculations due to lack of data related to average annual population. As recommended in the MfE guidance, methodology introduced by Water NZ, 2021 was used to estimate the emissions from wastewater treatment plants. WaterNZ methodology is based on biological oxygen demand load and total nitrogen load of influent, type of treatment process, the nature of effluent receiving environment, sludge treatment and sludge disposal. It is reported that sludge (biofilter media) was removed from Wyndham plant during the financial year, however this was excluded from the calculations due to lack of data on the quantity removed. Further, Council has recently established a new treatment plant in Curio Bay for which full data were not available for this analysis, thus excluded from the analysis. Table 8 below gives a summary of wastewater scheme data and number of populations served.

Table 9: Wastewater treatment plants operated by SDC

| No | **Scheme Name** | **Number of connections** | **Population served** | **Daily Discharge Limits (unless specified) m3/day** | **Primary Treatment** |
|---|---|---|---|---|---|
| 1 | Balfour | 90 (86 full and 8 half units) | 145 (2018 projections) | 250 | Trickling Filter |
| 2 | Browns | 13 including a local primary school | 145 (2018 projected) | 20 | Trickling Filter |
| 3 | Edendale/ Wyndham | 565 (672 full and 48 half) | 1162 (2013 est) | 264 (average dry weather flow)<br>528 (Daily Max) | Bio-filtro Worm Treatment |
| 4 | Gorge Road | 36.5 (36 full and 1 half units) | 218 (2018 projected) | 15 | Oxidation Pond |
| 5 | Lumsden | 345.3 (314 full and 7 three quarter units and 52 half) | 465 (2018 projected) | 140 (average dry weather flow) | Oxidation Pond |

[4] a measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide ($CO_2$)

| | | | | | |
|---|---|---|---|---|---|
| 6 | Manapouri | 331 (305 full and 52 half) | 915 (2023 projected) | 150 (average dry weather flow)<br>600 (daily max) | Oxidation Pond |
| 7 | Monowai | 15 | 27 (including a public toilet) | 9 (average dry weather flow)<br>25 (daily max) | Oxidation Pond |
| 8 | Nightcaps | 196 (177 full and 3 three quarters, 34 half units) | 299 (2018 projected) | 350 | Oxidation Pond |
| 9 | Ohai | 233 (217 full and 33 half units | 307 (2018 projected) | 120 (average dry weather flow)<br>480 (daily max) | Trickling Filter |
| 10 | Otautau | 460 (437 full and 6 three quarters and 37 half units) | 892 (2018 projected) | 460 (average dry weather flow) | Oxidation Pond |
| 11 | Riversdale | 254 (239 full, 2 three quarters and 28 half units) | 505 (2018 projected) | 260 (Annual Average Daily Flow) | Oxidation Pond |
| 12 | Riverton | 1153 (1074 full, 12 three quarter, 140 half units) | 1540 (2018 projected) peak population 5,524 | 530 | Oxidation Pond |
| 13 | Riverton Rocks | | | 650 | Oxidation Pond |
| 14 | Stewart Island | 483 (425 full, 114 half and 6 quarter units) | 434 (2018 projected), peak population 1,165 | 300 | Oxidation Pond |
| 15 | Te Anau | 2621 (2377 full, 6 three quarter, 479 half units) | 2,938 (2018 projected), peak population 7,472 | 2,500 (average dry eather flow) | Oxidation Pond |
| 16 | Tokanui | 67 (63 full, 1 three quarter, 6 half units) | 147 (2018 projected) | 55 | Oxidation Pond |
| 17 | Tuatapere | 364 (357 full, 14 half, 1 quarter units) | 557 (2018 projected) | 243 (average dry weather flow) | Oxidation Pond |
| 18 | Wallacetown (AGL) | 281 (265 full and 31 half units) | 680 (2018 projected) | 22730 (operated by Alliance Group) | Oxidation Pond |
| 19 | Winton | 1,233 (1,186 full, 13 three quarter, 74 half units) | 2,430 (2018 estimated) | 750 | Oxidation Pond |
| | | **Total population served** | **13,806** | | |

Water NZ (2021) Guidance on Carbon Accounting Guidelines for Wastewater Treatment: $CH_4$ and $N_2O$ was adopted to estimate emissions from wastewater treatment plants. The Guidance elaborates three levels of assessment for emissions from treatment plants. Those are Level 1, 2 & 3 assessments. Selection of assessment level depends on the availability of data, where Level 1 is population-based assessment, while Level 2 is a plant-specific assessment, and Level 3 is based on direct measurement. Influent BOD load data was not available for any of the plants owned and controlled by SDC, as such Level 1 assessment was adopted. It is however important that Council moves to Level 2 Assessment, as soon as possible, at least for the larger treatment plants to improve the accuracy.

Similarly, the Guidance Note introduces two levels of assessment for Discharge emissions. This study adopts Level 1 assessment to estimate emissions from discharge of effluent, due to lack of site-specific data. Table 9 provides a summary of the calculation.

Table 10: $CH_4$ and $N_2O$ emissions from wastewater treatment

| Pop$^n$ | Total BOD (kg) | Total N (kg) | $CH_4$ WWTP | $N_2O$ WWTP (kg N2O/y) | $CH_4$ Discharge | $N_2O$ Direct | $N_2O$ indirect | $CH_4$ Total | $N_2O$ Total |
|---|---|---|---|---|---|---|---|---|---|
| 13,806 | 510,822 | 75,933 | 56,937.68 | 152.03 | 1,529.04 | 786.07 | 57.33 | 58,466.72 | 995.42 |

*Numbers are rounded to full numbers

Detailed analysis covering factors and assumptions used for individual plants is presented separately.

Table 11: Emissions from wastewater treatment plants

| Emissions source | Kg | GWP (AR4) | Kg $CO_2$-e |
|---|---|---|---|
| Total $CH_4$ | 58,466.72 | 25 | 1,461,668.00 |
| Total $N_2O$ | 995.42 | 298 | 296,635.16 |
| | | **Total** | **1,758,303.16** |

### 3.1.5 Forestry (carbon sequestration)

A detailed breakdown of forest data was not available for this assessment. As such, data from both SDC's Forest Management Plan (FMP) (2022- 2032) and Annual Report 2021/2022 were used for this analysis. As per the FMP, SDC owns 1,840.4 ha of forest lands located in five areas as follows:

- Dipton – 234.0 ha
- Gowan Hill – 323.9 ha
- Ohai 2 – 51.1 ha
- Ohai Mine – 515.4 ha
- Waikaia – 716.0 ha

The current operational area covers 1529.3ha, while the balance is a combination of riparian and boundary setbacks, native vegetation and unproductive lands. By 2022, out of the operational area, 1,490.8 ha are productive forest, 38.5 ha are a land bank (land designated for replanting), and 3.3 ha of un-productive exotic riparian crop. Further, approx. 90% of the total extent covers Radiata forest (Pinus radiata), and the balance 10% is Douglas fir (Pseudotsuga menziesii).

As per the Annual Report 2021/22, 1,384 ha of Council forests are pre-1990 forests and 116.8 ha are post-1989 forests. These are registered in the NZ Emissions Trading Scheme (ETS). Council received 82,914 NZUs, as compensation units, for pre-1990 forests when the ETS was first introduced in 2008. Further, for the forest in the ETS, Council has accumulated additional 24,715 units. In 2021/2022 financial year, Council received additional 2,044 NZUs[5] for its post 1989 forests in the ETS. In the same year, Council harvested 30.8 ha of pre-1990 forests.

This assessment accounts NZUs received during 2021/2022 financial year, as Council has been using stock-change accounting so far. However, emissions related to harvesting of 30.8 ha will not be factored in the emissions profile, given these are pre-1990 forests and Council will replant these areas over the course of next few years.

[5] Equivalent to one tonne of $CO_{2\text{-}e}$

### 3.1.6 Category 1 Emissions

The direct emissions from Council operations included emissions from vehicle fleet, stationary fuel combustion, wastewater treatment facilities, and carbon removal from forestry.

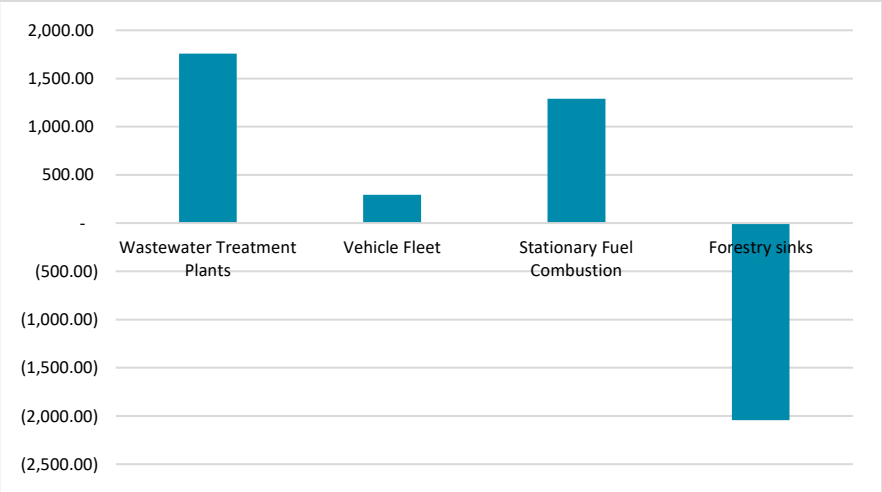


Figure 4: Comparison of Category 1 emissions sources

## 3.2 Category 2

This section covers indirect emissions from imported electricity. e-Bench, Council's energy data management platform, carries data related to electricity consumptions at each Installation Control Points (ICP), a unique electricity meter specific number, making it useful for emissions calculation. e-Bench data were verified before use for this assessment, using original invoices from the two service providers, Meridian Energy and Genesis.

Based on the analysis, water supply is the main energy consumer, contributing to 58% of total energy consumption of SDC, followed by Sewerage (15%), Street lighting (12%), and Administrative offices and libraries (8%). Stewart Island's electricity consumption was excluded from this analysis.

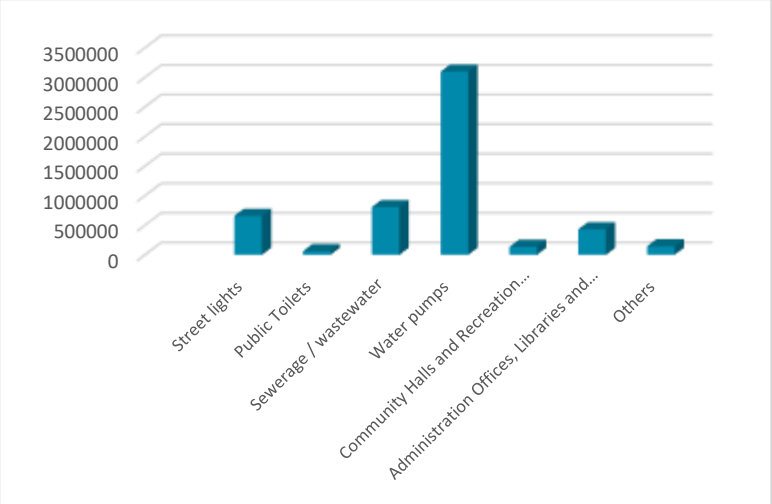


Figure 5: Electricity consumption of SDC

Council's main energy supplier is Genesis Energy, which accounts for 56% of total purchased electricity for Council operations. Currently, there are 19 ICPs connected to Genesis energy, primarily for street lighting, Forth Street office, and several larger pumping stations. The remaining 44% come from Meridian Energy, which supplies electricity to 172 ICPs (low consumed) throughout the district.

Both e-Bench data and data from supplier invoices were used for this analysis. There is a slight difference between the total values obtained from the two sources. e-Bench data were used for the final emissions calculation, considering that e-Bench's data have already been normalised for calendar months, providing a better picture of energy consumption during the financial year. The Table below provides the total purchased electricity related emissions of SDC.

Table 12: Purchased electricity emissions

| Annual energy consumption (kWh) | Conversion factor (kg $CO_2$-e /kWh) | Emissions (kg $CO_2$-e) | Source of the Conversion Factor |
|---|---|---|---|
| 5,343,164 | 0.120 | 641,640.68 | MfE, 2022 |

It is important to note that, 82% of total power generation of New Zealand is from renewable sources. Meridian Energy is 100% renewable energy company, while a considerable portion of Genesis' power generation depends on coal, oil and gas[6]. However, at ICP level, it is difficult to identify or differentiate the original source of energy, making it difficult to make an impact on emissions profile by changing the service provider.

## 3.3 CATEGORY 3

Category three covers indirect emissions from transportation. This includes; business travel, freight, and employee commuting and upstream emissions from purchased fuel.

### 3.3.1 Business Travel

Business Travel includes staff travel to business events, trainings, field locations, including Stewart Island. Council has taken measures to centrally coordinate business travel, aiming to increase the efficiency of travel management. This has also increased the quality of travel data management. For instance, Orbit World Travel, Council's main travel service provider, is systematically maintaining data relevant to staff's business travel, which have been used for this analysis. Orbit World Travel's data management system covers Air Travel, Accommodation, and Taxi services. It has been noted that a limited number of Taxi bookings had been done outside this system, and those were excluded from this analysis due to lack of data.

Council staff also relies on ferry service to travel to Stewart Island and Ulva Island. Invoices of Real Journey were used for this analysis. The distance between Bluff and Stewart Island ferry terminal was considered as 37km, while the distance between Bluff and Ulva Island was considered as 38km. MfE Guidance does not provide respective emissions factors for travels using ferries. As such emissions factors issued by UK Government was used for the analysis (ie, for RORO Ferry).

Given the impact of COVID-19 pandemic, Council's travels had significantly been affected during this period, as such no international travels have been reported during the financial year. Domestic air travels had also been minimum. Following Table provides a summary of business travels during the financial year.

Table 13: Business travel related emission sources

| Source | Description | Unit | Amount | Source of data |
|---|---|---|---|---|
| Air travel (domestic) | Airbus 320 | Passenger km | 9,266 | Orbit World Travel |
| | De Havilland Dash 8-300 | Passenger km | 25,033 | Orbit World Travel |
| | Aerospatiale ATR 72 | Passenger km | 23,301 | Orbit World Travel |
| | Pilatus PC-12 | Passenger km | 492 | Orbit World Travel |
| | Britten-Norman Islander | Passenger km | 12,312 | Stewart Island Flights invoices |

[6] Genesis owns Huntly power station (935MW), NZ's largest and only coal powered power plant

| | | | | |
|---|---|---|---|---|
| Hotel accommodation | New Zealand | Room per night | 159 | Orbit World Travel |
| Taxi | | km | 580 | Orbit World Travel |
| Ferry | Bluff-Oban<br>Bluff - Ulva Island | Passenger km | 1,233 | Real Journey invoices |

The Table below summarises the calculation of emissions from Business Travel. For this analysis, Airbus 320 was considered as a large aircraft, whereas De Havilland Dash 8-300 and Aerospatiale ATR 72 were considered as medium size aircrafts. Pilatus PC-12 and Britten-Norman Islander were considered as small aircrafts for this analysis. Given the most of the domestic flights happening below 25,000 feet cruising altitude, emissions factors without radiative forcing were adopted.

Table 14: Air-travel emissions

| Source | Description | Unit | Amount | Emissions Factor kg $CO_2$-e/unit[7] | Emissions (kg $CO_2$-e) | Source of emissions factor |
|---|---|---|---|---|---|---|
| Air travel (domestic) | Large aircraft | Passenger km | 9,266 | 0.090 | 833.94 | MfE, 2022 |
| | Medium aircraft | | 48,334 | 0.120 | 5,800.08 | MfE, 2022 |
| | Small aircraft | | 12,804 | 0.352 | 4,507.01 | MfE, 2022 |
| Hotel accommodation (New Zealand) | | Room per night | 159 | 9.4 | 1,488.00 | MfE, 2022 |
| Taxi | | km | 580 | 0.225 | 130.32 | MfE, 2022 |
| Ferry | | Passenger kms | 1,233 | 0.01874 | 23.10 | UK BIES conversion factors[8] |

Further, SDC has also reimbursed staff and Councillors for the use of their personal vehicles for business travel. Total amount paid during the financial year as travel reimbursement was $74,655.03. Data related to fuel usage or kms travelled were not available for personal vehicle usage, as such emissions factor for Taxi service was used. It is important to maintain mileage or fuel usage data for private vehicle usage for business travel in order to improve the accuracy of emissions calculations. It has been noted that a limited number of business travel taken place using personal vehicles, which have not been reimbursed, and those were excluded from this analysis.

Table 15: Emissions from personal vehicle usage

| Source | Amount ($) | Emissions Factor kg $CO_2$-e/unit | Emissions (kg $CO_2$-e) | Source of emissions factor |
|---|---|---|---|---|
| Business Travel_ personal vehicles | 74,655.03 | 0.070 | 5,225.85 | MfE, 2022 |

Total emissions from business travel is **13,318.30 kg CO2-e** for the 2021/2022 financial year. It is considered that public transport was not used during the financial year, as these data were not available.

### 3.3.2 Freight

NZ Couriers is the main service provider for freight services. Council also relies on ferry services and Stewart Island flights to transport goods from and to Stewart Island. New Zealand Couriers, as one of their corporate services to the clients, maintains data and report emissions from freight services. Even though, the methodology adopted by NZ Couriers is verified by Toitu Environcare, this assessment re-estimated the emissions using MfE emissions factor to ensure the consistency of the approach adopted.

[7] Emissions factors for 2020 without radiative forcing multiplier was used, considering the maximum cruising altitude of most of domestic flights are less than 25,000 feet.

[8] conversion-factors-2021-full-set-advanced-users.xlsm (live.com)

Table 16: Total freight of goods by New Zealand Couriers Ltd.

| Source | Packages | Total weight (kg) | Van tkm[9] | Shuttle Truck tkm | Long-haul Truck tkm | Plane tkm | Ferry tkm |
|---|---|---|---|---|---|---|---|
| Amount | 242 | 265 | 15 | 2 | 150 | 63 | 2 |

Table 17: Emissions from freight of goods by NZ Couriers

| Mode | tkm | Emissions factor (kg CO2-e) | Total Emissions ($kgCO_2$-e) | Source of emissions factors |
|---|---|---|---|---|
| Air Freight | 63.00 | 2.377[#] | 149.75 | MfE, 2022 |
| Sea Freight | 2.00 | 0.061[*] | 0.12 | MfE, 2022 |
| Long-Haul Heavy Truck Freight | 150.00 | 0.105 | 15.75 | MfE, 2022 |
| Shuttle Truck | 2.00 | 0.390 | 0.78 | MfE, 2022 |
| Van | 15.00 | 0.390 | 5.85 | MfE, 2022 |
| **Total** | | | **172.25** | |

[#] Emissions factor for domestic air freight without radiative forcing factor

[*] emissions factor for RoRo ferry – 0-1,999 LM

In addition to the above, invoices from service providers (ie, Stewart Island Flights and Rakiura Shipping) show that during the course of the financial year, both ferry service and flights have been used to freight goods to and from Stewart Island. Stewart Island Flights has air freighted 15 letters and three boxes of goods to Stewart Island. Weight of the freight was not available for calculations. Initial estimates show that the emissions from these domestic air freights are negligible, as such excluded from the assessment.

#### *3.3.2.1 Waste collection and transfer*

Council's Waste Services is a major component of transportation related emissions. Wastenet, a council controlled organisation, is tasked with kerbside collection and transportation of waste to final treatment on Council behalf. However, Council still owns and controls the operation in terms of setting KPIs and other operational policies for Council's Waste Services. Therefore, even though Wastenet falls outside Council's organisational boundary, Waste Services provided by the Council to the district has been considered as emissions within organisational boundary. Further to the above, Council has also been obtaining services of several direct suppliers to provide waste management services to several locations, which are not currently covered by Wastenet. These include; Rakiura/Stewart Island and public toilets and SDC offices. Table 17 below provides a summary of the waste management operation of SDC.

SDC provides a fortnightly kerbside collection for rubbish and recyclables through a twin wheelie bin service to townships. Rubbish and recyclables then transferred to six waste transfer stations for onward sorting and transportation to a landfill operated by AB Lime at Winton or Material Recovery Facility in Invercargill depending on the type of waste for final treatment.

Table 18: Waste service operation of SDC

| Kerbside Collection of Rubbish and Recyclables | Waste Transfer Stations (Recycle Centres and Transfer Station) | | Transfer of Rubbish and Recyclables to final disposal | Final Treatment |
|---|---|---|---|---|
| ▪ Wastenet – fortnightly kerbside collection for rubbish and recyclables<br>▪ SIESA – Stewart Island | Refuse Transfer Stations:<br>▪ Lumsden<br>▪ Otautau | Recycling drop-off centres:<br>▪ Garston<br>▪ Lumsden | ▪ Wastenet - Rubbish collected at transfer stations is transport by road to the regional sanitary landfill (AB Lime) | ▪ AB Lime - Rubbish collected in throughout the district is |

[9] tkm- tonne kilometer, which is the weight (in tonnes) multiplied by the distance travelled (km)

| | | | | |
|---|---|---|---|---|
| ▪ Allwaste – Lumsden Railway station, SDC – Forth Street, Mossburn Toilet complex<br>▪ Bond Contracts Ltd. - Waihopai Toetoe Recreation Reserve<br>▪ Kiwi Skips Ltd.– scrap cars, tires and other metal scrap<br>▪ Southern Transport Ltd. – Harbour refuse collect, Winton memorial hall<br>▪ Easy Bins Southland Ltd – collection of waste in other locations | ▪ Riverton<br>▪ Rakiura/SI<br>▪ Te Anau<br>▪ Winton<br>▪ Wyndham | ▪ Manapouri<br>▪ Mokatua<br>▪ Mossburn<br>▪ Ohai<br>▪ Riversdale<br>▪ Riverton<br>▪ Te Anau<br>▪ Tokanui<br>▪ Tuatapere | ▪ Wastenet - Recyclables collected in Recycling Drop-off centres are transported to ICC Material Recovery Facility in Invercargill<br>▪ Rakiura Shipping – Rubbish (other than food waste) and recyclables sea freight to mainland. Recyclables are road freighted to ICC MRF<br>▪ Allwaste – Rubbish are road freighted to AB Lime landfill | disposed at AB Lime landfill (in 2021/2022 FY, 5866.25 tonnes had been disposed)<br>▪ ICC Material Recovery Centre – Recyclables collected in throughout the district |

Wastenet uses 'Landfill 3000', a weigh bridge control system with access database, to manage waste data of the three councils. However, certain data fields were not available for 2021/2022 Financial Year and data related to kerbside collection or transportation of waste from waste transfer station to final treatment facility (weight and distance transported) were not available for 2021/2022 financial year. These do not fall under the current scope of data management, which needs to be improved. As such this analysis was based on available information and a number of methods were adopted to build a clearer picture on the emissions related to waste services.

Table 19: Monthly waste and recycle weights 2021/2022 financial year

| **Waste Collection Data (Source: Wastenet)** | **Tonnes** |
|---|---|
| Green waste | 873.11 |
| Recycling | 1,824.41 |
| Metals | Data not available |
| Materials Diverted from Landfill Total | 2,697.52 |
| Red bin rubbish | 3,755.33 |
| Landfill disposal | 6,080.60 |
| Material Discarded by Southland Dist Total | 8,778.12 |
| % of Materials Diverted from Landfill | 31% |
| Annual materials diversion rate (kg) per person, per annum for Southland District | 268.44 |

(A) Council uses a local shipping company to sea-freight collected waste (including recyclables) from Stewart Island to Bluff. As discussed earlier, Stewart Island waste management does not come under the purview of Wastenet operations, as such Council relies on direct service providers. Rakiura Shipping Ltd. is the main service provider to sea freight waste (both recyclables and general waste) from Rakiura Stewart Island to mainland. The company then road freight recyclables component of the waste from Bluff to ICC material recovery facility at Invercargill. Allwaste Ltd. handles the general waste component and transports those from Bluff to AB Lime landfill site in Winton. Invoices from Rakiura Shipping Ltd. provide wharfage data, which have been used for this analysis. Distance between Bluff to Invercargill and Bluff to Winton was estimated considering the closest routes. Real Journey has also done a limited number of sea freights during this period and those were also incorporated into the final values.

Table 20: Sea-freight of waste from Stewart Island

| Source | Unit | Amount | Data Source |
|---|---|---|---|
| Sea Freight – Recyclables and other general waste | tkm | 10,072.30[10] | Rakiura Shipping invoices and Real Journeys invoices |

Note: 272.13 tonnes of waste sea freighted across Foveaux Strait to mainland, which is 37 km one-way

The following Table provides emissions from sea freight of wastes from Stewart Island.

Table 21: Emissions from sea-freight of waste

| Source | Units | Amount | Emissions Factor kg $CO_2$-e/unit | Emissions (kg $CO_2$-e) | Source of emissions factor |
|---|---|---|---|---|---|
| Sea Freight – Recyclables and other general waste | tkm | 10,072.30 | 0.061[11] | 614.44 | MfE, 2022 |

(B) Waste collection and disposal is a main activity related to downstream transportation. Wastenet and several other direct service providers operate this service on Council's behalf. Data related to waste transportation were not available for the analysis, except for Stewart Island. Invoices from Allwaste suggests that out of 272.13 tonnes of waste sea freighted across Foveaux Strait, 234.3 tonnes are general waste, which has then been road freighted to landfill facility run by AB Lime. The balance 37.83 tonnes are recyclables, which have been processed at Invercargill material recovery facility.

Rubbish collected from the district is initially transported to six waste transfer stations and then transported to landfill facility at Winton. The final landfill disposal quantity of waste in 2021/2022 Financial Year was available and it was 6,080.60 tonnes. Distance travelled was estimated using average distance from waste transfer stations to Winton (AB Lime landfill). This comes to 54.76 km. Additional 20km was added to cover the distance travels by waste trucks to collect wheelie bin waste biweekly. During the financial year, 3,755.33 tonnes of rubbish have been collected through red wheelie bins. Therefore, total tonne-km (tkm) of road freight sums-up to 408,120.8 {(6,080.6 x 54.77) + (3755.33 x 20km)}.

Further to the above, during the same period Wastenet has collected 1,824.41 tonnes of recyclables from the Southland district and processed at Invercargill Material Recovery Facility. It is assumed that 1/3 of this is collected through Yellow wheelie bins. Average distance travelled from 11 drop-off centres to MRF at Invercargill was estimated considering the closest route between the two locations. Further, yellow bin collection was also added to the equation. Therefore, total road freight of recyclables sums-up to 173,042.5 tkm {(1824.41x88.18) + (608.14x20)}.

Table 22: Road freight of waste and recyclables

| Source | Unit | Amount | Data Source |
|---|---|---|---|
| Road Freight of SI rubbish from Bluff to Winton | tkm | 14,479.74 | Allwaste invoices. Distance from Bluff to AB Lime landfill site is estimated as 61.8km based on the closest route. |
| Road Freight of SI recyclables from Bluff to Winton | tkm | 1,025.19 | Rakiura Shipping invoices. Distance from Bluff to MRF, Invercargill is estimated as 27.1km based on the closest route. |
| Road Freight – rubbish from other six waste transfer stations | tkm | 408,120.80 | Wastenet data and estimated distance |

[10] Council has also used Real Journeys Ltd to freight some items to and from Stewart Island. These were also factored in the calculations

[11] RoRo ferry (0-1,999LM) emissions factor was used

| | | | |
|---|---|---|---|
| Road Freight – recyclables from 11 drop-off centres | tkm | 173,042.5 | Wastenet data and estimated distance |
| **Total** | **tkm** | **596,668.23** | |

Table 23: Emissions from sea and road freight of waste

| Source | Units | Amount | Emissions Factor kg $CO_2$-e/unit | Emissions (kg $CO_2$-e) | Source of emissions factor |
|---|---|---|---|---|---|
| Road Freight – Waste services | tkm | 596,668.23 | 0.105[12] | 62,650.16 | MfE, 2022 |

The following assumptions were also made during the estimation, as full account of data was not available.

1. Emissions related to transport of waste by community members to drop-off centres were excluded, as data were not available.
2. Waste collected at Lumsden Railway station, Mossburn toilets, Recreation Reserve at Waihopai Toetoe, Harbour refuse collect, Winton memorial hall, and a few other sites were excluded from this assessment due to lack of site-specific data. It is assumed that waste collected at these locations was also treated at waste transfer stations and comingled with other waste once reached waste transfer stations.
3. It was assumed that all greenwaste was processed at the two sites and not being disposed at the regional landfill.
4. Bi-weekly collection of waste from Stewart Island was excluded from the analysis due to lack of data.
5. It is important to obtain the log sheets of all waste trucks and improve data management related to waste truck movements to better estimate emissions from waste collection and transportation.

### 3.3.3 Staff Commuting

A questionnaire was developed to conduct a staff survey to estimate staff commuting and work from home related emissions (Pls see Annex I for the questionnaire). However, only sample survey was carried out given the time limitation and considering that the staff had not yet been fully sensitised on climate actions. The same questionnaire will be used for the next financial year to get a clearer picture on the emissions related to this activity. Even though, sample survey comprised of 5% of the total staff of the Council, a quick comparison with ICC's staff commuting and work from home emissions suggests that the findings are comparable. Following two tables summarise the findings of the sample survey.

Table 24: Summary of findings of sample staff survey – staff commuting

| Res | Fuel Type | Engine Capacity | Distance travelled (return) | # of working days | % WFO | Total distance travelled per year | Use of Vehicle | Total vehicle km travelled per year |
|---|---|---|---|---|---|---|---|---|
| 1 | Petrol | 2001 – 3000 cc | 3 | 229 | 30% | 206.1 | 100% | 206.1 |
| 2 | Petrol | 1351-1600 cc | 24.4 | 229 | 80% | 4,470.08 | 100% | 4,470.08 |
| 3 | Petrol | 1351-1600 cc | 18 | 229 | 55% | 2267.1 | 50% | 1,133.55 |
| 4 | Petrol | >3001 cc | 50 | 229 | 10% | 1145 | 100% | 1,145 |
| 5 | Diesel | 2001 – 3000 cc | 3.78 | 229 | 60% | 519.372 | 70% | 363.56 |
| 6 | Diesel | 2001 – 3000 cc | 12 | 229 | 92% | 2,528.16 | 100% | 2,528.16 |
| 7 | Petrol | 2001 – 3000 cc | 3.4 | 229 | 95% | 739.67 | 70% | 517.77 |
| 8 | Petrol | 2001 – 3000 cc | 5 | 229 | 85% | 973.25 | 100% | 973.25 |
| 9 | Petrol | 2001 – 3000 cc | 134 | 229 | 30% | 9,205.8 | 100% | 9,205.8 |
| 10 | Petrol | <1350 cc | 10 | 229 | 98% | 2,244.2 | 100% | 2244.2 |

[12] Long-haul heavy truck

Table 25: Summary of findings of sample staff survey – work from home

| Res | Total working days | % WFH | Total # of WFH days | with heating | No of days with heating | No of days without heating |
|---|---|---|---|---|---|---|
| 1 | 229 | 70% | 160.3 | 65% | 104.2 | 56.11 |
| 2 | 229 | 20% | 45.8 | 1% | 0.46 | 45.34 |
| 3 | 229 | 45% | 103.05 | 10% | 10.31 | 92.75 |
| 4 | 229 | 90% | 206.1 | 40% | 82.44 | 123.66 |
| 5 | 229 | 40% | 91.6 | 50% | 45.8 | 45.8 |
| 6 | 229 | 8% | 18.32 | 70% | 12.82 | 5.5 |
| 7 | 229 | 5% | 11.45 | 0% | 0 | 11.45 |
| 8 | 229 | 15% | 34.35 | 45% | 15.46 | 18.89 |
| 9 | 229 | 70% | 160.3 | 40% | 64.12 | 96.18 |
| 10 | 229 | 2% | 4.58 | 30% | 1.37 | 3.27 |
| | | | | Total | 336.97 | 498.88 |

MfE emissions factors were adopted to estimate emissions from staff commuting. SDC has had 208 staff members on its pay roll in 2021/2022 financial year. The findings of the sample survey were extrapolated to the total staff. Emissions from staff's work from home is separately presented under Category 4 below.

Table 26: Emissions from staff commuting

| Fuel Type | Engine Capacity | Distance travelled (km) | Emissions factor (kg $CO_2$-e/km) | Emissions (kg $CO_2$-e) | Source of Emissions Factor |
|---|---|---|---|---|---|
| Petrol | <1350 cc | 2,244.2 | 0.204 | 457.82 | MfE, 2022 |
| Petrol | 1351-1600 cc | 5,603.63 | 0.212 | 1,187.97 | MfE, 2022 |
| Petrol | 2001 – 3000 cc | 10,902.92 | 0.265 | 2,889.27 | MfE, 2022 |
| Petrol | >3001 cc | 1,145.00 | 0.317 | 362.96 | MfE, 2022 |
| Diesel | 2001 – 3000 cc | 2,891.72 | 0.270 | 780.76 | MfE, 2022 |
| | | | Total | 5,678.78 | |
| | | | Total Emissions for the full staff | 118,118,62 | |

Note: emissions factors for pre-2010 vehicle fleet were used considering the majority of vehicles of the sample are pre-2010.

### 3.3.4 Category 3 Total Emissions

Under Category 3 emissions, indirect emissions from transportation, covering business travel, freight, and employee commuting and working from home were estimated. The Table 27 below summarises these emissions.

Table 27: Summary of Category 3 emissions

| Emissions Source | | Total Emissions (kg $CO_2$-e) | % of Category 3 emissions |
|---|---|---|---|
| Business Travel | Air travel (domestic) | 11,141.03 | 5.58 |
| | Hotel accommodation | 1,488.00 | 0.75 |
| | Taxi travel | 130.32 | 0.07 |
| | Ferry service | 23.10 | 0.01 |
| | Personal vehicle usage | 5,225.85 | 2.62 |
| Freight | NZ Couriers | 172.25 | 0.09 |

| | | | |
|---|---|---|---|
| Sea Freight | Recyclables and general waste from SI | 614.44 | 0.31 |
| Road Freight | Recyclables and general waste from SI and other areas | 62,650.16 | 31.39 |
| Staff commuting | | 118,118.62 | 59.19 |
| | **Total Category 3 Emissions** | **516,713.88** | |

## 3.4 CATEGORY 4

Category 4 involves Indirect GHG emissions from products that Council uses. This assessment under this Category will consider transmission and distribution losses of purchased energy, Water supply and wastewater treatment (services obtained by Council), Landfill disposal of waste (council services and services obtained by Council), Capital goods and Other purchased goods and services. Full account of data was not available for many areas, as such estimates were arrived using invoiced values and Motu, 2014 emissions factors.

### 3.4.1 Transmission and Distribution Losses of Purchased Electricity

Transmission and distribution losses of purchased electricity were estimated using the energy consumption data. The data for the assessment were obtained from e-Bench and invoices from the suppliers. Table 29 below provides a summary of emissions from transmission and distribution losses of purchased electricity.

Table 28: Emissions from transmission and distribution losses of purchased electricity

| Energy source | Annual energy consumption | Conversion factor (kg CO2-e /kWh) | Emissions (kg CO2-e) | Source of the Conversion Factor |
|---|---|---|---|---|
| Purchased electricity (kWh) | 5,343,164 | 0.0110[13] | 58,901.97 | MfE, 2022 |

### 3.4.2 Emissions from work from home

As discussed under Section 3.3.3., emissions from work from home were estimated using a sample staff survey. Sample survey findings were extrapolated to the total staff to estimate total emissions from work from home. Table 31 below shows the total emissions from work from home.

Table 29: Emissions from work from home

| Source | Units | Amount | Emissions Factor kg $CO_2$-e/unit | Emissions (kg $CO_2$-e) | Source of emissions factor |
|---|---|---|---|---|---|
| Emissions from work from home – Without heating | Employee per day | 10,376.70 | 0.0665 | 690.05 | MfE, 2022 |
| Emissions from work from home – With heating | Employee per day | 7,008.98 | 0.9791 | 6,682.49 | MfE, 2022 |
| | | | **Total** | **7,280.59** | |

### 3.4.3 Wastewater and Water Supply

This section covers emissions from wastewater and water supply services obtained for Council operation. Actual amounts of water usage and wastewater production data were not available, as such per capita conversion factors were used in estimating emissions related to this sub-category. During 2021/2022 financial year, Council had 208 staff members in its pay-roll, which was the basis for this calculation. It was assumed that 80% of the total staff (177) are based in Invercargill offices.

[13] 2020

Table 30: Emissions from wastewater and water supply services obtained by Council

| Source | Unit type | Number of units | Emissions factor (kg CO2-e/unit) | Emissions (kg CO2-e) | Source of emission factor |
|---|---|---|---|---|---|
| Water supply services | Per capita | 177 | 3.785 | 669.94 | MfE, 2022 |
| Wastewater services | Per capita | 177 | 48.360 | 8,559.72 | MfE, 2022 |

### 3.4.4 Waste Disposal

As mentioned in Section 3.3.2.1, SDC offers various waste management services to the Southland district, as one of its key statutory responsibilities. Section 3.3.2.1 covered emissions related to waste collection and transportation. This section covers the emissions from final disposal of waste.

Rubbish collected by Wastenet and other direct service providers is finally disposed of at a privately-owned regional landfill outside of Winton, which is managed by AB Lime. The landfill is a Class A landfill with landfill gas recovery, thus Methane emitted from anaerobic digestion of organic matter is collected and destroyed by flaring, converting Methane ($CH_4$) into $CO_2$. Carbon dioxide released from this operation is considered as part of the natural carbon cycle, thus does not factor in emissions report. As discussed previously, Wastenet is equipped with waste data management system called 'Landfill 3000', a weighbridge records based data management system. However, a detailed breakdown of waste data was not available for 2021/2022 financial year. As such, this assessment was based on a waste study conducted by Wastenet in 2018 to assess the composition of waste disposed of at the regional landfill. Greenwaste is usually managed through open windrow composting and not being disposed of at the regional landfill. Therefore, greenwaste was not factored in this calculation. Further, emissions from closed landfills were not also factored in this analysis.

As per the 2018 Waste Study Southland's waste composition is as follows.

Table 31: Primary composition of waste to landfill in Southland district (Wastenet, 2018)[14]

| Waste type | Percentage |
|---|---|
| Food | 23.1 |
| Paper | 9.3 |
| Wood | 9.2 |
| Textile | 6.3 |
| Nappies | 5.2 |
| Plastics | 12.5 |
| Hazardous waste | 23.1 |
| Rubber | 0.4 |
| Ferrous metal | 2.5 |
| non-ferrous metal | 0.5 |
| Glass | 4.1 |
| Rubble | 3.8 |

During the financial year, Wastenet has disposed of 6,080 tonnes of waste at the regional landfill. It is assumed that waste composition reported at the 2018 waste study remains unchanged and waste collected in 2021/2022 financial year has had same composition.

[14] http://www.wastenet.org.nz/Tools/Publications/WasteNotReport.aspx

Table 32: Emissions from waste disposal

| Waste type | Composition (%) | Weight of waste disposed of at landfill (kg) | Emissions Factor | Total Emissions ($kgCO_2$-e) | Source of Emissions Factor |
|---|---|---|---|---|---|
| Food | 23.1 | 1,404,618 | 0.602 | 845,580.40 | MfE, 2022 |
| Paper | 9.3 | 565,495 | 0.876 | 495,374.32 | MfE, 2022 |
| Wood | 9.2 | 559,415 | 0.339 | 189,641.75 | MfE, 2022 |
| Textile | 6.3 | 383,077 | 0.438 | 167,788.08 | MfE, 2022 |
| Nappies | 5.2 | 316,191 | 0.219 | 69,245.87 | MfE, 2022 |
| Other | 46.9 | 2,851,801 | NA | - | MfE, 2022 |
| **Total** | **100** | **6,080,600** | | **1,767,630.42** | |

[#] Emissions factors associated with waste of known composition and waste disposal to Class 1 landfill with landfill gas recovery was adopted

Waste reduction and diverting more waste from landfills can significantly reduce the emissions footprint from waste services. Council currently aims to increase waste diversion from landfill from 35% to 40%, which is an important strategic move to reduce emissions from waste disposal. It is also important to improve waste data management to have a clear idea about the composition of rubbish disposed by waste transfer stations to develop further strategies for emissions reduction.

Council is obtaining services from Allwaste Ltd. and Bond Contracts Ltd. to manage the waste generated in its offices in Forth Street office and two Don street offices. Data related to quantities of waste generated in these locations were not available for the assessment. Therefore, an estimation was made based on invoice values and Motu, 2014 (Romanos, et al., 2014) emissions factors. It is assumed that the majority of the office staff located in these three offices, and waste generated in other offices have already been covered above.

Table 33: Emissions from waste generated in operations.

| Source | Total Dollar-output (NZ$) | Emissions conversion factor (kg $CO_2$-e/Dollar Output)* | Total Emissions (Kg $CO_2$-e) | Source for Emissions Factor |
|---|---|---|---|---|
| Waste generated in operations | 4,097.14 | 0.1512 | 737.48 | Romanos, et al., 2014 |

[*] Inflation adjusted using https://www.rbnz.govt.nz/monetary-policy/about-monetary-policy/inflation-calculator

### 3.4.5 Purchased Goods and Services

A substantial portion of SDC's annual budget is spent on procurement of goods and services to support its day to day operations. These vary from purchasing office consumables to obtaining infrastructure maintenance services. There are over 280 cost accounts under which these expenses are reported and it is not practical to calculate emissions separately for each cost category. Further, data were not fully available to estimate emissions from these upstream Scope 3 activities, as such, all purchased goods and services were clustered under 14 cost categories and the most relevant emissions factors from Romanos, C., et al., 2014 (Motu 2014 paper) were used to assess the emissions. Table below summaries the expenditures under each cost category, emissions factor and emissions.

Table 34: Emissions from purchased goods and services

| Cost Description | Expenditure (NZ$) | Emissions Factor ($tCO_2$-e/ Dollar Output) | Emissions factors adjusted for inflation[15] | Emissions ($tCO_2$-e) | 2007/I/O Tables description (Romanos, C., et al., 2014) |
|---|---|---|---|---|---|
| Advertising and PR | 314,188.20 | 0.00009 | 0.0000756 | 23.75 | Advertising, market research and management services |
| Catering | 23,191.10 | 0.00022 | 0.0001848 | 4.29 | Food and beverages services |
| Building cleaning and pest control | 775,674.65 | 0.00011 | 0.0000924 | 71.67 | Building cleaning, pest control and other support services |
| Contractors, including infrastructure assets maintenance | 8,464,430.15 | 0.00023 | 0.0001932 | 1,635.33 | Heavy and civil engineering constructions |
| Contractors – Construction services | 162,481.82 | 0.00016 | 0.0001344 | 21.84 | Construction services |
| Employment and Administration | 608,050.28 | 0.00007 | 0.0000588 | 35.75 | Employment and other administrative services |
| Forestry and logging | 2,663,652.80 | 0.00032 | 0.0002688 | 715.99 | Forestry and logging |
| Grants and donations | 3,548,740.43 | 0.00010 | 0.000084 | 298.09 | Religious services; civil, professional and other interest groups |
| Insurance | 645,703.15 | 0.00004 | 0.0000336 | 21.70 | Health and general insurance |
| IT & Communication Services | 641,464.24 | 0.00004 | 0.0000336 | 21.55 | Telecommunications services including internet service provider |
| Legal and Accounting | 4,033,270.73 | 0.00004 | 0.0000336 | 135.52 | Legal and accounting services |
| Printing | 129,981.47 | 0.00024 | 0.0002016 | 26.20 | Printing |
| Professional services | 8,596,179.19 | 0.00008 | 0.0000672 | 577.66 | Veterinary and other professional services |
| Repair and maintenance | 8,276,174.16 | 0.00011 | 0.0000924 | 764.72 | Repair and maintenance |
| Total emissions from purchased goods & services | | | | 4,354.07 | |

General office consumables were excluded from this analysis. Paper usage was separately estimated based on photocopy paper and various notebooks being used by Council staff. During 2021/2022 Financial Year, approx. 0.66 tonnes of paper had been used by Council.

Table 35: Emissions from paper usage

| Paper usage (tonnes) | Conversion factor (kg $CO_2$-e /tonne) | Emissions (kg $CO_2$-e) | Source of the Conversion Factor |
|---|---|---|---|
| 0.66 | 919.4 | 606.8 | BEIS, UK, 2022 |

Note: Paper and board: paper emissions factor was adopted

[15] Inflation adjustment was done using https://www.rbnz.govt.nz/monetary-policy/about-monetary-policy/inflation-calculator (General CPI - 1 NZ$ in Q2 2022 is equivalent to 0.84 NZ$ in Q2 2014)

### 3.4.6 Capitals Goods and Expenditure

SDC also invests on acquisition of new assets, and upgrading and maintaining physical assets such as roads, plants, buildings, technology, or equipment. These are important part of Council's annual expenditure to deliver or maintain the level of services pledged by Council. Similar to purchased goods and services, capital expenditures were also clustered under common cost categories due to practical reasons and most relevant emissions factors were used to estimate the emissions. Table 35 below summarises the emissions from Capital Goods.

Table 36: Emissions from capital goods

| Account Description | Expenditure (NZ$) | Emissions Factors (tCO2-e/ Dollar Output) | Adjusted to inflation ($tCO_2$-e/NZ$)[16] | Total emissions ($tCO_2$-e) | 2007/I/O Tables description (Romanos,C., et al., 2014) |
|---|---|---|---|---|---|
| Renewal & acquisition of key infrastructure assets - bridges, 3Waters infrastructure, roading and footpaths | 28,157,726.75 | 0.00023 | 0.0001932 | 5,440.07 | Heavy and civil engineering construction |
| Renewal and improvements of buildings | 2,074,521.47 | 0.00025 | 0.00021 | 435.65 | Non-residential building construction |
| Computer Hardware - Acquisition and Renewal | 113,380.61 | 0.00019 | 0.0001596 | 18.10 | Electronic and electrical equipment manufacturing |
| Computer Software - Acquisition | 20,500.00 | 0.00006 | 0.0000504 | 1.03 | Computer system design and related services |
| Furniture & Fittings - Renewal and Acquisition | 350,131.15 | 0.00022 | 0.0001848 | 64.70 | Furniture manufacturing |
| Library Book - Acquisition & Renewals | 187,298.50 | 0.00005 | 0.000042 | 7.87 | Library and other information services |
| Marine & Other Assets - Acquisition and Renewal (Including work in progress) | 2,496,108.86 | 0.00016 | 0.0001344 | 335.48 | Construction services |
| Local Government | 411,253.24 | 0.00015 | 0.000126 | 51.82 | Local Government Administration |
| Vehicles - Acquisition & Renewals | 205,124.83 | 0.00013 | 0.0001092 | 22.40 | Motor vehicle and motor vehicle parts wholesaling |
| **Total emissions from capital goods** | | | | **6,377.12** | |

### 3.4.7 Category 4 Total Emissions

Under Category 4 emissions, this assessment covered indirect emissions from product use by SDC. This includes use of purchased goods and services (operational expenditure), use of capital goods, transmission and

[16] Emissions factors were adjusted to Inflation using https://www.rbnz.govt.nz/monetary-policy/about-monetary-policy/inflation-calculator (General CPI - 1 NZ$ in Q2 2022 is equivalent to 0.84 NZ$ in Q2 2014)

distribution losses of purchased energy, landfill disposal of waste and waste services obtained by Council, wastewater and water supply services obtained by Council. The Table below summarises the Category 4 emissions.

Table 37: Category 4 emissions

| Emissions area | Emissions ($tCO_2$-e) | % |
|---|---|---|
| Purchased goods & services | 4,354.68 | 34.63 |
| Capital goods | 6,377.12 | 50.71 |
| Landfill disposal and office waste | 1,767.63 | 14.06 |
| Transmission & distribution Losses of purchased electricity | 58.78 | 0.47 |
| Emissions from work from home | 7.55 | 0.07 |
| Office waste | 0.62 | 0.00 |
| Wastewater and water supply services | 7.55 | 0.06 |
| **Total** | **12,575.60** | |

# 4 RECOMMENDATIONS

Southland District Council's gross GHG emissions for the 2021/ 2022 financial year were 16,758.38 tCO2-e. During the same period Council has removed 2,044 tCO2-e bringing Council's net emissions of the financial year to 14714.38 tCO2-e. The Figure 6 below illustrates emissions/removals under each emissions source.

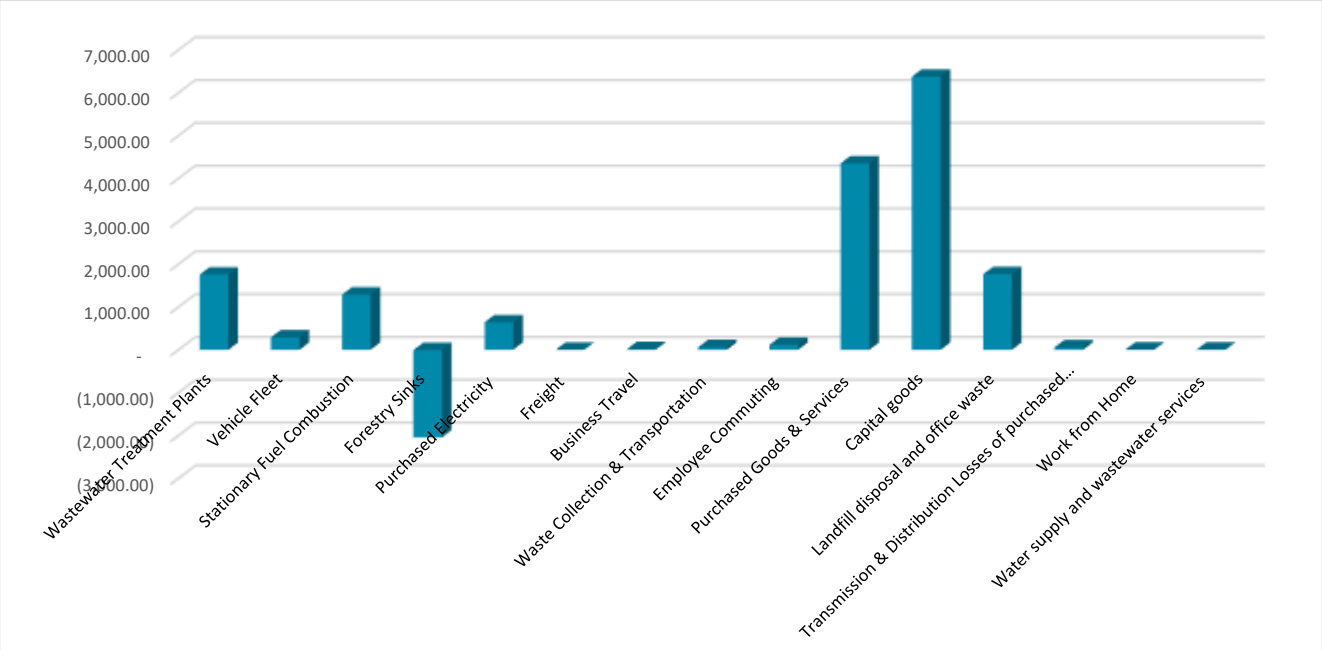


Figure 6: Emissions / removals from key emissions sources

Emissions from purchased goods and services (Category 4) contributed to 75% of total GHG emissions of the financial year. Council's direct emissions were responsible for 20% of all emissions, while emissions from purchased electricity and transportation were responsible for 4% and 1% of all emissions respectively. The Figure 7 below summarises the emissions based on ISO categories of emissions.

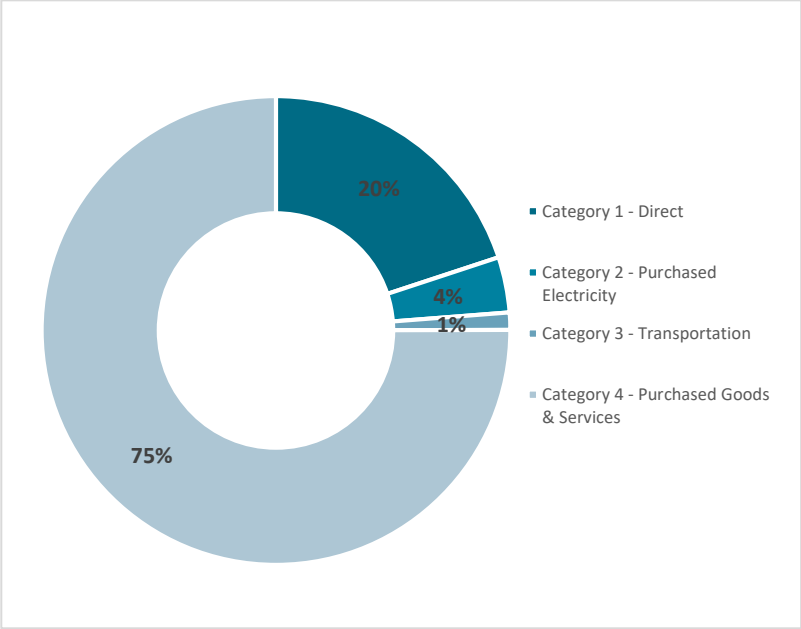


Figure 7: SDC's emissions based on ISO emissions categories

This section covers suggestions to improve data management for future emissions calculations and high-level recommendations to reduce SDC's emissions. These suggestions and recommendations are primarily based on data, which had been analysed for this assessment. It is however important to work with the respective activity management teams to identify practically feasible options to reduce emissions.

## 4.1 SUGGESTIONS TO IMPROVE EMISSIONS DATA MANAGEMENT

1. Maintain key data for emissions calculations in a centrally managed data management system to improve accuracy. e-Bench, Council's energy data management platform, has the potential and capability to be used as the central data management system for emissions data. It is noted that the new version of e-Bench, which will be available to the councils by mid-2023, is fully equipped with emissions data management. Currently, the platform is under only for electricity usage data management. In addition to that, mobile fuel combustion data, stationary fuel combustion data, business travel, freight, and refrigerant usage data can also be maintained and managed through the same system with a nominal service charge.
2. Build an inventory of heating equipment and refrigerators – SDC requires to develop and maintain a full inventory of heat pumps/air conditioners, refrigerators in Council buildings and facilities. The inventory should consist of data related to equipment, location (address), make, model, year of manufacture, installation year, refrigerant type (R32, 400a etc.), refrigerant load, refrigerant top ups done in the year, service provider and contact details. Once the inventory is developed this can be maintained in the e-Bench data management system.
3. Maintain mileage log sheets for the full vehicle fleet - It was noted that mileage log sheets are not maintained for a few vehicles. It is crucial to maintain log sheets for all council vehicles, owned and rented. Council shall establish a system to access log sheets of waste trucks to enable the Council to estimate emissions from waste collection and transportation.
4. Collect plant-specific nutrient load data for wastewater treatment plants – due to lack of plant-specific data, this assessment was carried out using Level 1 assessment. It is however important that SDC moves to Level 2 assessment at least for the major treatment plants. This requires plant-specific nutrient load data in influent and effluent waters. Further, it is also important to maintain sludge removal information for each plant.

5. While the majority of travel bookings are taking place through a centralised process, it was noticed that a limited number of travels had been arranged outside this process. It is important to maintain data related to all business travels in one location for increased accessibility. Further, a significant portion of business travel is also made using personal vehicles. It is important to maintain fuel consumption data (or number of kms travelled at a minimum) related to personal vehicle usage for official visits.
6. Maintain fertiliser and chemical data – Council, as a part of its forestry and parks operations, uses various chemicals and fertilisers. Fertilisers, especially nitrogen fertilisers, have very high emissions factors (emissions per unit application), as such could have a significant impact on Council's emissions profile. Fertiliser application data, however, were not available for this assessment. It is important to maintain these data or obtain an annual account of fertiliser applications from the service providers to support emissions calculations.
7. Even though a questionnaire was developed to conduct a staff survey to estimate emissions related to staff commuting and work from home, only a sample survey was carried out for this assessment. It is important to conduct annual staff survey to estimate work from home and staff commuting emissions to improve the accuracy of this data set.
8. SDC shall work with suppliers and service providers to improve Scope 3 upstream emissions estimation. ICC has already incorporated the following clause in their solicitation documents to obtain relevant data directly from the service providers. A similar approach is recommended for SDC to obtain as much data as possible from the service providers to enable the Council to estimate emissions.

*Note: Disclosure of information requested in this section is discretionary. Inability to provide requested information does not negatively impact the merit of application.*

- Do you already collect data on GHG emission generated by your activities? (Y/N)
- Are you able to disclose primary data on GHG emission that may be produced by your activity on behalf of the ICC? (Y/N)
- Do you require subcontractors to provide data on GHG emissions? (Y/N)
- Can you identify the countries of manufacture for imported goods? (Y/N)

Source: ICC, 2022

## 4.2 SUGGESTION FOR EMISSIONS REDUCTION

This section discusses the potential emissions abatement options for SDC based on data analysis. During the 2021/2022 Financial Year, SDC's gross emissions were 16,758.38 $tCO_2$-e and in the same year Council has earned 2,044 NZUs from its forestry operations. Therefore, net emissions stand at 14,714.38 $tCO_2$-e.

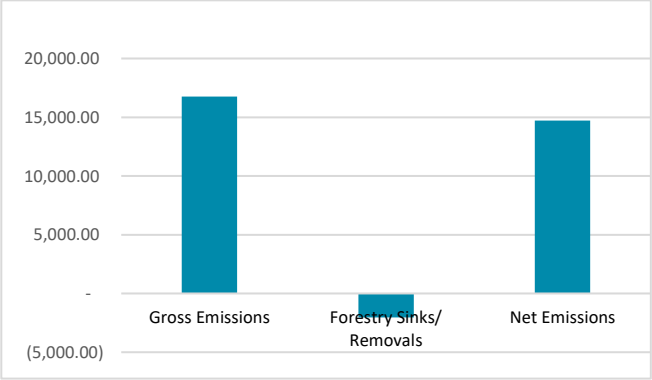


Figure 8: SDC's gross Vs net emissions

1. Net zero target - it is important that Council aims for a net zero target for Council's operations before the 2050 national deadline. New Zealand's statutory framework requires emissions of all greenhouse gases (except biogenic methane) to be net zero by 2050. As such, Council has a statutory responsibility to achieve net zero by 2050. However, Council's responsibility for emissions reduction goes beyond council operations and Council shall also work towards reducing the emissions from the entire Southland district. The district is currently responsible for 7.9% of all emissions of New Zealand (STAT NZ, 2021). Achieving net zero will require reducing gross emissions as much possible as well as off-setting the residual emissions using carbon sequestration/ forestry.

   Council can also set up an intermediary target for Scope 1 and 2 emissions. Given the current composition of Scope 1 and 2 emissions and government's proposal to implement 3 Waters reforms, Council may be able to achieve net zero emissions of Scope 1 and 2 emissions before 2035 with a minimum effort. As such, an intermediary target covering Scope 1 and 2 emissions is an appropriate way forward for SDC.

2. New forests - Given the age structure of SDC's forests, it is plausible to believe that Council will start harvesting of post 1989 forests over the next 10 years, which will have drastic implications on Council's emissions profile. Therefore, Council will have to carefully revisit the forestry portfolio, considering future potential emissions and Council's net zero target. Given the findings of this assessment, it is unlikely that Council will be able to achieve net zero emissions without adding new forests (native or exotic) to its portfolio. Extent, species mix, pruning regime, and timing of new plants shall be determined through a detailed study looking at the emissions profile.

3. Vehicle fleet – Council can consider adding more plug-in hybrid vehicles (PHEV) to its vehicle fleet, when current fleet is upgraded in the future. However, these decisions should also be based on the availability of EV infrastructure, embodied carbon, and lifespan of PHEV vehicles compared to other options and also considering the suitability of PHEV vehicles for council operations.

4. SIESA – Council will have to identify a better renewable energy mix to support Rakiura Stewart Island's power generation. As found in this assessment, current diesel-powered power generation operation is responsible for 39% of the total direct emissions (Category 1) of Council. Green hydrogen, as an energy source is evolving fast and shall be explored further for Rakiura Stewart Island. It is important to note that greening of power generation will also have other co-benefits to the Rakiura Stewart Island, including the opportunity to rebrand its image as a green/sustainable tourism destination.

5. Electricity Consumption – Explore energy efficient options for water pumps and street lights to reduce emissions from purchased electricity. Purchased electricity contributes to 4% of the total emissions of Council and water pumps, street lights and wastewater treatment plants are among the leading electricity consumers. It is important to identify strategies to improve energy efficiency of these areas, in order to reduce energy bill as well as emissions from purchased electricity.

6. Waste disposal – reduce emissions by diverting waste from landfill. The waste service activity management plan highlights the importance of promoting reuse and recycling of waste to reduce the landfill disposal. Household composting of food waste and other biodegradables shall be explored with communities, coupled with community projects such as community gardens.
7. Finally, it is highly recommended to do a deep-dive for each activity management area with respective teams to identify practical solutions to reduce emissions from Council's operations. Once these options are available, it is important to conduct a Marginal Abatement Cost Curve (MACC) analysis for all new investments to identify the financial cost benefits of the investment as well as abatement potential of each option. Options that yield highest net present value and emissions abatement shall be prioritised.

Annex I

| Questionnaire No | |
|---|---|

# Staff Survey 2021/2022

Carbon Footprint Calculations – Staff Commuting and Work from Home

Please answer all questions as accurately as possible to allow for accurate Corporate carbon footprint calculations. This survey focuses on **2021/2022 financial year**, as such all questions are related to the year ending on **30 June 2022**. Please √ appropriate box/es.

1. How do you best describe your mode of commute to work in 2021/2022? (If you had used more than one mode, please indicate percentage use of each mode)

| | |
|---|---|
| Driving a personal vehicle | |
| Bicycling | |
| Walking | |
| Carpooling / shared ride | |
| Public Transport/Bus | |

2. What kind of vehicle did you drive to work in 2021/2022? (If you had used more than one vehicle, provide percentage use of each vehicle)

    a. Fuel Type

| | | |
|---|---|---|
| Diesel | | |
| Petrol | | |
| Electric, including e-bikes | | |
| Petrol Hybrid | | |
| Petrol Plug-in Electric Vehicle (PHEV) | | |

b. Engine Capacity and Manufacturing Year of your vehicle (Not relevant if you have selected "Electric" for 2a)

| | | | |
|---|---|---|---|
| <1350 cc | | Pre-2010 | |
| 1351-1600 cc | | 2010-2015 | |
| 1601 – 2000 cc | | Post-2015 | |
| 2001 – 3000 cc | | | |
| >3001 cc | | | |

3. How many kilometres per day on average did you travel to work (one-way)?

| | |
|---|---|
| Car/ SUV/ Ute/ Van | |
| Motorcycle | |
| Walk | |
| Bike | |
| Public Transport/Bus | |

4. What percentage of time did you work from home in 2021/2022? (Just needs to be your best estimate)

| |
|---|
| |

5. What is the energy source of your home electricity?

| | |
|---|---|
| Rooftop Solar | |
| Grid Electricity | |
| Other sources (pls explain) | |

6. What is the energy source of your home heating system?

| | |
|---|---|
| Electricity | |
| Wood Log/ Biomass | |
| Coal | |
| LP Gas/Diesel | |

7. What percent did you have your heating/air conditioning on, while you were working from home? (just needs to be your best estimate)

| | |
|---|---|
| Heating | |
| Air conditioning | |

8. Do you have any suggestions to reduce emissions from staff commuting and work from home? (Optional)

……
……
……