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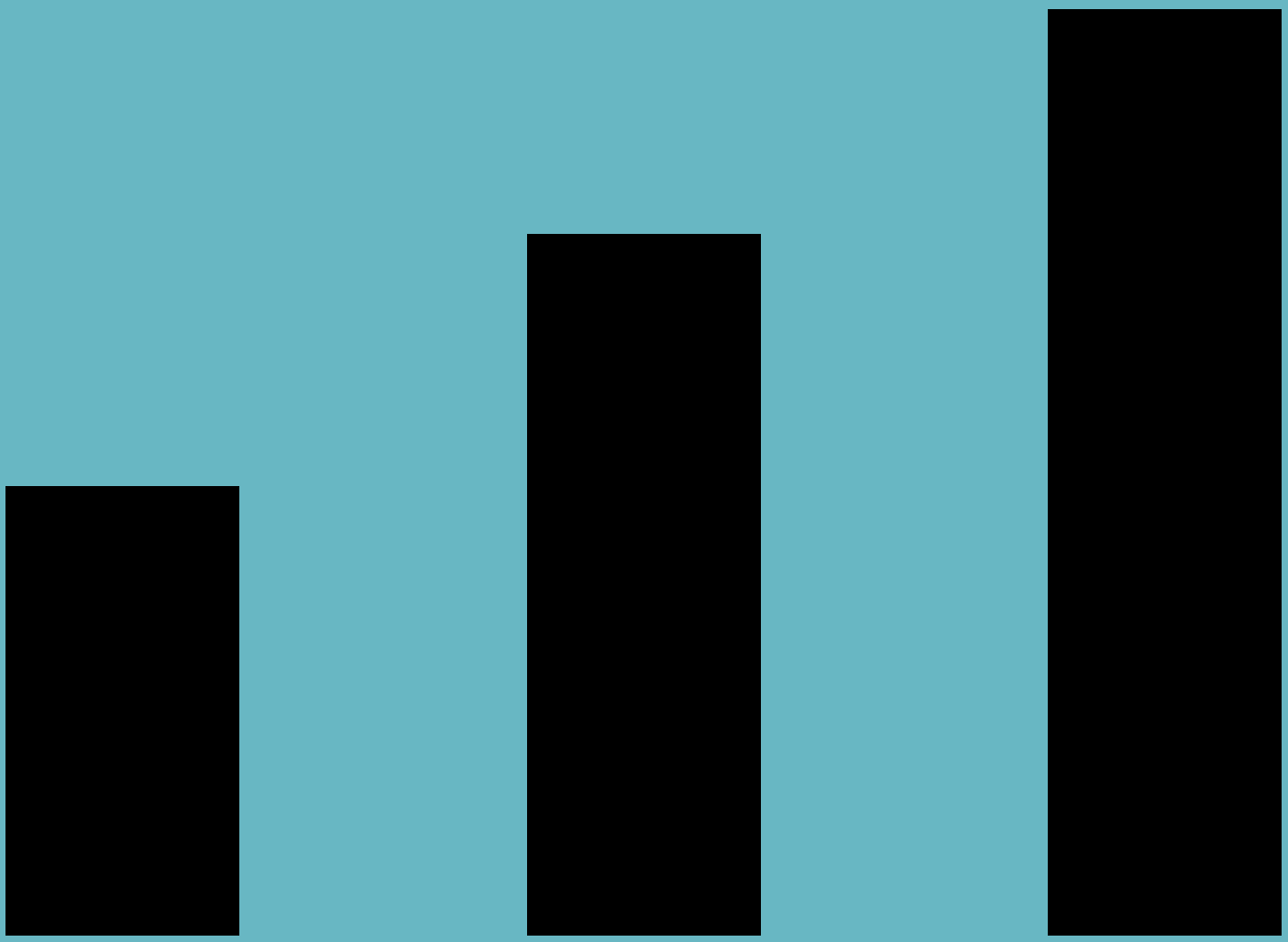
Greenhouse Gas Emissions Overview for Ryans Road development, Christchurch

EAC21002



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Glossary

Greenhouse Gas (GHG)	Greenhouse gases (GHG) are gases that influence the way in which the Earth's atmosphere traps heat. Increasing levels of GHGs in the atmosphere are causing the phenomenon of climate change. (Refer to appendix 1 for further information).
Carbon Dioxide Equivalent (CO_2-e)	A standard unit for measuring GHG Inventories. The impact of each different GHG is expressed in terms of the global warming potential (GWP) of one unit of carbon dioxide (CO_2). Typically expressed in kilograms (kg CO_2-e) or tonnes (tCO_2-e).
Global Warming Potential (GWP)	A measure of a gas's ability to cause radiative forcing in the atmosphere (or climate change) relative to the ability of CO_2. For example, methane has a GWP of 28, thus 1kg of methane emitted is 28 times more potent than 1kg of CO_2.
Emission Factor	A metric that converts a specific emission source - such as a litre of diesel - into terms of CO_2 or CO_2-e.
Sequestration	The removal and storage of carbon dioxide from the atmosphere, for example by vegetation (forestry).
Biogenic methane	Biogenic methane is that which is produced by living organisms. In the climate change sense, this means emissions resulting from biological processes in the waste and agriculture sectors.
Embodied carbon emissions	Embodied carbon emissions are from the production of materials and products that are used to develop an asset/ building.
Operational carbon emissions	Operational carbon emissions occur during the use stage of an asset or building's life and are from the energy and other resources used when operating the asset/building.
Net zero carbon	Net zero means achieving a balance between the greenhouse gas emissions produced by an entity (company, region or country) and those removed from the atmosphere (via sequestration).

Executive Summary

1 The proposed industrial subdivision and development of 55.5ha at the corner of Ryans and Grays Roads, adjacent to the southern end of Christchurch International Airport (CIA) will contribute to a reduction in greenhouse gas emissions for the following reasons:

1.1 It is located in close proximity (2km) to CIA, being the largest employment centre in the South Island, a major logistics hub with several large distribution centres located at Dakota Park, and excellent accessibility and connectivity to Canterbury's strategic arterial roading network.

1.2 The site is flat, with good ground conditions which means the amount of embodied carbon required in building foundations (a key component of building emissions) is limited.

1.3 It leverages existing infrastructure by way of Ryans and Grays Roads, meaning less new infrastructure (and embodied carbon) is required to be developed

Introduction

2 Carter Group Limited (CGL) has commissioned Lumen Limited (Lumen) to undertake a high-level assessment of greenhouse gas (*GHG*) emissions for the proposed subdivision and industrial development of 55.5ha of Rural Urban Fringe zoned land.

3 The proposed development site is located at the corner of Ryans and Grays Roads, adjacent to the southern end of CIA in Christchurch.

Planning Context

4 Policy 1 of the National Policy Statement on Urban Development 2020 (NPS-UD) describes the attributes of "well-functioning urban environments".

5 Of relevance to this assessment, NPS-UD Policy 1(e) requires that planning decisions contribute to well-functioning urban environments, which are urban environments that, as a minimum: ...(e) support reductions in greenhouse gas emissions.

6 My understanding is that Policy 1(e) was included in response to the Climate Change Response (Zero Carbon) Amendment Act 2019 to support achievement of New Zealand's GHG emissions targets through the NPS-UD.

7 New industrial developments can achieve this in one or more of the following ways:

7.1 Being well located to key transport corridors and logistics hubs;

7.2 Having good accessibility for workers and/ or visitors;

7.3 Through subdivision, site and building designs that support reductions in the overall GHG footprint by future occupants / end-users;

7.4 Through subdivision, site and building designs that minimise emissions associated with infrastructure development.

Overview of proposed development site and location

8 The site is located on the corner of Ryans Road and Grays Road, adjacent to the southern end of CIA, as shown in the figure below.

Figure 1: Location of the site (plan by Capture Land Development Consultants)

9 The centre of the site is approximately 3.5km by road to the Christchurch Airport terminal building, and approximately 2.0km to the centre of Dakota Park, CIA's freight and logistics business park. Notably, several major logistics players (Freightways, Courier Post, NZ Post and Mainfreight) have large facilities in and around Dakota Park.

10 The Christchurch Airport precinct is growing at a rapid rate, with both passenger numbers and new property developments on the rise. According to the airport[1], more than 7,000 people are employed on the airport campus, making it the largest single centre of employment in the South Island.

11 The site is approximately 3km from the nearest residential areas, being the suburbs of Russley, Avonhead and Broomfield.

[1] https://www.christchurchairport.co.nz/about-us/who-we-are/our-campus

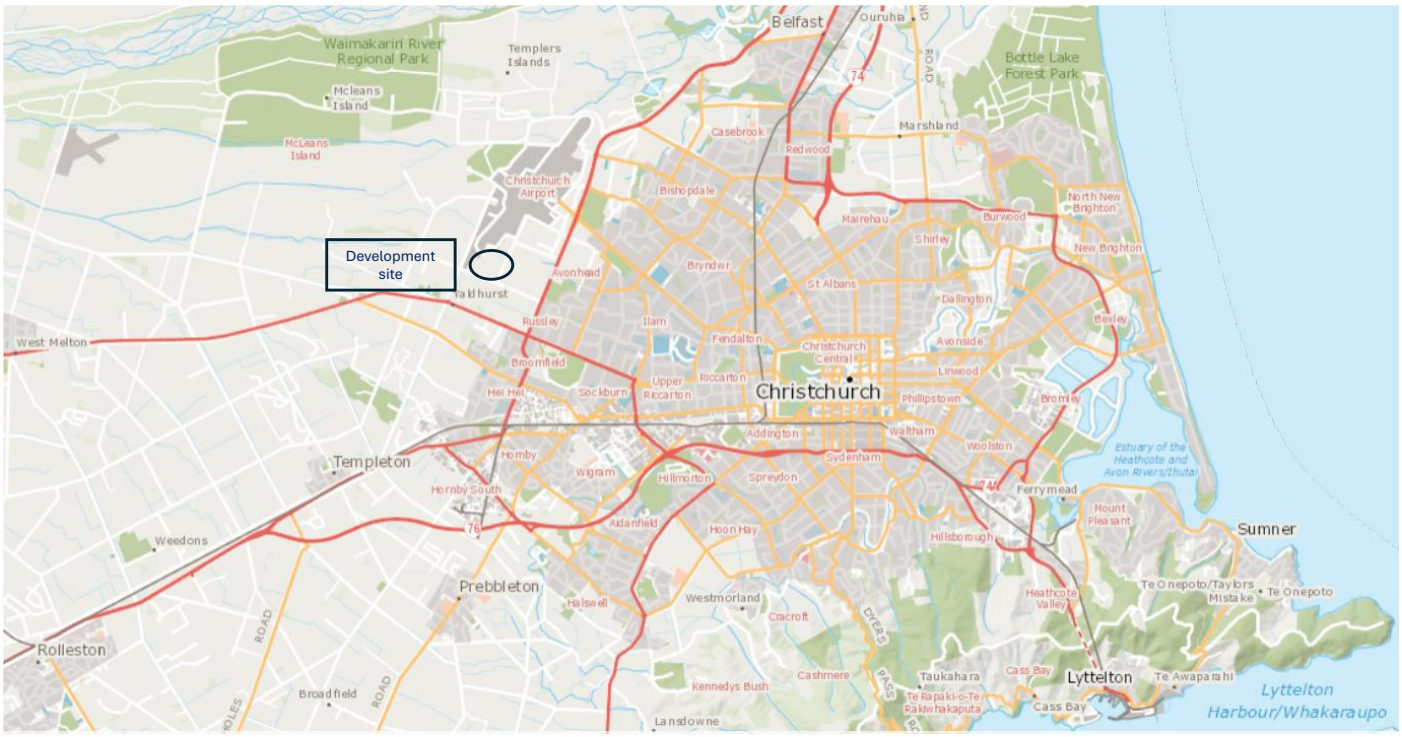

Figure 2: Location of the site, in terms of the Christchurch metro area.

12 The site layout plan shows 126 lots, ranging from 1,000m^2 up to approximately 4.76ha.

Key considerations/observations from an emissions perspective

13 Like any new industrial development, GHG emissions will be emitted during different stages of the project:

13.1 Construction of the infrastructure required to support the development;

13.2 Construction of the buildings; and

13.3 Emissions arising from the operations of the businesses based in the buildings – primarily energy usage.

14 Emissions will also arise from travel associated with the businesses that choose to locate in the development – via:

14.1 Commuting of employees who work at the premises;

14.2 Travel of customers to and from the sites; and

14.3 The transportation of goods (inbound and outbound) to the premises.

15 Infrastructure-related emissions are a major component of emissions for any sort of commercial/industrial development.

15.1 For instance, a single km of road has been modelled[2] to have a carbon footprint of ~2,320 tCO_2-e per lane.

15.2 To put this into perspective – the average annual emissions from the electricity used in a typical NZ home are around 0.7t CO_2-e, and the emissions from travelling 10,000km in an average car are 2.5t CO_2-e.

15.3 In other words, the emissions incurred in building 1km of 2-lane road is equivalent to the annual electricity use of about 6,600 houses (2,320*2 / 0.7).

15.4 At the time of writing this report, there is limited information regarding other infrastructure-related emissions however these are likely to be high relative to other emissions associated with commercial development and therefore should be considered when evaluating GHG impacts.

16 In terms of GHG emissions from infrastructure work (i.e. prior to the construction of the commercial premises):

16.1 The site is relatively flat which limits the requirement for earthworks and therefore the amount of fossil fuels that will be used in preparing the site for development.

16.2 According to the Infrastructure Report prepared by Capture Land Consultants, no soil will be required to be brought on to the site and only a relatively small amount of excavated soil will need to be removed, reducing the fossil fuel required for the disposal of excess soil.

16.3 Whilst there is currently limited scope to avoid the use of GHG producing construction materials, lower emissions materials are being developed all the time, and it is likely that by the time development commences some lower emissions materials could be specified by the developer.

16.4 The bulk of materials required in the development are anticipated to be roading-related (concrete/asphalt), water, wastewater and stormwater piping and electrical infrastructure.

16.5 The development will utilise existing roads (Ryans and Grays roads). This will limit the amount of additional road-building emissions required, as constructing new roads involves emissions from the use of heavy machinery, asphalt production, and transportation of materials. Reusing existing infrastructure avoids these emissions.

17 The second major component of GHG emissions is the emissions associated with construction of the commercial properties. The major contributing factor is the emissions that are "embodied" in materials that are used in the build.

17.1 Embodied carbon refers to the emissions generated during the production, transportation, and assembly of building materials. Materials such as concrete and steel have high embodied carbon due to their energy-intensive manufacturing processes. In contrast, timber has substantially lower embodied carbon, making it a more sustainable alternative in certain applications.

17.2 In a typical warehouse, a substantial portion of the embodied carbon is associated with the concrete used in the foundations. The quantity of concrete required depends on the soil

[2]https://www.nzta.govt.nz/assets/resources/carbon-emissions-baselines-for-infrastructure-projects/Carbon-Baselines-2023-Report_FINAL.pdf

conditions, as these determine the type and depth of foundation needed to support the building's weight.

17.3 Based on discussions with Lumen's civil engineering team, who have reviewed Tetra Tech Coffey's Geotechnical Assessment Report, soil conditions at the site are expected to be suitable for shallow foundations, which are appropriate for lightweight, low-rise buildings typical of commercial warehouses. Shallow foundations require less concrete compared to deep foundations, thereby reducing embodied carbon emissions.

17.4 Furthermore, per Tetra Tech Coffey's Geotechnical Assessment Report, the Christchurch Liquefaction Vulnerability Map categorises the site as having low liquefaction vulnerability. This suggests minimal need for additional foundation reinforcements to address liquefaction risks, further contributing to reduced material use and associated emissions.

17.5 Compared to other industrial sites with poor soil conditions or higher liquefaction potential, this site's favourable characteristics will result in lower emissions associated with foundation construction. When scaled across an industrial park with over 100 buildings, this could translate into a substantial reduction in embodied carbon emissions, representing a significant positive environmental impact.

18 When it comes to emissions from operational energy use, the type of activity that the tenant undertakes will largely dictate this, but the location can influence the emissions.

19 The main factors influencing operational energy emissions are:

19.1 how energy efficient a building is;

19.2 the type of energy that is used in the building (electricity, LPG);

19.3 the size of the building; and

19.4 the use of on-site renewables (e.g. solar PV).

20 Emissions can be minimised by encouraging[3] energy efficient buildings to be developed, ensuring that natural gas/LPG infrastructure is not provided as part of the development and ideally encouraging the uptake of solar PV panels.

21 An ideal industrial site for solar is a flat site, that is free of obstructions and unlikely to be built out in the future. As such I consider the site would be ideal for rooftop solar, and furthermore it may be possible to locate solar panels on the ground adjacent to the buildings (potentially over car parks – which is now required in France, or on otherwise unutilised land).

22 New industrial properties offer the potential to be much more energy efficient than traditional NZ properties, due to better building materials, the installation of energy efficient lighting, insulation (where appropriate) and the ability to ensure that buildings are oriented to maximise the potential outputs of rooftop solar, as well as ensuring that appropriate electrical infrastructure is provided to allow electric vehicle charging.

23 Voluntary measures that could also be adopted by CGL as the land developer, or by future building developers include: the development of energy-efficient buildings; policies excluding natural gas/LPG infrastructure in the development; and (to the extent possible in this location, given potential airport operational constraints) the adoption of solar PV panels. While these

[3] Rules mandating such requirements are not proposed, however they can be readily encouraged or promoted by the land developer and/or commercial developers.

measures are not required to mitigate significant effects or to achieve an acceptable development outcome, they remain relevant to overall sustainability and energy use. Some of these considerations are discussed further where they align with regulatory standards or planned development provisions.

24 I understand that natural gas/LPG reticulation throughout the development will not be provided, and I support this decision.

25 The National Environmental Standards for greenhouse gases from industrial process heat[4] are also relevant in terms of energy use. This standard requires that:

25.1 New coal boilers that deliver heat < 300C are prohibited

25.2 Resource consent is required for any new fossil fuel boilers that emit 500 tonnes and above of CO_2-e per year, per site.

25.3 An emissions (reduction) plan must be developed and included with the resource consent application.

26 This means that any business planning to operate a fossil fuel boiler on the site that emits more than 500 tonnes of CO_2-e per year must obtain specific consent.

27 Activities of this nature are not proposed as part of this application. Consequently, it is unlikely that substantial fossil fuel use for stationary energy or process heat will occur across the site. Therefore, this is not considered further.

Emissions from transportation

28 Emissions from transportation are primarily a function of mode of transport (i.e. vehicle type), distance travelled, weight carried, and frequency of travel.

29 Emissions from transportation primarily arise from trips undertaken in vehicles that use fossil fuels.

30 When considering trips to and from an industrial property this will include trips that are undertaken in passenger vehicles (by staff and customers), any trips to and from the site undertaken in commercial vehicles, particularly trucks, and the use of machinery (such as forklifts) for day-to-day operations.

31 The need for commercial vehicles on site (such as forklifts) is not unique to the development proposed and would occur regardless of the location of the development.

32 However, the fact that the site is likely to have adequate electrical capacity means that there could be expected to be a faster uptake of electric commercial vehicles (forklifts, vans and trucks) at this site compared to sites that are electrically constrained (for instance sites in metro areas are often electrically constrained).

33 Given the likely nature of businesses that will operate on this site, it is reasonable to expect that the movement of freight to and from the development will be a significant contributor to transport emissions. Freight movement (being a key determination of transportation related emissions) is discussed in more detail below.

[4] https://environment.govt.nz/acts-and-regulations/national-policy-statements/national-policy-statement-for-greenhouse-gas-emissions-from-industrial-process-heat/

Employee Travel

34 It is difficult to accurately model or predict the level of travel-related emissions that will arise from employee travel to a proposed development, as we don't know where the staff may reside, nor how they may travel to their workplace.

35 The nearest residential areas are about 3- 3.5km from the site (Russley, Broomfield and Avonhead). This is a distance that could be easily cycled, so some employees could travel by active mode to access their workplace, if they chose to.

36 However, I note that cycle volumes in the subdivision are anticipated to be low, in part due to the 'barrier' created by SH1, as identified in Mr Fuller's report. Given these anticipated low volumes, no dedicated cycle lanes have been provided within the site or the adjacent network, albeit roads within the development are wide enough to enable cars and trucks to safely pass cyclists. Additionally, the decision to only build footpaths on one side of the roads within the site contributes to reduced embodied emissions, aligning with objectives to reduce emissions.

37 Currently, no public transport services directly connect to the site. The nearest public transport routes include the City/Airport bus route (29), operating every 10–15 minutes along Memorial Avenue, and the 140 route (Mount Pleasant to Hornby Hub), which runs through the suburb of Russley along Bentley Street. The closest bus stop for these services is approximately 2.3 kilometres from the site meaning it is unlikely that many employees would opt for public transport as a means of commuting. However, a potential future extension of the City/Airport route through Dakota Park and into the development could improve accessibility and bus parking and turning areas to support future public transport integration could readily be provided by public transport providers in future.

38 In the short to medium term, the majority of employees are expected to commute to the site using private vehicles. However, with approximately 7,000 employees already working in the Airport precinct, the growing workforce facilitated by this proposal could increase opportunities for vehicle sharing. Ride-sharing initiatives could be an effective way to reduce travel-related emissions and minimise congestion, particularly as the employee base continues to expand.

39 Considering this reliance on private vehicles, the types of vehicles employees use over the development's lifetime is a relevant consideration. A growing share of passenger trips is expected to occur in electric vehicles (EVs), which produce approximately 90% lower emissions per kilometre compared to internal combustion engine vehicles and it is likely that EV charging infrastructure will be incorporated throughout the site by individual site developers, to meet growing staff and visitor needs.

Customer Travel

40 The nature of the development, being primarily industrial, means that the volume of customers to the site should be low compared to the volume of staff and freight movements. Hence, the emissions from customer travel are likely to be negligible, albeit this travel will most likely be by private vehicle. However, the future provision of EV charging facilities as described above would help to reduce these emissions.

Freight

41 According to Mr Fuller's evidence, 792 heavy vehicle movements are anticipated per day – a significant figure.

42 The site's strategic location near State Highway 1 (providing excellent access both North and South) and State Highway 73 (Westward access) positions it as an ideal hub for freight transportation. This proximity can reduce transportation emissions by shortening travel distances for goods and services, both inbound and outbound.

43 Considering other industrial site locations across wider Christchurch, this site is somewhat unique due to its close proximity to both major regional highways serving the city. This access to the West Coast as well as North and South routes, could result in lower-freight related transport emissions.

44 Additionally, the site's close proximity to the airport would make it particularly advantageous for airfreight operations, exporters and industries related to aerospace.

45 Its closeness to key transport and distribution facilities (such as NZ Couriers, NZ Post and Mainfreight) located in Dakota Park minimises the distance goods must travel, further reducing greenhouse gas (GHG) emissions associated with logistics.

46 Consistent with the discussion above, the establishment of EV charging facilities for heavy vehicles would further help to mitigate emissions.

Recommendations and Opportunities

47 In my opinion, this development meets fundamental requirements for supporting emissions reductions and does not give rise to significant adverse effects related to greenhouse gas (GHG) emissions.

48 While no additional measures are strictly required, there are several opportunities to further enhance sustainability and energy efficiency. These opportunities are not essential but could strengthen the development's long-term environmental performance. It is acknowledged that such initiatives would need to be developer imposed or encouraged or voluntarily adopted by future business activities establishing and as such measures may not be feasible for all activities establishing. Examples of these opportunities include:

Prevent New Fossil Fuel Connections (Where Feasible)

49 In addition to the decision not to develop reticulated natural gas/LPG within the development, the installation of new LPG/fossil fuel infrastructure on sites could be precluded or discouraged by the developer, acknowledging this may not be feasible depending on the businesses operating within the development.

Minimising High-Embodied Carbon Materials

50 The use of high-embodied carbon materials (e.g., concrete, cement, steel, bitumen) could be minimised and lower embodied carbon materials (e.g., cross-laminated timber) maximised where practical. And, where possible, roading infrastructure such as vehicle accessways could be minimised to lower the carbon footprint of construction.

Provision for EV Charging Infrastructure *("EV Ready" Sites)*

51 This aligns with national EV infrastructure targets and ensures future compatibility. Again, this initiative could be adopted or promoted by the developer or adopted by future businesses.

Encourage Energy Efficiency

52 New industrial buildings can integrate energy-efficient materials and design elements from the outset, reducing long-term energy demand.

Advanced Waste Management

53 Encourage recycling and organic waste collection to support a circular economy approach, noting the site's proximity to the proposed Ecogas[5] organics processing facility (expected in 2026) makes this particularly relevant. This might entail site design by future businesses that provides dedicated organic waste collection infrastructure.

Future Public and Active Transport Provision

54 Advocating for public infrastructure to support a potential future bus route to the site from Christchurch Airport, as well as potential future pedestrian/cycling connections.

[5] https://www.ecogas.co.nz/christchurch

Tree Retention & Green Spaces

55 Noting that the site's proximity to the airport may restrict the opportunity to maximise tree coverage the planned planting of new trees and shrubs in shared spaces and along road frontages (as shown in concept plans) will result in increased levels of carbon dioxide sequestration given the very limited tree coverage currently at the site.

Rooftop Solar Potential

56 Encourage, within any airport-related constraints, solar adoption through measures such as rooftop solar requirements, solar-covered parking, and potentially ground-mounted panels where space allows; and battery storage in order to support the integration of renewable energy (particularly solar).

Concluding Comments

57 For the reasons set out in this document, I conclude that the proposed development will support a reduction in greenhouse gas emissions and does not result in significant adverse effects in this context.

57.1 It is located in close proximity to Christchurch airport, noted as the largest employment centre in the South Island, and a major logistics hub with several large distribution centres located at Dakota Park, just 2km from the proposed site.

57.2 Considering other industrial site locations across wider Christchurch, this site is somewhat unique due to its close proximity to both major regional highways serving the city. This access to the West Coast as well as North and South routes, could result in lower-freight related transport emissions.

57.3 The site is flat, with good ground conditions which means the amount of embodied carbon required in building foundations (a key component of building emissions) is limited, especially compared to sites in areas with liquefaction potential.

57.4 It leverages existing infrastructure by way of Ryans and Grays Roads, meaning less new infrastructure (and embodied carbon) is required to be developed.

Appendix 1: Overview of greenhouse gases

58 There are several gases that contribute to the problem of global warming, the most prevalent of these being carbon dioxide (CO_2), methane and nitrous oxide.

59 Each of these gases has differing abilities to trap extra heat in the atmosphere, and it is the trapping of this heat that leads to global warming.

60 When evaluating GHG emissions, it is useful to have a common measure to allow comparisons between gases.

61 As CO_2 is by far the most prevalent of the GHGs, it is standard practice when measuring emissions to determine the level of each gas emitted, and then convert these emissions into their carbon dioxide equivalent, or CO_2-e.

62 The global warming potential (*GWP*) of a gas is a measure of its ability to trap extra heat in the atmosphere over time relative to CO_2. This is most often calculated over a 100-year period and is known as the 100-year GWP.

63 The GWP of CO_2 is 1.

Appendix 2: Greenhouse Gas Emissions Context

64 The Paris Agreement is an international treaty on, adopted by 197 countries in 2015, including New Zealand.

65 Its overarching goal is to hold "the increase in the global average temperature to well below 2°C above pre-industrial levels" and pursue efforts "to limit the temperature increase to 1.5°C above pre-industrial levels.

66 The Agreement requires signatory countries to commit to interim emissions reduction targets (to 2030), with the long-term goal of achieving net zero emissions. Most developed countries, including New Zealand, have set a target of net zero by 2050.

New Zealand's Response: Climate Change Legislation and Governance

67 In response, the New Zealand government passed the Climate Change Response (Zero Carbon) Act in late 2019. This act does four key things:

67.1 Sets a series of emissions targets for New Zealand:

(a) Net zero emissions for all GHGs (excluding biogenic methane) by 2050.

(b) A 24-47% reduction in biogenic methane by 2050.

(c) A 10% reduction in biogenic methane emissions by 2030.

67.2 Establishes a system of 5-year emissions budgets to act as stepping stones towards the long-term 2050 target.

67.3 Requires the Government to develop and implement policies for climate change adaptation and mitigation.

67.4 Establishes a new, independent Climate Change Commission to provide expert advice and monitoring to help keep successive governments on track to meeting long-term goals.

68 The Interim Committee was superseded and replaced by the independent Climate Change Commission (The Commission) in November 2019.

69 In May 2021 they produced a comprehensive report providing advice on how NZ should go about achieving emissions reductions: *Ināia tonu nei: a low emissions future for Aotearoa*[6] report (June 2021). The report and associated documentation included:

69.1 A comprehensive report detailing recommendations for how NZ should best go about achieving emissions reductions.

69.2 The development of a "demonstration pathway" that details the Commission's core scenario/model for developing its recommended emissions budgets.

69.3 Recommended net emissions budgets for the periods 2022-25, 2026-2030 and 2031-2035.

[6] https://www.climatecommission.govt.nz/our-work/advice-to-government-topic/inaia-tonu-nei-a-low-emissions-future-for-aotearoa

70 Key strategies for achieving the reduction targets, relevant to an urban context include the following:

70.1 increasing the mix of renewables in our electricity generation network;

70.2 conversion of fossil fuelled industrial, manufacturing, and process heat to low emissions energy (electricity or biomass);

70.3 electrification of our vehicle fleet;

70.4 increasing the proportion of (personal) travel undertaken using active travel modes and public transport;

70.5 reducing freight emissions; and

70.6 minimising organic waste.

The First Emissions Reduction Plan (2022-2025)

71 Drawing on this advice, the NZ Government then developed and released a comprehensive Emissions Reduction Plan (*ERP*)[7], on 16th May 2022.

72 In April 2023, the Commission released an updated demonstration pathway, aligned with the confirmed ERP budgets.

The Second Emissions Reduction Plan (2026-2030) – Currently Applicable

73 In November 2023, the Climate Change Commission provided advice on the direction of policy for the incoming Government's second emissions reduction plan (2026-2030). This advice contained a set of 27 recommendations.

74 The National-led government released a discussion document for the governments second emissions reduction plan in July 2024, followed by the final plan in December 2024[8].

75 The second Emissions Reduction Plan is the current applicable framework for assessing how developments support emissions reductions.

76 The second emissions plan is notably "lighter" on specific policies to reduce emissions than the first plan, with more emphasis on reducing "net" emissions than "gross" emissions.

77 The new plan has a greater reliance on new technology (particularly in Agriculture) carbon removals (via forestry and other means) compared to the initial plan.

78 However, there are several key strategies for reducing gross emissions within the second emissions reduction plan, with relevance to urban areas. These include the following:

- Increasing renewable energy by reducing the consenting burden through Electrify NZ
- Targeting 10,000 public EV chargers by 2030
- Investing in resource recovery through the Waste Minimisation Fund
- Improving organic waste and landfill gas capture
- Improving public transport
- Enabling heavy vehicle decarbonisation.

[7] https://environment.govt.nz/what-government-is-doing/areas-of-work/climate-change/emissions-reduction-plan/
[8] https://environment.govt.nz/publications/new-zealands-second-emissions-reduction-plan/