



Greenhouse Gas Assessment

GEMCO Excess Water Disposal

GEMCO

24 January 2025

→ **The Power of Commitment**

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Executive summary

As part of the referral for the GEMCO Excess Water Disposal project (the Project) commissioned by GEMCO a greenhouse gas (GHG) emissions inventory was prepared in accordance with the *National Greenhouse Gas and Energy Reporting Act 2007* (NGER Act) and other relevant standards. The inventory is based on the annual emissions for the life of the Project.

Scope 1, Scope 2 and Scope 3 emissions have been estimated for the construction, operational and decommissioning phases of the project and are expressed in terms of equivalent carbon dioxide (CO₂e).

Emissions for the construction of the Project from NH2 to the port in total are estimated to be 62.3 kt CO₂e, comprising 11.5 kt CO₂e of Scope 1 emissions (direct GHG emissions) and 50.81 kt CO₂e of Scope 3 emissions (indirect GHG emissions) (Table ES1). Operational emissions are estimated to be 12 kt CO₂e total per year of operation, and decommissioning emissions are estimated to be 10.5 kt CO₂e for one year. For all Project phases, Scope 2 - Grid electricity consumption, it was assumed that there was no connection to grid electricity, therefore the emissions are zero. Emissions for the Project are summarised below.

Table ES 1 GEMCO Excess Water Disposal Project total Greenhouse Gas Emissions Summary

Project phase	Duration	Emissions (t CO ₂ e)				
		Scope 1	Scope 2	Scope 3	Total	Total per year
Construction phase for NH2 to ocean outfall*	1 year	11,535	0	50,812	62,346	62,346
Operational phase *	Annual	9,858	0	2,438	-	12,296
Decommissioning*	1 year	7,386	0	4,801	12,187	12,187

Annual emissions for the Project are negligible compared to annual emissions in Northern Territory and Australia, at 16.7 Mt CO₂e and 432.6 Mt CO₂e in 2022, respectively¹.

A number of opportunities have been identified to reduce the Project emissions, including the use of a biodiesel blend for both stationery equipment and vehicles, and purchasing renewable energy for the operation of the NH2 pump for the pipeline. Implementing these emissions reduction initiatives could result in a reduction in construction emissions and cost savings.

This emissions inventory and GHG management plan is based on information available at the time of this referral and is to be updated as the Project progresses through the detailed design, construction, and operational phases, as more information becomes available.

This report is subject to, and must be read in conjunction with, the limitations set out in Section 3.2 and the assumptions and qualifications contained throughout the report.

¹ State and Territory GHG inventories 2022 – Australia’s National Greenhouse Accounts

Abbreviations and acronyms

Abbreviation	Description
AS	Australian Standard
AFNO	Ammonium nitrate/fuel oil
BOM	Bureau of Meteorology
CH ₄	Methane
CO ₂	Carbon dioxide
CO ₂ e	Carbon Dioxide Equivalent
EF	Emissions factor
EPA	Environmental Protection Authority (NT)
EP Act	<i>Environmental Project Act 2019</i>
GEMCO	Groote Eylandt Mining Company Pty Ltd
GHG	Greenhouse gas
GHG Protocol	Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard
GL	Gigalitres
GWP	Global warming potential
ha	Hectares
IPCC	Intergovernmental Panel on Climate Change
kL	Kilolitre
kt	Kilotonne
M	Mega
MAT	Mean annual temperature
ML	Megalitre
MMP	Mining Management Plan
MPa	Megapascal
Mt	Megatonne
Mtpa	Million tonnes of product per annum
N ₂ O	Nitrous oxide
NDC	Nationally determined contributions
NGA	National Greenhouse Accounts
NGER	National Greenhouse Gas and Energy Reporting
NGER Act	<i>National Greenhouse and Energy Reporting Act 2007</i>
NT	Northern Territory
pa	Per annum
SCM	Supplementary cementitious materials
SF ₆	Sulphur hexafluoride
TAGG	Transport Authorities Greenhouse Group
t	Tonnes
the Port	Milner Bay Port Facility
the Project	Excess Water Disposal project

Abbreviation	Description
TOR	Terms of Reference
v	Volt
Wh	Watt-hour
Y	Year

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1. Introduction

1.1 Project background

Groote Eylandt Mining Company Pty Ltd (GEMCO) operates an open cut, strip-mining operation, on Groote Eylandt, in the Gulf of Carpentaria in Northern Territory (NT). The existing operation mines manganese ore by open-cut methods before processing the ore at an on-site facility. Manganese is then transported by road train to GEMCO's Milner Bay Port Facility (the Port) (Figure 1).

To access the manganese ore, existing vegetation is cleared, topsoil and overburden is removed, forming mine pits (quarries). As mining intersects aquifers and due to rainfall and runoff in some areas, water naturally collects within the quarries. The water is extracted, and a portion is typically used during operations with surplus water transferred between quarries and released to bushland in accordance with the existing Mining Management Plan (MMP).

Deeper mining has resulted in greater groundwater intrusion within the quarries while progression of mining towards the coast has resulted in an increase in salinity within quarry water in some areas. Mine models indicate dewatering volumes could reach up to 100 gegalitres (GL) per annum (pa) in the near future. To address this increase in quantity and salinity a marine outfall project (the Excess Water Disposal project (herein the Project)) is being evaluated to allow the discharge of up to 80 GL pa of water from the quarries.

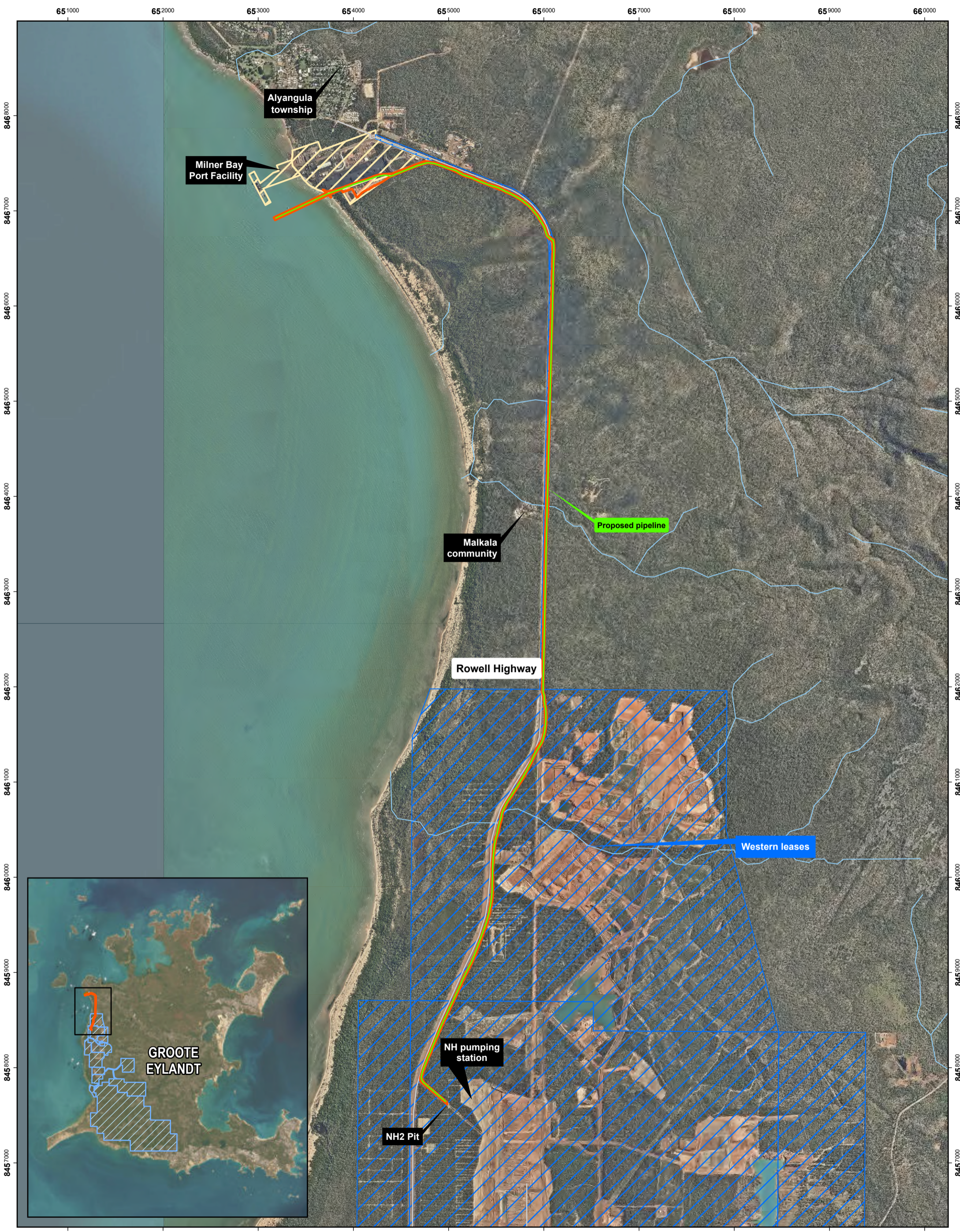
GEMCO is currently in the Feasibility Stage (FS) of the Project, which will include pipeline and pumping infrastructure from an existing northern quarry to a discharge point at the Port. The pipeline is planned to traverse adjacent to the Rowell Highway (road train haul route; Figure 1) and utilise areas of existing or historical disturbance as far as practical. A referral under the *Environment Protection Act 2019 (NT)* (EP Act) has been prepared to assess the potential impacts of the Project.

1.2 Purpose of this report

This Greenhouse Gas (GHG) desktop assessment report has been prepared to support the assessment of the Project impacts and forms part of the referral documentation. The purpose of this report is to an inventory of Project annual emissions for the life of the project, for each relevant GHG. Total emissions are expressed in 'CO₂ equivalent' terms for Scope 1, Scope 2 and Scope 3 emissions as per the National Greenhouse and Energy Reporting (NGER) scheme and Clean Energy Regulator. This report also identifies opportunities to reduce or maintain the GHG forecast without impacting GEMCO GHG operations. This is in line with the Northern Territory EPA's Objective to "Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050". For these emissions the following definitions apply:

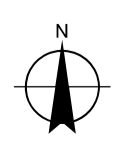
- 'Scope 1' means direct emissions of GHGs from sources within the boundary of the facility and as a result of the facility's activities (including emission from vegetation clearing).
- 'Scope 2' means emissions of GHGs from the production of electricity, heat, or steam that the facility will consume, but that are physically produced by another facility.
- 'Scope 3' means indirect emissions of GHGs generated in the wider community other than scope 2 emissions. Occurring as a consequence of the activities of a facility project but arise from sources not owned or controlled by that facility's business.

This report it is written to inform the planning and approvals process for the project, it is not a formal lifecycle assessment. Information in this report draws on best available estimates at the time of analysis and is to be revised as new data becomes available. However, this estimation of GHG emissions from the proposed construction and operations of the project helps in understanding the impacts and encourages consideration of opportunities to reduce emissions.



- Legend**
- Road
 - Stream
 - Proposed pipeline
 - ▨ Disturbance area
 - ▨ Special purpose lease
 - ▨ Lease boundaries

Paper Size ISO A3
 0 230 460 690 920
 Metres
 Map Projection: Transverse Mercator
 Horizontal Datum: GDA2020
 Grid: GDA2020 MGA Zone 53



South32 Group Operations Pty Ltd
 GEMCO Excess Water Disposal Project
 Greenhouse Gas Assessment Report

Project No. 12624084
 Revision No. A
 Date 29/11/2024

Locality plan

FIGURE 1

N:\AU\Brisbane\Projects\4412624084\GIS\Map\Working\12624084_GEMCO\12624084_GEMCO.aprx - 12624084_NVIA_601_LocalityPlan
 Print date: 29 Nov 2024 - 08:10

Data source: GHD: predicted mixing zone (2024); South32: Aerial photos (2023); Pipeline route (2024); GEMCO tenements (2024); Pipeline disturbance footprint (2024); South32/GHD: Special purpose lease (2024); GA: road (2024); NT gov: Stream (2024); World Imagery: Earthstar Geographics
 World Imagery: Maxar. Created by: mvandermerwe

1.3 Project spatial boundary

The Project spatial boundary (geographic area and definitions for this report is provided Table 1.

Table 1 Project spatial boundary

Term	Definition
Project	All aspects of the GEMCO Excess Water Disposal Project (excluding internal movement of water) including construction and operation.
Construction footprint	Area directly impacted by the Project through construction and operations as far as can be feasibly predicted.

1.4 Scope and limitations

This report has been prepared by GHD for GEMCO and may only be used and relied on by GEMCO for the purpose agreed between GHD and GEMCO as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than GEMCO arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. Site details established through information provided by GEMCO to GHD are assumed to be correct and reflect current site conditions at the time the information was provided and that previous studies used to inform the preparation of this document are accurate and reflect the site conditions at the time. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by GEMCO and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Legislative context

2.1 International framework

International guidelines applicable to the project include:

- Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report (2021)
- Paris Agreement under the United Nations Framework Convention on Climate Change (2016)
- Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (GHG Protocol) (World Business Council for Sustainable Development and World Resources Institute, 2015).

As Australia is party to the Paris Agreement and Kyoto Protocol, efforts must be made to halt the increase of global average temperatures and the Australian government has made a commitment to a 28 percent reduction of GHG emissions below 2005 levels by 2030. The Australian government has committed to net zero by 2050 (Nationally Determined Contributions (NDCs)). This includes:

- Reduce its GHG emissions:
 - 2015 NDC: committed to reduce emissions by 26 to 28 percent below 2005 levels by 2030
 - 2020 NDC update: affirmed the 2030 target
 - 2021 NDC update: committed to net zero 2050
- Track progress towards those commitments
- Report each year on Australia's GHG emission.

The Greenhouse Gas Protocol provides the basis of the *National Greenhouse and Energy Reporting Act 2007* (NGER Act) and is a framework for businesses and government to report GHG emissions.

2.2 Australian framework

Australian legislation and guidelines applicable to this GHG assessment include:

- NGER Act
- National Greenhouse and Energy Reporting (Measurement) Determination 2008
- National Greenhouse and Energy Reporting Regulations 2008
- National Greenhouse Accounts (NGA) Factors workbook, Commonwealth Department of Industry, Science, Energy and Resources 2021.

A summary of what is covered by the legislation is presented in Table 2.

Table 2 GHG legislation summary

Act/ Scheme	Description
NGER Act and Regulations	Provides for data accounting in relation to GHG emissions and energy consumption and production.
National Greenhouse and Energy Reporting (Measurement) Determination 2008	Provides methods and criteria for calculating GHG emissions and energy data under the NGER Act.
National Greenhouse Accounts	Provides methods and criteria for calculating GHG emissions.

These guidelines are considered representative of good practice GHG accounting in Australia and are applicable to the Project.

2.3 Northern Territory framework

The NT government has made a commitment to reach net zero by 2050. To achieve this, all sectors will need to contribute to meeting a net zero emissions target, recognising the level of emissions they release to the atmosphere and their varying opportunities and capacities to avoid and mitigate their emissions.

A range of policy and legislative provisions will be required to facilitate a transition to a low-carbon economy:

- Delivering the Climate Change Response: Towards 2050 A Three-Year Action Plan for NT Government.
- Development of an overarching Emissions Reduction Strategy for the entire NT economy.
- Greenhouse Gas Emissions Offsets Policy.
- Greenhouse Gas Emissions Management for New and Expanding Large Emitters.

The Greenhouse Gas Emissions Management for New and Expanding Large Emitters Guidelines clarifies the NT Government's minimum expectations for emissions management and how such requirements to manage emissions will be mandated through environmental authorisations. These guidelines also state that for national reporting purposes, Scope 3 emissions should be accounted for.

3. Methodology

3.1 Overview

This GHG Assessment has been prepared to estimate the GHG emissions for the proposed project and develop management opportunities to monitor and reduce GHG emissions. In undertaking this assessment, a data analysis and desktop review were performed.

The following tasks, shown below in Figure 2 have been completed as part of this GHG inventory assessment. The GHGs being assessed include carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), perfluorocarbons, hydrofluorocarbons and sulphur hexafluoride (SF₆), where relevant.

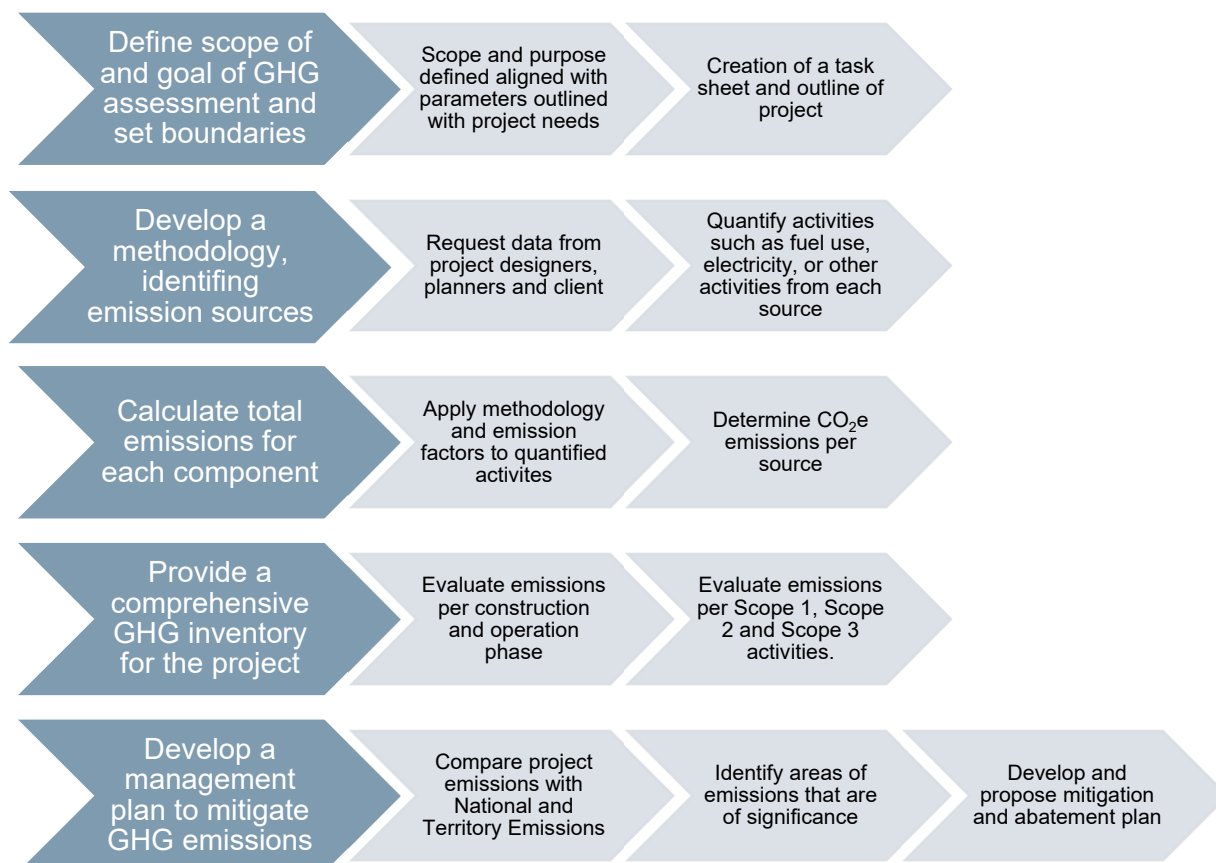


Figure 2 GHG Assessment and management plan approach

The data considered in the GHG assessment was sourced from project documents available at the time of writing. The emission factors used for this inventory were sourced primarily from the NGA Factors.

To estimate vegetation clearing related emissions and lost carbon sink, FullCAM modelling was used. The methodology required classification of the vegetation communities within the Construction footprint and the size of the area to be cleared.

Section 4 of this report provides detailed information on the inclusions, exclusions, and assumptions made within our calculations.

3.1.1 Greenhouse gases and global warming potential

The GHGs considered in this assessment and the corresponding global warming potential (GWP) for each gas are listed in Table 3. GWP is a metric used to quantify and communicate the relative contributions of different substances to climate change over a given time horizon.

GWP accounts for the radiative efficiencies of various gases and their lifetimes in the atmosphere, allowing for the impacts of individual gases on global climate change to be compared relative to those for the reference gas carbon dioxide. In this assessment, the GWPs from the NGER Regulations 2008, updated from 1 July 2021, were used. These are reflective of radiative forcing over a 100-year time horizon.

Table 3 Select greenhouse gases and 100-year global warming potential

Greenhouse gas	Global Warming Potential
Carbon dioxide (CO ₂)	1
Methane (CH ₄)	28
Nitrous oxide (N ₂ O)	265

3.2 Scope and limitations of assessment

3.2.1 Scope

This inventory comprises Scopes 1, 2 and 3 emissions associated with project works, during both construction and operation as well as decommissioning of the Project as described in section 1.2.

A GHG assessment for each component of the Project was carried out.

The boundary of works associated with this assessment is:

- The construction of a 12km Pipeline from a northern quarry (NH2 quarry) to the Port facility including the ocean outfall
- Operation and maintenance phase
- Decommissioning phase

3.2.2 Limitations

The following limitations apply to the preparation of this assessment:

- Wherever possible, project design information was used to calculate GHG emissions, however, given the limited availability of information, a number of assumptions have been made as detailed in the sections below.
- As the Project progresses through the feasibility study, detailed design, construction and operational phases, this inventory is to be updated with more relevant information as it becomes available.
- The assessment was based on emission factors (EF) available at the time of the assessment and future changes in emission factors or GWP were not considered.
- Scope 3 estimates are based on industry averages rather than supplier-specific information. The activity data is limited in the early stages of the Project, therefore, the numbers used are based on the best information currently available; these could be expected to change, and any updates to these numbers would fall under a separate scope of work.

4. Emissions calculation

4.1 Emissions sources

The following sources of emissions have been considered in this assessment:

- Fuel consumption from on-site equipment and plant during construction
- Emissions associated with vegetation losses – fuel use, lost carbon sink and composting
- Fuel associated with electricity generation during construction activities
- Concrete batching
- Material inputs for construction activities
- Waste processing
- Potable water use and sewage
- Staff travel to and from site (flights and local land travel)
- Staff accommodation, facilities and offices
- Fuel use during operations
- Electricity use during operations (if any)
- Ongoing maintenance activities
- Scope 3 emissions (as defined by section 4.3)

There are additional emission sources that would be associated with the Project, such as expenditure on supporting services such as insurances, accounting services, etc. Estimates of activity data were not available, and they have therefore been incorporated by applying an uplift to the overall inventory.

4.2 Exclusions

The following items were excluded from the assessment as their contribution to the inventory is anticipated to be minor, not relevant, or outside of the scope:

- Emissions that are likely to be immaterial including:
 - Emissions associated with combustion of fuels used in minor quantities such as LPG, gasoline, solvents, oils, and greases.
 - Emissions associated with the leakage of hydrofluorocarbons. The project may use negligible quantities of hydrofluorocarbons for refrigeration and air conditioning during construction of the Project, however, these quantities would be negligible.
 - Emissions associated with minor quantities of acetylene welding gases.
 - Emissions from sulphur hexafluoride or perfluorocarbons – these substances are not proposed to be used or stored as part of the Project.

4.3 Assumptions

Consistent with financial and quantity estimation for projects, the calculations for GHG emissions are only as accurate as the information available. The estimations provided should not be relied upon more than the data which it was calculated from. High level assumptions for the Project overall inventory are described below in Table 4. These assumptions are listed in detail against the relevant emission in the GHG Inventory in Appendix A.

Table 4 GEMCO Excess Water Disposal Project overall assumptions

Parameter	Assumptions
Construction diesel consumption	– The construction methodology and timeline have been estimated based on information provided by GEMCO, relevant industry experience and assumptions detailed in Section 4.1.
Construction electricity	– We have assumed there is no third-party electricity consumption associated with construction.
Construction period	– The construction period, number of working days per week and the number of working hours per day have been determined from the Project Description.
Vegetation removal	– The biomass class has been determined using the methodology in FullCAM 2020 for the location of the Project. – Vegetation classifications, cleared areas and areas of inundation were informed by the Terrestrial Ecology Assessment report prepared for the referral.
Maintenance	– Diesel associated with maintenance of the Project has been assumed based on industry experience and relevant reference projects.

Detailed assumptions relating to the GHG emissions inventory of the Project are presented below in Table 5.

Table 5 Greenhouse gas assessment assumptions

Parameter	Assumptions
Construction Phase – Scope 1	
Construction diesel	<ul style="list-style-type: none"> – Diesel used during construction was based on the information provided by GEMCO in <i>J24019-013-SCH-RevA GHG Estimates 240430 with DS Fuel Tab.</i> – Mobilisation fuel included: <ul style="list-style-type: none"> • Pipes - on Road Perth to Darwin • Load pipe in Perth / unload and place in containers in Darwin • Misc items - on Road Perth to Darwin • Pipes - on Barge - Darwin to Groote E • Pipe - Groote E; Port to Site • Misc Items - Groote E; Port to Site • Equipment for unloading • Equipment - on Barge - Darwin to Groote E – Plant fuel burn included activities of: <ul style="list-style-type: none"> • Client Project Management Team - External Project (NH2 - Port) • Civils - External Project (NH2 - Port) • Mechanical, Piping & Structural (MPS) - External Project (NH2 - Port) • Electrical, Instrumentation & Controls (EIC) - External Project (NH2 - Port) • Marine Works - External Project (NH2 - Port) – For plant including: <ul style="list-style-type: none"> • Light Vehicle • CAT 825 Soil Compactor • CAT 345 (50t) Excavator • CAT 14H Grader • Tipper truck • Water truck / agi truck • Service Truck • CAT D7 Dozer • Flat Bed Truck • CAT 986 Loader • Manitou • Franna

Parameter	Assumptions										
	<ul style="list-style-type: none"> • McElroy Trackstar 1200 • Leibher 100t crane • Leibher LRB 355 pilling rig • Barge 										
Vegetation removal – diesel for clearing and lost carbon sink	<ul style="list-style-type: none"> – Corridor width as described in <i>J24019-Rev2-SK101 to SK108 Prelim clearing extents plans</i> – Vegetation clearing types as detailed in MP-288 GEMCO Dewatering Alignment - Project Disturbance and Alignment (IMAGE) (2024-0806) (3).pdf <table border="1"> <thead> <tr> <th>Proposed Clearing Areas</th> <th>Sum of area (ha)</th> </tr> </thead> <tbody> <tr> <td>New Clearing Area</td> <td>7.90</td> </tr> <tr> <td>On-lease Regrowth Clearing (TBC)</td> <td>1.98</td> </tr> <tr> <td>Off-lease Regrowth Clearing (TBC)</td> <td>0.53</td> </tr> <tr> <td>Grand Total</td> <td>10.42</td> </tr> </tbody> </table>	Proposed Clearing Areas	Sum of area (ha)	New Clearing Area	7.90	On-lease Regrowth Clearing (TBC)	1.98	Off-lease Regrowth Clearing (TBC)	0.53	Grand Total	10.42
Proposed Clearing Areas	Sum of area (ha)										
New Clearing Area	7.90										
On-lease Regrowth Clearing (TBC)	1.98										
Off-lease Regrowth Clearing (TBC)	0.53										
Grand Total	10.42										
Concrete batching plant	<ul style="list-style-type: none"> – It was assumed that all concrete batching will occur on site using a concrete batching plant. – The total quantity of concrete was determined as 1,801 t (based on the information provided by GEMCO). – Concrete tanks were estimated by GHD and included 154 t of concrete. – The batching plant emissions were calculated using an emission factor of 242 t CO₂e/t concrete produced, sourced from the ISCA IS materials calculator v2 - LCI v2017. – Excludes compaction of ground or laying sand etc first. 										
Transport of materials	<ul style="list-style-type: none"> – Diesel used during transport was based on the information provided by GEMCO in <i>J24019-013-SCH-RevA GHG Estimates 240430 with DS Fuel Tab.</i> 										
Staff local land travel	<ul style="list-style-type: none"> – It is assumed that this is already covered by construction activities, with the airport next to accommodation/project, the net impact is negligible. 										
Staff accommodation	<ul style="list-style-type: none"> – To be estimated based on staff numbers and personal electricity consumption per day to convert to equivalent diesel consumption which was determined as 0.19 kg CO₂e/\$. – Water supply and wastewater treatment <ul style="list-style-type: none"> • Staff consumption only. Excludes water required for dust suppression (covered in Construction Phase - Scope 3). – Accommodation <ul style="list-style-type: none"> • Based on estimated diesel consumption to generate electricity. Was estimated based on staff numbers and personal electricity consumption per day to convert to equivalent diesel consumption which was determined as 0.19 kg CO₂e/\$. – Catering <ul style="list-style-type: none"> • Assumed catering expenditure per person per day of \$45 (higher EF due to flying everything in accounted for by higher cost of food). 										
Construction Phase – Scope 2											
Scope 2 - Grid electricity consumption	<ul style="list-style-type: none"> – It is assumed that there is no connection to grid electricity during construction, therefore the consumption is zero. 										
Construction Phase – Scope 3											
Material inputs	<ul style="list-style-type: none"> – As per the information provided by GEMCO in <i>J24019-013-SCH-RevA GHG Estimates 240430 with DS Fuel Tab.</i> 										
Waste production (recycling and landfill)	<ul style="list-style-type: none"> – Assumptions based on average waste processing from NGER Accounts factors of 0.2 t CO₂e/t as a Scope 3 emission factor. 										
Potable water and sewage	<ul style="list-style-type: none"> – To be estimated based on staff members usage of L per person per day. – Emission factor from <i>Transport Authorities Greenhouse Group (TAGG), 2013, Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects</i>, wastewater per person, has been used. – Mine water, not potable water, is assumed to be used for dust suppression so is excluded from this calculation. 										

Parameter	Assumptions																				
Staff return flights (chartered and commercial)	<ul style="list-style-type: none"> – To be estimated based on staff numbers. – Chartered flights would come from Cairns or Darwin to Groote Eylandt. – Commercial flights would come from Perth or Brisbane to Cairns or Darwin. – Location of staff is assumed 60% from Perth/Brisbane and 40% from Darwin/Cairns. 																				
Staff local land travel	– It is assumed that this is already covered by construction activities, with the airport next to accommodation/project, the net impact is zero.																				
Services expenditure (OE, insurance, etc.)	– An estimate of this could not be provided, therefore it has been covered with an uplift of 5%.																				
Catering	<ul style="list-style-type: none"> – To be estimated based on staff numbers. – A higher EF will be associated due to flying food to site. – Catering expenditure per person per day is assumed to be \$45. 																				
Operational Phase – Scope 1																					
Fuel Consumption (NH2 pump BAU)	– Assumes 9,432L of diesel per day based on genset performance of 164.8 L/h at 75% load.																				
Operational Phase – Scope 2																					
Grid electricity consumption	– It is assumed that there is no connection to grid electricity during operation, therefore the consumption is zero.																				
Operational Phase – Scope 3																					
Maintenance	<ul style="list-style-type: none"> – Consumables of 424L/year of oil and grease. – Flights of 24 return trips between Cairns and Darwin. – Maintenance staff local land travel is 420km/yr. 																				
Decommission Phase – Scope 1																					
Construction diesel	– Assumed to be the same as the construction phase as no other information is available.																				
Vegetation removal – diesel for clearing and lost carbon sink	– While vegetation would regrow and sequester carbon within the project footprint. This has been excluded as there are no details on the type of vegetation to be planted.																				
Decommission Phase – Scope 2																					
Grid electricity consumption	– It is assumed that there is no connection to grid electricity during operation, therefore the consumption is zero.																				
Decommission Phase – Scope 3																					
Waste Processing	<p>The following has been assumed for those items with embodied carbon in the construction phase:</p> <table border="1"> <thead> <tr> <th>Item</th> <th>Assumption</th> </tr> </thead> <tbody> <tr> <td>DN1000 PN10 PE100 co-extruded white HDPE</td> <td>Recycling/landfill</td> </tr> <tr> <td>DN1400 PN10 PE100</td> <td>Recycling/landfill</td> </tr> <tr> <td>Precast concrete tank - 20 kL</td> <td>Reused as tank</td> </tr> <tr> <td>Precast concrete tank - 576 kL</td> <td>Reused as tank</td> </tr> <tr> <td>Pipe concrete collar weights - concrete collars</td> <td>Landfill</td> </tr> <tr> <td>Pipe concrete collar weights - concrete bases</td> <td>Landfill</td> </tr> <tr> <td>Pipe concrete collar weights - SS2507 stainless bolts</td> <td>Landfill</td> </tr> <tr> <td>Outfall tank location - solar powered skid</td> <td>Reused for similar purpose</td> </tr> <tr> <td>Rock for back-filling wave-zone at port</td> <td>Left in situ or reshaped</td> </tr> </tbody> </table>	Item	Assumption	DN1000 PN10 PE100 co-extruded white HDPE	Recycling/landfill	DN1400 PN10 PE100	Recycling/landfill	Precast concrete tank - 20 kL	Reused as tank	Precast concrete tank - 576 kL	Reused as tank	Pipe concrete collar weights - concrete collars	Landfill	Pipe concrete collar weights - concrete bases	Landfill	Pipe concrete collar weights - SS2507 stainless bolts	Landfill	Outfall tank location - solar powered skid	Reused for similar purpose	Rock for back-filling wave-zone at port	Left in situ or reshaped
Item	Assumption																				
DN1000 PN10 PE100 co-extruded white HDPE	Recycling/landfill																				
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Precast concrete tank - 20 kL	Reused as tank																				
Precast concrete tank - 576 kL	Reused as tank																				
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Pipe concrete collar weights - concrete bases	Landfill																				
Pipe concrete collar weights - SS2507 stainless bolts	Landfill																				
Outfall tank location - solar powered skid	Reused for similar purpose																				
Rock for back-filling wave-zone at port	Left in situ or reshaped																				
Transport of materials	– Assumed to be the same as the construction phase as no other information is available.																				
Staff local land travel	– Assumed to be the same as the construction phase as no other information is available.																				
Staff accommodation	– Assumed to be the same as the construction phase as no other information is available.																				

5. Emission Inventory

Results of this GHG emissions assessment are presented in the following sections.

5.1 GEMCO Excess Water Disposal Project Total

Table 6 below summarises the total emissions associated with the Project works for the construction from NH2 to the port, operational, and decommissioning phases (Source: *J24019-013-SCH-RevA GHG Estimates 240430 with DS Fuel Tab.xlsx*).

Table 6 GHG emissions summary for the overall GEMCO Excess Water Disposal Project

Project phase	Duration	Emissions (t CO ₂ e)				
		Scope 1	Scope 2	Scope 3	Total	Total per year
Construction phase for NH2 to the port*	1 year	11,535	0	50,812	62,346	62,346
Operational phase *	Annual	9,858	0	2,438	-	12,296
Decommissioning*	1 year	7,386	0	4,801	12,187	12,187

*an uplift of 5% applied to cover additional emissions sources associated with the Project

5.1.1 Construction phase emissions estimation

Emissions associated with the construction of the Project from NH2 to the port are presented below in Table 7. The total GHG emissions during construction are estimated at 62,346 t CO₂e over one year. Emissions embodied in the pipe materials are the largest source of emissions during the construction phase, accounting for ~70%. This is followed by emissions from diesel burnt by mobile plant and lost carbon sink due to vegetation clearing ~15%.

Table 7 Summary of construction phase emissions

Activity	Activity data	Unit	Emissions (t CO ₂ e)			
			Scope 1	Scope 2	Scope 3	Total
DN1000 PN10 PE100 co-extruded white HDPE	25000.2	m	-	-	41,645	41,645
DN1400 PN10 PE100	1059.75	m	-	-	3,468	3,468
Precast concrete tank - 20 kL	12	t	-	-	3	3
Precast concrete tank - 576 kL	142	t	-	-	34	34
Pipe concrete collar weights - concrete collars	1,159	t	-	-	280	280
Pipe concrete collar weights - concrete bases	488	m ³	-	-	283	283
Pipe concrete collar weights - SS2507 stainless bolts	120	kg	-	-	1	1
Outfall tank location - solar powered skid	76,978	\$	-	-	15	15
Rock for back-filling wave-zone at port	6,280	m ³	-	-	183	183
Loss from vegetation clearing (carbon content only)	10.42	ha	3,951	-	-	3,951
Fuel consumed mobilising inputs to site	687,503	L	1,863	-	459	2,322
Fuel consumed on site	1,880,991	L	5,097	-	1,256	6,353
Waste processing	540.48	m ³	-	-	42	42
Staff return flights - Charter - Cairns or Darwin to Groote Eylandt	760	pax	-	-	262	262

Staff return flights - Commercial - Perth or Brisbane to Cairns or Darwin	529	pax	-	-	439	439
Water supply and wastewater treatment	470	person months	-	-	2	2
Accommodation	470	person months	75	-	18	93
Catering	470	person months	-	-	0.3	0.3
Sub-Total			10,986	0	48,392	59,378
Uplift (5%)			549	-	2420	2,969
TOTAL			11,535	-	50,812	62,346

5.1.2 Operations and maintenance phase annual emissions estimation

Table 8 provides an estimation of emissions occurring as a result of operations annually. The largest contributors to operational emissions are from fuel consumed for powering the pump (99%).

Table 8 Summary of operational phase annual emissions

Activity	Quantity	Units	GHG Emissions (t CO ₂ e)			
			Scope 1	Scope 2	Scope 3	Total
Fuel consumed on site (NH2 pump BAU)	3,464,755	L/year	9,389	-	2,314	11,702
Maintenance staff return flights - Charter - Cairns or Darwin to Groote Eylandt	24	pax/year	-	-	8	8
Maintenance staff local land travel	420	km/year	0.1	-	0.02	0.1
Hydraulic oil and engine oil	424	L/year	0.2	-	0.3	0.5
Greases	1.92	L/year	<0.01	-	<0.01	<0.01
Sub-Total			9,389	0	2,322	11,711
Uplift (5%)			469	-	116	586
TOTAL			9,858	0	2,438	12,296

*Annual emissions for the operation contribution

5.1.3 Decommissioning emissions estimation

Table 9 provides an estimation of emissions occurring as a result of decommissioning the Project. The largest contributors to decommissioning emissions are from fuels usage, which attributes to 86% of total emissions.

Due to no input data the decommissioning phase emission estimations were based off the construction phase estimations where relevant. Waste process was amended to include the assumed increased waste from landfill of certain items with embodied carbon.

Table 9 Summary of decommissioning phase emissions

Activity	Activity data	Unit	Emissions (t CO ₂ e)			
			Scope 1	Scope 2	Scope 3	Total
Fuel consumed mobilising inputs to site	687,503	L	1,863	-	459	2,322
Fuel consumed on site	1,880,991	L	5,097	-	1,256	6,353
Waste processing	10,677	t	-	-	2,135	2,135
Staff return flights - Charter - Cairns or Darwin to Groote Eylandt	760	pax	-	-	262	262
Staff return flights - Commercial - Perth or Brisbane to Cairns or Darwin	529	pax	-	-	439	439
Water supply and wastewater treatment	470	person months	-	-	2	2
Accommodation	470	person months	75	-	18	93
Catering	470	person months	-	-	0.3	0.3
Sub-Total			7,034	0	4,572	11,606
Uplift (5%)			351		229	580
TOTAL			7,386	0	4,801	12,187

6. Emission Reduction Opportunities

The Project emissions total 85,138 t CO₂e which at an assumed carbon price of \$41² would require \$3,490,662 to offset and \$504,163 annually. Should GEMCO wish to offset residual emissions from the Project we have listed some potential emission reduction opportunities in Table 10 which could be compared against the offset price to determine value. We have catered these opportunities to match the Project specific emission categories in an attempt to provide high level value estimation.

Table 10 GEMCO Project emission reduction opportunities

Emissions category	Percentage of project emissions	Opportunity description	Costs to implement	Emissions saved	Costs saved*
Fuels	22%	Investigating lower-emission renewable diesel and biodiesel sources in place of diesel (Includes all fuels burnt onsite including mobilisation)	Additional cost of biofuel vs regular fuel	3-10% or 872 to 2,905 tons	\$29,633 to \$98,778
		Using renewables in place of operational phase diesel pump for water	Cost of construction and maintenance of solar or wind array	60-90% or 4,681 to 7,021 tons	\$159,150 to \$238,725
Reduced clearing areas	~6-7%	The project has already reduced clearing footprint required to minimise impacts on vegetation. This has also led to a reduction of Scope 1 emissions for the project.	Cost of redesign of pipeline alignment	19%** Or 747 tons	\$30,633

* Based on price of carbon offset² and assuming GEMCO is mandated to offset this amount if not mitigated.

** % of emissions associated with vegetation clearing

² Internal GEMCO carbon price of ton/ACCU, current at the time of assessment

7. Summary and conclusions

7.1 Total Project emissions estimate

The Project will generate an estimated total 62,346 t CO₂e emissions from NH2 to the port construction plus 12,296 t CO₂e per year of operation and 12,187 t CO₂e per year of decommissioning. The highest estimated annual scope 1 emissions will be less than 100,000 tCO₂e generated during the second year of construction when vegetation and land use change occurs Table 11.

Based on this estimate, the Project does not exceed the 'NT Large Emitters Policy's Industrial project threshold' or the 'Land use project threshold' and as such would not be required to meet the obligations under the *Large Emitters Policy (2021)* (Table 11). However, as GEMCO reports under NGER, these estimates should be updated annually to reflect the actual emissions during both the construction and operational phases.

Table 11 NT Large Emitters Policy thresholds for industrial projects

NT Large Emitters Policy	Construction (1 year)	Operation (annual)	Decommission (1 year)	Max Year
<i>Industrial project threshold: <100,000 tCO₂e scope 1 emissions in any one financial year</i>	62,346	12,296	12,187	62,346
<i>Land use project threshold: <500,000 tCO₂e scope 1 emissions from a single land clearing action</i>	3,951	-	-	3,951

7.2 Contribution to Net Zero by 2050 Policy

The annual GHG emissions in NT and Australia were reported to be 16.7 Mt CO₂e and 432.6 Mt CO₂e in 2022 respectively³. The Australian and state governments have committed to decarbonisation targets of net zero by 2050. The Project's emissions relative to Territory and National reported numbers is 62,346 t CO₂e + 12,297 t CO₂e per year of operation which is 1% and <1% respectively. Section 6 details how the project has reduced its emissions by 6-7% from minimising the vegetation clearing through alteration of the pipeline alignment. There is further reduction of the total project emissions available for using lower carbon fuels and using solar rather than diesel generators. To meet net zero by 2050 the project should investigate these opportunities further.

³ State and Territory GHG inventories 2022 – Australia's National Greenhouse Accounts

8. References

Commonwealth of Australia (2020), *National Greenhouse and Energy Reporting (Measurement) Determination 2008*, Compilation No. 12, July 2020

IPCC (2019), Refinement to the 2006 Guidelines for National Greenhouse Gas Inventories Volume 4 Chapter 7 for 'flooded land remaining flooded land'

Nazari, A and Sanjayan, J.G. (2017), Handbook of Low Carbon Concrete

Appendix A

GHG Inventory

Guide to tabs

Inventory - by GHD

Emission Factors - Collated by GHD

Activity data provided by the client

Assumptions and calculations by GHD

Australian National Greenhouse Accounts Factors

Source: <https://www.dcceew.gov.au/climate-change/publications/national-greenhouse-accounts-factors>
Version: August 2023

Stationary combustion of liquid fuels

Table 8 Direct (Scope 1) and indirect (scope 3) emission factors for the consumption of liquid fuels, including certain petroleum based products for stationary energy purposes

Fuel combusted	Energy Content factor (GJ / kL)	Scope 1 Emission Factor (kg CO2-e/GJ)				Combined gases	Scope 3 Emission Factor (kg CO2-e /GJ)
		CO2	CH4	N2O			
Diesel oil	38.6	69.9	0.1	0.2	70.20	17.3	
Biodiesel	34.6	0.0	0.08	0.2	0.28 NE		
Renewable diesel	38.6	0.0	0.1	0.2	0.30 NE		
Petroleum based oils (other than pet	38.8	13.9	0	0	13.9	18.00	
Petroleum based greases	38.8	3.5	0	0	3.5	18.00	

Emissions from solid waste disposal to landfill

Table 16 Indirect (scope 3) waste emission factors for total waste disposed to landfill by broad waste stream category

Waste stream	Volume to mass conversion factor (t/m3)	Scope 3 emission factor (t CO2-e/t)
Construction and demolition waste	0.39	0.2

Emissions from wastewater handling (domestic and commercial)

Table 17 Emission factors by wastewater treatment type

Wastewater Treatment Method	Emission factors (t CO2-e per person)
Managed aerobic treatment	0
Unmanaged aerobic treatment	0.1229
Anaerobic digester/reactor	0.3276
Anaerobic lagoon shallow (<2 metres)	0.0819
Anaerobic lagoon deep (>2 metres)	0.327

DEFRA Factors

Source: <https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2023>
 Version: 28 June 2023

Flights inc. WTT

			Tab: "Business travel- air"				Tab: "WTT- business travel- air"	
			With RF				With RF	
Haul	Class	Unit	kg CO2e	kg CO2e of CO2 per unit	kg CO2e of CH4 per unit	kg CO2e of N2O per unit	kg CO2e	kg CO2e
Domestic, to/from UK	Average passenger	passenger.km	0.27258	0.27101	0.00022	0.00134	0.03350	0.30608
Short-haul, to/from UK [up to 3700km]	Average passenger	passenger.km	0.18592	0.18499	0.00001	0.00092	0.02286	0.208777
	Economy class	passenger.km	0.18287	0.18196	0.00001	0.00090	0.02249	0.205359
	Business class	passenger.km	0.27430	0.27294	0.00001	0.00135	0.03373	0.308033
Long-haul, to/from UK [over 3700km]	Average passenger	passenger.km	0.26128	0.25998	0.00001	0.00129	0.03213	0.293411
	Economy class	passenger.km	0.20011	0.19911	0.00001	0.00099	0.02461	0.224718
	Premium economy class	passenger.km	0.32016	0.31857	0.00001	0.00157	0.03937	0.359525
	Business class	passenger.km	0.58029	0.57741	0.00002	0.00285	0.07137	0.651657
	First class	passenger.km	0.80040	0.79643	0.00003	0.00394	0.09844	0.898843
International, to/from non-UK	Average passenger	passenger.km	0.17580	0.17493	0.00001	0.00086	0.02162	0.197424
	Economy class	passenger.km	0.13464	0.13397	0.00001	0.00067	0.01656	0.151203
	Premium economy class	passenger.km	0.21542	0.21435	0.00001	0.00106	0.02649	0.241909
	Business class	passenger.km	0.39044	0.38850	0.00002	0.00192	0.04802	0.438463
	First class	passenger.km	0.53854	0.53587	0.00002	0.00265	0.06623	0.604772

Cars (by size)

		Tab: "Passenger vehicles" Diesel				Tab: "WTT- pass vehs & travel- land" Diesel	
Type	Unit	kg CO2e	kg CO2e of CO2 per unit	kg CO2e of CH4 per unit	kg CO2e of N2O per unit	kg CO2e	kg CO2e
Small car	km	0.13931	0.13763	4.6368E-06	0.00167181	0.03392	
Medium car	km	0.16716	0.16548	4.6368E-06	0.00167181	0.04079	
Large car	km	0.20859	0.20691	4.6368E-06	0.00167181	0.051	
Average car	km	0.16983	0.16815	4.6368E-06	0.00167181	0.04145	

AusLCl Emissions Factors

Source: <https://www.auslci.com.au/index.php/EmissionFactors>

AusLCl published processes, v1.42, CN assumption, released May 2023
Water supply and wastewater treatment - Australia 1.8982835 kg CO₂-e/kL

IELab scope 3 GHG emission factors

We have been trying to get a licence for these, but there have been delays from the provider. If this isn't finalised by the time the report is finalised, we'll need to be careful about referencing.

Forecasted for 2021, adjusted for inflation from the 2018 base year.

Food & catering	0.198848 kg CO2-e/\$
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Industrial machinery and equipment	0.195343 kg CO2-e/\$
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EPiC Database 2019

Copied from Yusi's Emission Factors Excel

Category	Sub-category	Material / Item / Process	Brand	Model	Unit of Measurement (UoM)	Embodied Energy (MJ)	Embodied Water (L)	Carbon Factor (kg CO2 eq / UoM) Global warming (GWP100a)	Source
Plastics	HDPE	High-density polyethylene (HDPE) pipe	Generic	Generic	kg	135	130	5.6	http://doi.org/10.26188/5da5552e
Metals	Stainless	Stainless steel extruded	Generic	Generic	kg	155	138	11.8	http://doi.org/10.26188/5da557cc4

ISCA IS materials calculator v2 - LCI v2017

Copied from Yusi's Emission Factors Excel

Source: MM Carbon Portal (ISCA v2.0)

Category	Sub-category	Material / Item / Process	Brand	Model	Unit of Measurement (UoM)	Embodied Energy (MJ)	Embodied Water (L)	Carbon Factor (kg CO2 eq / UoM) Global warming (GWP100a)
Aggregate	Aggregate	Crushed Rock	Generic	Generic	t	0	0	10.899017
Concrete and plaster products	Concrete precast	Precast, 50MPa, 0 percent SCMs	Generic	Generic	t	0	0	242
Concrete and plaster products	Concrete insitu	Insitu, 50MPa, 0 SCMs	Generic	Generic	t	0	0	242

Construction Phase GHG Assessment Inputs

Quantity of Construction Materials

Description	Quantity	Unit	Rate	Amount	Sub-Totals
External Project (NH2 - Port)					
Water Pipelines - NH2 Dam to Ocean Outfall Tie-in Tank					\$ 28,431,892.88
2x DN1000 PN10 PE100 co-extruded white HDPE	25000.2	Ln.m	\$ 1,117.90	\$ 27,947,785.66	
DN1400 PN10 PE100 (to tie-in tank)	204	Ln.m	\$ 2,373.07	\$ 484,107.22	
Ocean Outfall Tie-in Tank					151420.9785
Mechanical - 20 kL, precast concrete tank	1	Sum	\$ 74,443.07	\$ 74,443.07	
Outfall tank location - solar powered skid	1	Ea	\$ 76,977.91	\$ 76,977.91	
Civil Works					\$ 779,578.29
Clearing & Grubbing	7521.21	m2	\$ 5.33	\$ 40,122.48	
Bulk Earthworks	675.95	m3	\$ 46.64	\$ 31,528.33	
ESC Measures at river/creek crossings	1	Lsum	256916.74	256916.74	
Major road crossings	1	No.	\$ 449,000.00	\$ 449,000.00	
Access Roads	23	m3	\$ 87.42	\$ 2,010.74	
Marine Outflow Pipeline & Infrastructure					\$ 20,724,294.53
DN1400 m PN10 PE100 (Outflow tie-in tank to marine discharge tank)	123.9	m	\$ 2,452.19	\$ 303,826.66	
Marine Mobilisation and Preliminaries (Crane, Marine equipment, piling rigs & site facilities)	1	item	\$ 5,842,385.79	\$ 5,842,385.79	
General dredging and backfill - wave zone - cross section when back-filling with rock (150 m)	6280.31	m3	\$ 1,674.50	\$ 10,516,400.09	
DN1400 m PN10 PE100 (marine outflow pipeline)	731.85	m	\$ 2,252.52	\$ 1,648,509.93	
Pressure pipeline - supply and install pipe concrete collar weights - 9.5 T concrete collar, 4 m3 concrete, 4x SS2507 stainless bolts, placed every 6 m	122	Sum	\$ 11,608.77	\$ 1,416,269.66	
Precast concrete tank (576 kL)	1	Sum	\$ 996,902.41	\$ 996,902.41	

GHD Inventory Comments

Included
 Included

Included.
 Concrete EFs are in terms of kg or m3; they are based on the MPa rating, and are impacted by SCM content. Steel reinforcement would be expected.
 Don't have information on compaction of ground, or laying sand etc first.
 Included.
 "Skid" means it can be moved by a forklift. Probably has pump, level monitoring, dosing, etc. Probably all steel and electronics.

Excluded.
 Could have sand or gravel as inputs. Assumed all material from site, no third party supply. All processing and transport covered by provided fuel activity data. No material inputs.
 Excluded.
 Could have sand or gravel as inputs. Assumed all material from site, no third party supply. All processing and transport covered by provided fuel activity data. No material inputs.
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 Excluded.
 Could have sand or gravel as inputs. Assumed all material from site, no third party supply. All processing and transport covered by provided fuel activity data. No material inputs.

Included

Excluded.
 Assumed nothing left on site other than items accounted for elsewhere.
 Included.
 Rock type and grade not specified. Source not specified, assumed from the island, but fuel consumption required for processing doesn't appear in client activity data.

Included

Included.
 Concrete EFs are in terms of kg or m3; they are based on the MPa rating, and are impacted by SCM content. Steel reinforcement would be expected.
 Don't have information on compaction of ground, or laying sand etc first.
 Included.
 Concrete EFs are in terms of kg or m3; they are based on the MPa rating, and are impacted by SCM content. Steel reinforcement would be expected.
 Don't have information on compaction of ground, or laying sand etc first.

Summary - 25 April 2024

Trip	Fuel Burnt
Pipes - on Road Perth to Darwin	317167 Litres
Load pipe in Perth / unload and place in containers in Darwin	18600 Litres
Misc items - on Road Perth to Darwin	15120 Litres
Pipes - on Barge - Darwin to Groote E	185842 Litres
Pipe - Groote E; Port to Site	18584 Litres
Misc Items - Groote E; Port to Site	720 Litres
Equipment for unloading	11470 Litres
Equipment - on Barge - Darwin to Groote E	120000 Litres
TOTAL: 687503 Litres	

General Assumptions for the below Analysis

40 Foot containers will be used from Darwin to Island

All containers are on back loads (both barges and trucks from site back to port)

Item to be Mobilised to Site	Qty	Unit	Assumption
DN1000	25000	lin.m	These will be transported in 11.8lin.m lengths
DN1400	1060	lin.m	These will be transported in 11.8lin.m lengths
Pipework and valves, tanks, concrete collars, floats etc	Various	-	These will be transported from Perth
Cranes, piling rigs etc	Various	-	These will be transported from Perth
Pontoons, walkways etc	Various	-	These will be transported from Darwin

Item to be Mobilised to Site	Assumption	No. of 40 Foot Containers Required	Assumption
DN1000	There will be 4 pipes in each 40 foot container	530	Each dumb barge will carry 50 40 foot container
DN1400	There will be 1 pipes in each 40 foot container	90	Each dumb barge will carry 50 40 foot container

Item to be Moved on Site	No. of 40 Foot Containers Required	Assumption	No. of Trips
DN1000	530	1 container = 1 round trip = 1 hour	530
DN1400	90	1 container = 1 round trip = 1 hour	90
All Misc items	N/A	1 round trip = 1 hour	24

Equipment for unloading at GTE Port	Assumption	Total Barges to unload	Assumption
37T forklift at Port	Forklift will burn 20L/hr	21	12 hours to unload each barge

Equipment for unloading on Site	Assumption	Total trailers to be unloaded	Assumption
Various	Fuel burn of 20L/hr	643	30 minutes per trailer

Miscellaneous Equipment and Materials to be Mobilised to Site	Assumption	Barge Fuel Burn
Cranes, tanks, piling rigs, concrete collars, pontoons, generators, pipe floats etc	This will take 8 dumb barges	120000 Litres burnt

Load pipe on trailers in Perth / unload pipe and place in containers in Darwin	Assumption	No. of trailers	Assumption
DN100 / DN1400	30 mins to load each trailer and 60 mins to unload and place in containers	620	Equipment used will burn 20L/hr

No. of Pipe Lengths	Assumption	No. of Triple Road Trains Required	Road train will burn 60L/hr for the 41 hours from Perth to Darwin so fuel usage will be;	Truck and single trailer will burn 30L/hr operating around Darwin so fuel usage will be;
2119	18 of these will fit on a triple road train	118	289550 Litres burnt	
90	8 of these will fit on a double road train	11	27616 Litres burnt	
N/A	Varios items will fit on 3 triple road trains	3	7380 Litres burnt	
N/A	Varios items will fit on 3 triple road trains	3	7380 Litres burnt	
N/A	Varios items will fit on 6 single trailers	0		360 Litres burnt

No. of Dumb Barges Required	Barge Fuel Burn	Litres Burnt
11	Each dumb barge trip burns 15000 Litres	158900 Litres burnt
2	Each dumb barge trip burns 15000 Litres	26943 Litres burnt

Assumption	Port to Site Fuel Burn
Each round trip burns 30 litres per hour	15890 Litres burnt
Each round trip burns 30 litres per hour	2694 Litres burnt
Each round trip burns 30 litres per hour	720 Litres burnt

Forklift Fuel Burn
5040 Litres burnt

Equipment Fuel Burn
6430 Litres burnt

Litres Burnt
18600 Litres burnt

Construction Phase GHG Assessment Inputs

Source: J24019-013-SCH-RevA GHG Estimates 240430 with DS Fuel Tab.xlsx
Excerpt: NH2 to the Port only, as per the RFI

Project Manning Estimates

Activity	Duration	Start	Finish	Equipment Resources	Period
					Activity Manning Estimate - External Project (NH2 - Port)
					Estimated Manning
Client Project Management Team - External Project (NH2 - Port)					
Client Management - External Project (NH2 - Port)	303	1-Feb-26	1-Dec-26	4 x light vehicles	10
Civils - External Project (NH2 - Port)					
Civil Management External Project Component	153	1-Mar-26	1-Aug-26	4 x light vehicles, service men	4
Site laydown pads (NH2)	20	18-Mar-26	7-Apr-26	Grader, 2 x Side tipper, excavator, compactor, water cart	6
Site laydown pads Port	20	17-Sep-25	7-Oct-25	Grader, 2 x Side tipper, excavator, compactor, water cart	6
NH2 - Port Pipeline Corridor Crossings	80	27-Apr-26	16-Jul-26	2 x Side tipper, 2 x Excavator, water cart, 2 x ground crew	6
NH2 - Port Pipeline Corridor Preparation	90	18-Mar-26	16-Jun-26	Grader, dozer, 1 x excavator, water cart, 2 x side tipper	6
NH2 - Pump Station Pad	51	18-Mar-26	8-May-26	Grader, 2 x Side tipper, excavator, compactor, water cart	6
Mechanical, Piping & Structural (MPS) - External Project (NH2 - Port)					
Mechanical Management	153	1-Apr-26	1-Sep-26	2 x light vehicles	2
NH2 - Port Pipeline string	100	27-Apr-26	5-Aug-26	2 x Flat-bed truck, 2 x manatu, 2 x traffic controlers, 2 x light vehicles	6
NH2 - Port Pipeline welding	100	27-Apr-26	5-Aug-26	2 x Macilroy poly welding machines, 1 x excavator 1 x ground crew	4
NH2 - Pump Station Fitout	16	30-Mar-26	15-Apr-26	1 x Macilroy poly welding machine 1 x excavator 2 x ground personnel	4
Electrical, Instrumentation & Controls (EIC) - External Project (NH2 - Port)					
NH2 Pump Station Fitout - External Project (NH2 - Port)	24	17-Apr-26	11-May-26	2 x Light vehicles, 1 x manatu, 4 x electricians, 1 x supervisor	6
Marine Works - External Project (NH2 - Port)					
Marine Management	6	18-Mar-26	1-Sep-26	4 x light vehicles	6
Offshore sheet piling and trenching	161	18-Mar-26	26-Aug-26	2 x pilling rig, 1 x barge, 2 x excavators, 1 x loader, 4 x tipper trucks	12
Onshore tank	105	18-Mar-26	1-Jul-26	1 x excavators, 1 x loader, 4 x ground crew, 1 x agi-truck, 1 x franna, 1 x 100t crane, 1 x welding machine	10

Project Flight Requirements Estimates

Activity	Duration	Start	Finish	Equipment Resources	Period
					Activity Flights Estimate - External Project (NH2 - Port)
Total No. Return Charter Flights (Cairns or Darwin to Groote Eylandt and Return) - External Project (NH2 - Port)					
Client PM Team				7/7 Rosters = 2 return trips per month per person	
Civil Team				2/1 Rosters = 1.5 return trips per month per person	
MPS Team				2/1 Rosters = 1.5 return trips per month per person	
EIS Team				2/1 Rosters = 1.5 return trips per month per person	
Marine Team				2/1 Rosters = 1.5 return trips per month per person	
Total No. Commercial Flights (Perth or Brisbane to Cairns or Darwin Return) - External Project (NH2 - Port)					
Client PM Team				75% of Client PM team travel on to Brisbane - 25% live locally Cairns or Darwin	
Civil Team				40% of Civil Team travel on to Brisbane or Perth - 60% recruited locally Cairns or Darwin	
MPS Team				40% of MPS Team travel on to Brisbane or Perth - 60% recruited locally Cairns or Darwin	
EIS Team				40% of EIS Team travel on to Brisbane or Perth - 60% recruited locally Cairns or Darwin	
Marine Team				100% of Marine Team Travel on to Brisbane or Perth	

Construction Fuel Requirements Estimate

Activity	Duration	Start	Finish	Equipment Resources	Period
					Activity Manning Estimate - External Project (NH2 - Port)
					Litres/month
Client Project Management Team - External Project (NH2 - Port)					
Client Management - External Project (NH2 - Port)	303	1-Feb-26	1-Dec-26	4 x light vehicles	7,200
Civils - External Project (NH2 - Port)					
Civil Management External Project Component	153	1-Mar-26	1-Aug-26	4 x light vehicles, 1 x service truck	11,232
Site laydown pads (NH2)	20	18-Mar-26	7-Apr-26	Grader, 2 x Side tipper, excavator, compactor, water cart	55,332
Site laydown pads Port	20	17-Sep-25	7-Oct-25	Grader, 2 x Side tipper, excavator, compactor, water cart	55,332
NH2 - Port Pipeline Corridor Crossings	80	27-Apr-26	16-Jul-26	2 x Side tipper, 2 x Excavator, water cart, 2 x ground crew	40,272
NH2 - Port Pipeline Corridor Preparation	90	18-Mar-26	16-Jun-26	Grader, dozer, 1 x excavator, water cart, 2 x side tipper	47,340
NH2 - Pump Station Pad	51	18-Mar-26	8-May-26	Grader, 2 x Side tipper, excavator, compactor, water cart	55,332
Mechanical, Piping & Structural (MPS) - External Project (NH2 - Port)					
Mechanical Management	153	1-Apr-26	1-Sep-26	2 x light vehicles	3,600
NH2 - Port Pipeline string	100	27-Apr-26	5-Aug-26	2 x Flat-bed truck, 2 x manatu, 2 x light vehicles, 2 x traffic controlers,	26,688
NH2 - Port Pipeline welding	100	27-Apr-26	5-Aug-26	2 x Macilroy poly welding machines, 1 x excavator 1 x ground crew	15,750
NH2 - Pump Station Fitout	16	30-Mar-26	15-Apr-26	1 x Macilroy poly welding machine 1 x excavator 2 x ground personnel	13,575
Electrical, Instrumentation & Controls (EIC) - External Project (NH2 - Port)					
NH2 Pump Station Fitout - External Project (NH2 - Port)	24	17-Apr-26	11-May-26	2 x Light vehicles, 1 x manatu, 4 x electricians, 1 x supervisor	3,600
Marine Works - External Project (NH2 - Port)					
Marine Management	6	18-Mar-26	1-Sep-26	4 x light vehicles	7,200
Offshore sheet piling and trenching	161	18-Mar-26	26-Aug-26	2 x pilling rig, 1 x barge, 2 x excavators, 1 x loader, 4 x tipper trucks	84,132
Onshore tank	105	18-Mar-26	1-Jul-26	1 x excavators, 1 x loader, 1 x agi-truck, 1 x franna, 1 x 100t crane, 1 x welding machine, 4 x ground crew	34,659

1-Jan-25	1-Feb-25	1-Mar-25	1-Apr-25	1-May-25	1-Jun-25	1-Jul-25	1-Aug-25	1-Sep-25	1-Oct-25	1-Nov-25	1-Dec-25	1-Jan-26	1-Feb-26	1-Mar-26	1-Apr-26	1-May-26	1-Jun-26	1-Jul-26	1-Aug-26	1-Sep-26	1-Oct-26	1-Nov-26	1-Dec-26	1-Jan-27	1-Feb-27
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1-Jan-25	1-Feb-25	1-Mar-25	1-Apr-25	1-May-25	1-Jun-25	1-Jul-25	1-Aug-25	1-Sep-25	1-Oct-25	1-Nov-25	1-Dec-25	1-Jan-26	1-Feb-26	1-Mar-26	1-Apr-26	1-May-26	1-Jun-26	1-Jul-26	1-Aug-26	1-Sep-26	1-Oct-26	1-Nov-26	1-Dec-26	1-Jan-27	1-Feb-27
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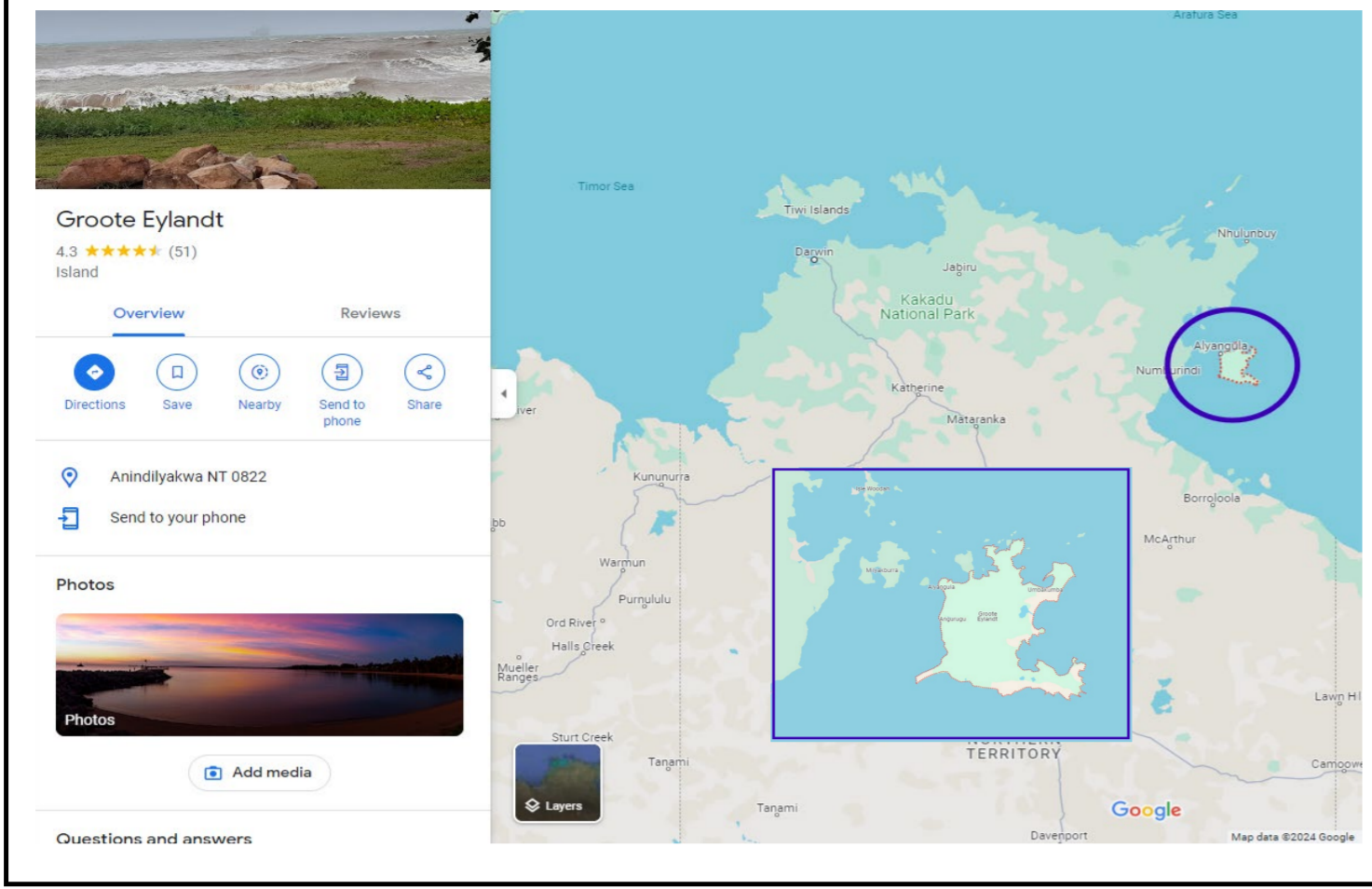
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0	0	0	0	0	0	0	0	0	0	0	0	0	0	34,659	34,659	34,659	34,659	34,659	0	0	0	0	0	0	

Source: [J24019-013-SCH-RevA GHG Estimates 240430 with DS Fuel Tab.xlsx](#)
Excerpt: NH2 to the Port only, as per the RFI

Pit Location	NH2	Note
Pump Motor Size	330kW	<i>WEG W22</i>
Pump Motor Qty	6	
Generator Size	Prime 50Hz 1100kVA	<i>Cat C32</i>
Generator Qty	3	
Fuel Consumption @ 75% Load (L/hr)	164.8	<i>Diesel</i>
Availability (%)	80%	
CO2 produced per litre of diesel fuel (kg)	2.7	

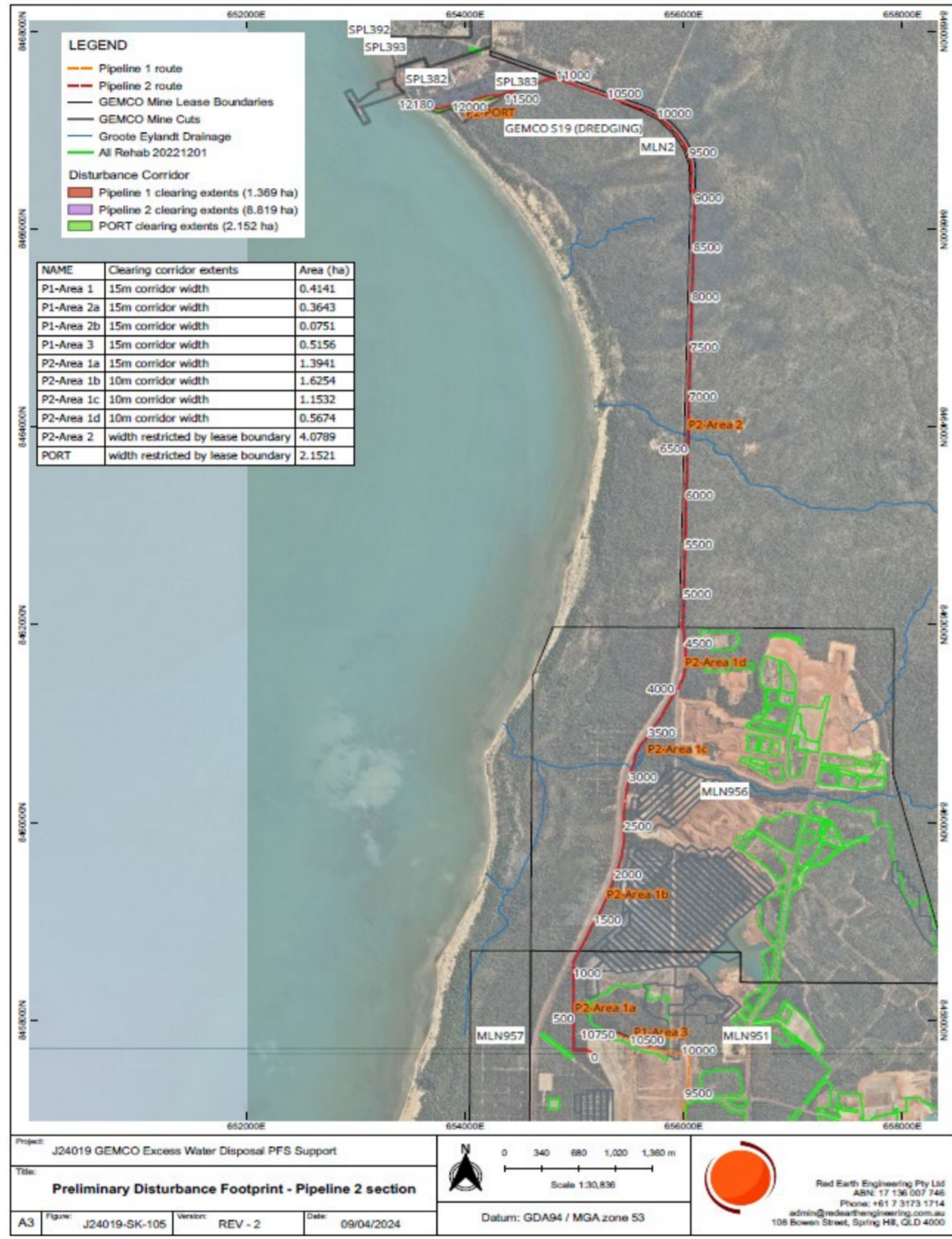
Fuel Consumed	NH2
Litres per Day	9,492
Litres per Week	66,630
Litres per Month	288,730
Litres per Year	3,464,755

Site Location: Groote Eylandt - Island off of the Northern Territory



Project Location: Pipeline 2 only

Source: [J24019-Rev2-SK101 to SK108 Prelim clearing extents plans.pdf](#)



Coordinates in Google Earth:

GEMCO Port -13.859923N, 136.421415E
 Boundary of P2 Area 2 -13.908077N, 136.443980E
 Southmost extent of pipeline -13.947029N, 136.435941E



Utility Availability

Reference

- <https://www.powerwater.com.au/about/regulation>
- <https://www.powerwater.com.au/about/what-we-do/our-plans-and-values/reports>
- [https://www.powerwater.com.au/_data/assets/pdf_file/0013/216040/Indigenous Essential Services Annual Report 2023.pdf](https://www.powerwater.com.au/_data/assets/pdf_file/0013/216040/Indigenous-Essential-Services-Annual-Report-2023.pdf)

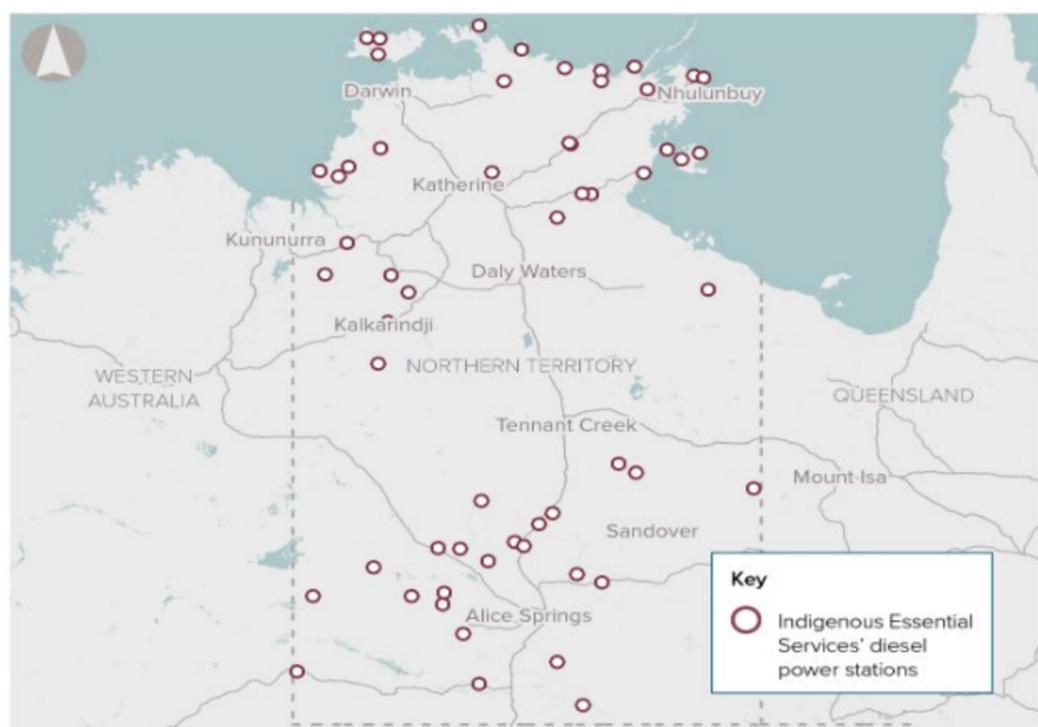
Power and Water is the sole electricity Network Service Provider for the Northern Territory. Power and Water publish Corporate Reports annually. The only mention of Groote Eylandt in these reports is in the Indigenous Essential Services annual report



This shows water supply and wastewater, and electricity supply.

Infrastructure Australia's map of the program identifies the electricity supply: diesel power stations.

<https://www.infrastructureaustralia.gov.au/map/northern-territory-remote-community-power-generation-program>



Power Supply

Source: <https://incal.cummins.com/www/literature/casehistories/F-1963-BHPBilton-en.pdf>
 The diesel gensets that power GEMCO are: Cummins QSK60

Source: <https://www.regency-generators.co.uk/kb/article/400>

For the Cummins QSK60-G4 HPI diesel engine
 The gross engine output at prime power is: 1730 kW

Percent of prime power	Power (kW)	Fuel Consumption (L/h)	Fuel Efficiency (L/kWh)
25%	432.5	114	0.263583815
50%	865	200	0.231213873
75%	1297.5	291	0.224277457
100%	1730	394	0.227745665

Average: 0.236705202

Electricity consumption per person

Source: <https://www.abcb.gov.au/resources/climate-zone-map>

The island is in Climate Zone 1

Source: <https://www.aer.gov.au/documents/frontier-economics-simple-electricity-and-gas-benchmarks-december-2020-june-2021>

Only NEM areas are included. Some residences would have PV, so this would be an underestimate.
 Taking QLD Climate Zone 1 results as indicative:

Household size	Unit	Summer	Consumption over 3 months			Spring	Annual Tc	Annual per pers	Monthly per person	Equivalent Monthly Diesel Consumption per person (L)
			Autumn	Winter						
5+	1 kWh		1,029	948	887	895	3,759	3,759	313	74
	2 kWh		1,721	1,516	1,309	1,387	5,933	2,966	247	59
	3 kWh		1,973	1,603	1,388	1,412	6,375	2,125	177	42
	4 kWh		2,690	2,237	1,914	2,178	9,019	2,255	188	44
5+	kWh		2,690	2,404	2,365	2,256	9,715	1,943	162	38

SS2507 stainless bolts

<https://www.sandmeyersteel.com/2507.html>

SS2507 Physical Properties:

Density: 7,800 kg/m³

Modelled as a cylinder

Tom Jeffery's assumption:

Length 0.1 m

Diameter 0.02 m

(overstated on length, understated by missing head and bolt)

Volume 3.14159E-05 m³

Mass 0.245044227 kg

Flight distance calculator: <https://www.airmilescalculator.com/>

Staff return flights - Charter - Cairns or Darwin to Groote Eylandt

	Trip Distance (km)	Trip Return Distance (km)	Assumed class	EF (kg CO2-e/ pax.km)	Trip Return Emissions (tCO2-e)
Cairns to Groote Eylandt	1048	2096	Economy	0.205359354	0.430433207
Darwin to Groote Eylandt	629	1258	Economy	0.205359354	0.258342068

Staff return flights - Commercial - Perth or Brisbane to Cairns or Darwin

	Trip Distance (km)	Trip Return Distance (km)	Assumed class	EF (kg CO2-e/ pax.km)	Trip Return Emissions (tCO2-e)
Perth to Cairns	3433	6866			
Perth to Darwin	2652	5304	Economy	0.205359354	1.089226016
Brisbane to Cairns	1391	2782	Economy	0.205359354	0.571309724
Brisbane to Darwin	2851	5702			

Definitions:

"DN" = "Diamere Nominal" i.e. nominal minimum outer diameter in mm.

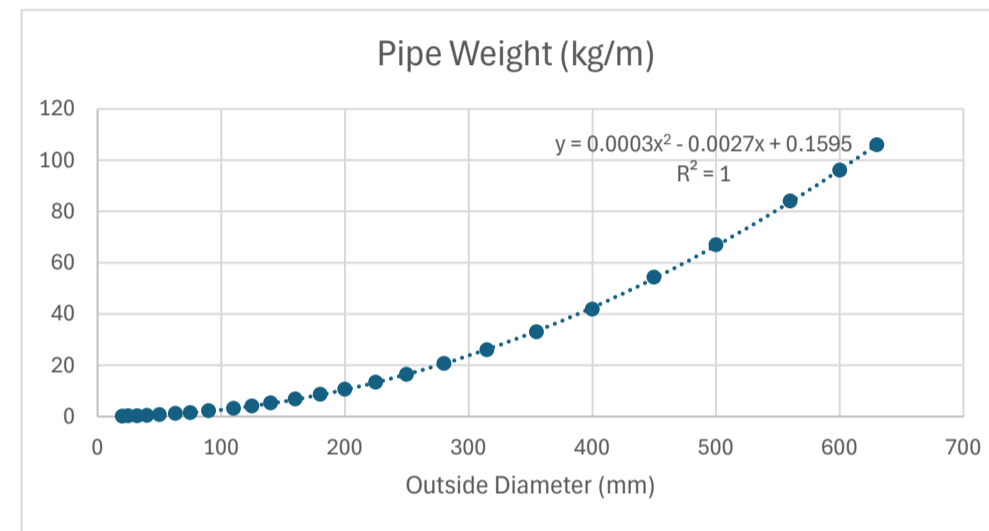
PN is pressure grade i.e. max pressure in bar.

PE100 is a grade of high-density polyethylene.

https://www.engineeringtoolbox.com/pe-pipe-weights-d_324.html

Pressure Rating: PN10

Outside Diameter (mm)	Pipe Weight (kg/m)
20	0.11
25	0.17
32	0.28
40	0.44
50	0.68
63	1.1
75	1.5
90	2.2
110	3.2
125	4.1
140	5.2
160	6.8
180	8.6
200	10.6
225	13.4
250	16.4
280	20.6
315	26
355	33
400	41.9
450	54.3
500	67
560	84
600	96
630	106
710	149.4725
800	189.9995
900	240.7295
1000	297.4595
1200	428.9195
1400	584.3795
1600	763.8395



maintenance activities

Estimates by Tom J

inputs	per machine	replace every x hrs	per month	Totals
construction				
				just need to times months by years of construction or operation
hydraulic oil (L)	220	2000	22	
engine oil (L)	20	300	13.33333	
grease (L)	2	2500	0.16	
flights			2	assume to darwin
Operation				
hydraulic oil (L)	220	2000	22	
engine oil (L)	20	300	13.33333	
grease (L)	2	2500	0.16	
flights			2	
Distance from airport to GEMCO port (km)			17.5	

Concrete tanks

Source: Estimates from Tom J

	576KL	20KL
volume needed	576	20 m3
radius	8.56	1.5 m
height	2.5	2.6 m
thickness	0.13	0.13 m
circumference	53.78407	9.424778 m
volume check	575.4895	18.37832 m3
area of base and top	230.1958	7.068583 m2
area of wall	134.4602	24.50442 m2
vol of concrete	47.40528	4.104491 m3
weight	141978.8	12295 kg
density	2995	2995.499 kg/m3

this one is 12.3ton in the specs

Available vegetation types in FullCAM 2020 for project area

Available Trees	27
Acacia Forest and Woodlands	
Acacia mangium	
Acacia Open Woodland	
Acacia Shrubland	
Callitris Forest and Woodlands	
Casuarina Forest and Woodland	
Chenopod Shrub; Samphire Shrub and Forbland	
Eucalyptus Low Open Forest	
Eucalyptus Open Forest	
Eucalyptus Open Woodland	
Eucalyptus Tall Open Forest	
Eucalyptus Woodland	
Heath	
Low Closed Forest and Closed Shrublands	
Mallee eucalypt species	
Mallee Woodland and Shrubland	
Mangrove; tidal mudflat; samphire and bare areas; claypan; sand; rock; salt lak	
Melaleuca Forest and Woodland	
Mixed species environmental planting	
Native Species Regeneration <500mm rainfall	
Native Species Regeneration >=500mm rainfall	
Other Forests and Woodlands	
Other Shrublands	
Pinus cambaea var. hondurensis	
Rainforest and vine thickets	
Tropical Eucalyptus woodlands/grasslands	
Unclassified Native vegetation	

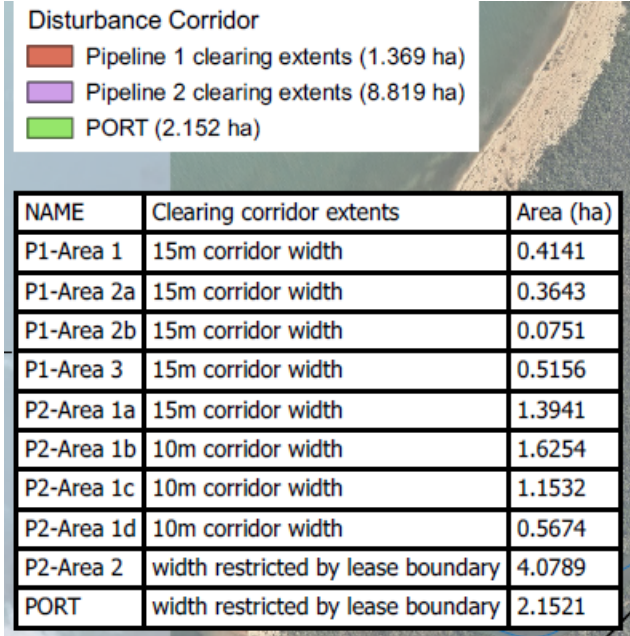
Dominant vegetation type in project area

Source: [Greenhouse Gas Emissions/12624084_Vegetation_Community_Data.xlsx](#)
From GHD Ecology Team (Mickey Dwyer)

L3_BR_FLR	Sum of area (ha)
Eucalyptus mid woodland	48.76
Cleared	46.79
Eucalyptus mid open forest	31.61
Melaleuca low open woodland	5.99
Corymbia mid woodland	5.57
Melaleuca mid woodland	3.52
Acacia low woodland	3.2
Melaleuca mid open forest	2.5
Callitris mid open forest	1.3
Ocean	1.17
Bare	1.13
Regrowth	0.68
Dapsilanthus sedgeland	0.58
Chrysopogon tall tussock grassland	0.45
Grand Total	153.25

Area to be cleared

Source: [J24019-Rev2-SK101 to SK108 Prelim clearing extents plans.pdf](#)



NH2 to Port, clearing: 10.971 ha

New alignment

Area to be cleared

Source

Description	Proposed Clearing Areas		
	New Clearing Areas	On-lease Regrowth Clearing (TBC)	Off-lease Regrowth Clearing (TBC)
Area m ²	78,088	19,826	5,362
	7.90	1.983	0.536
SUB TOTAL (Ha)		10.418	

NH2 to Port, clearing: 10.42 ha

Coordinates for FullCAM

Representative points for sensitivity assessment:

GEMCO Port	-13.859923N, 136.421415E
Boundary of P2 Area 2	-13.908077N, 136.443980E
Southmost extent of pipeline	-13.947029N, 136.435941E

Timeframe for clearing

Project timing not specified yet
Assumed construction start of 2026
Modelling date 1 Jan 2026

FullCAM Results - max C mass on site (tC)

	GEMCO Port -13.859923N, 136.421415E	Boundary of P2 Area 2 -13.908077N, 136.443980E	Southmost extent of pipeline -13.947029N, 136.435941E
Eucalyptus Low Open Forest	786.36	920.18	816
Eucalyptus Open Forest	901.22	1035.05	943.35
Eucalyptus Open Woodland	743.35	895.05	878.03
Eucalyptus Tall Open Forest	1061.18	1195.01	1281.34
Eucalyptus Woodland	786.26	931.31	904.83

Worst-case loss of stored carbon

4698.246667 tCO2-e

New alignment

FullCAM Results - max C mass on site (tC)

	Regrowth Area middle point -13.8587858; 136.4346962'	New Clearing Area Approx middle point -13.9023704; 136.4433611'
Eucalyptus Tall Open Forest		813.81
Regrowth Area	263.76	

Worst-case loss of stored carbon

3951.09 tCO2-e

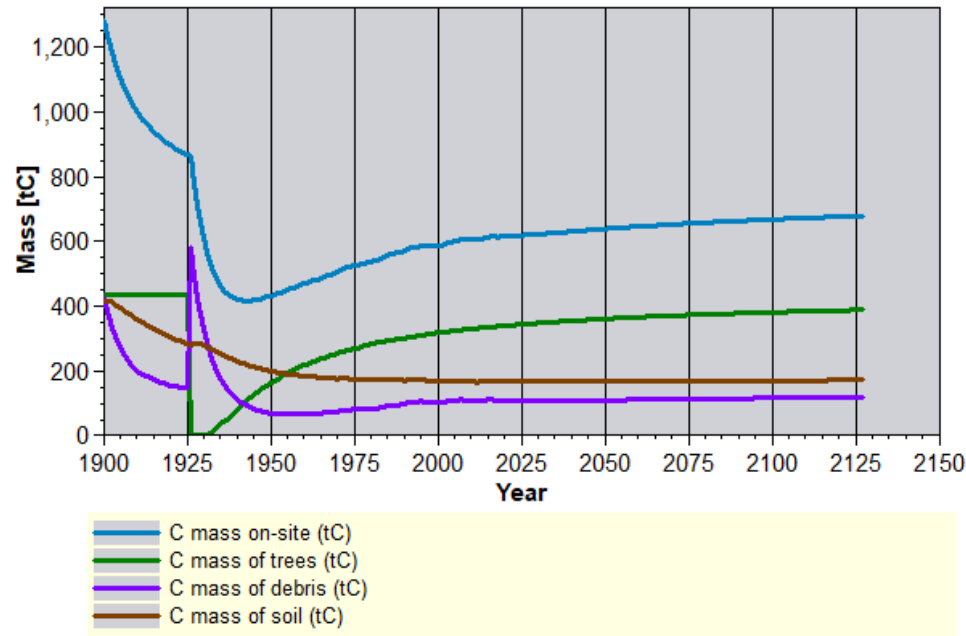
Results if using FullCAM methodology employed in development of TAGG approach

Source: TAGG, 2013, Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects
 Section: "2.5.2 FullCAM Configuration"

Model Start 01-January-1900
 Clearing 31-December-1925
 Planting 01-January-1926
 Results date 01-January-2026 <- assumption of maturity after 100 years
 Model end 31-December-2126

Veg type Eucalyptus Tall Open Forest
 Location -13.947029N, 136.435941E

Results:



	C mass on site (tC)	tCO2
01-January-1900	1,281.10	4697.367
01-January-2026	619.72	2272.307
31-December-2126	679.28	2490.693

Discussion

The initial (1900) value is consistent with the value to the left.
 The 100-year planting (2026) value is approximately half that.
 The 200-year planting (2126) value is slightly higher than the 100-year value.
 The trend is upwards but slow, unclear if/when it would reach the initial value.
 It is unclear why that is the case. Investigation into FullCAM's models would be required.

Conclusion

The result to the left, consistent with initial conditions, will be used.
 The justification of conservatism is more defensible than one of consistency with an unexplained method.

TAGG approach

Couldn't find the "Transport authorities greenhouse group (TAGG) Greenhouse Gas Assessment Workbook for Road Projects"

Found: TAGG, 2013, Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects

The vegetation clearing modelling approach is described in Appendix C

Appendix C is a GHD report from 2012

This uses an older version of FullCAM and related datasets.

The method heavily reduces the granularity of that data, and generalises it.

The outcome was a lookup table based on vegetation class and potential maximum biomass class.

A conservative approach was used, so the results using this approach would likely be overestimated.

Conclusion

The method to the left will be used.

Justification: That method uses newer and more granular data.

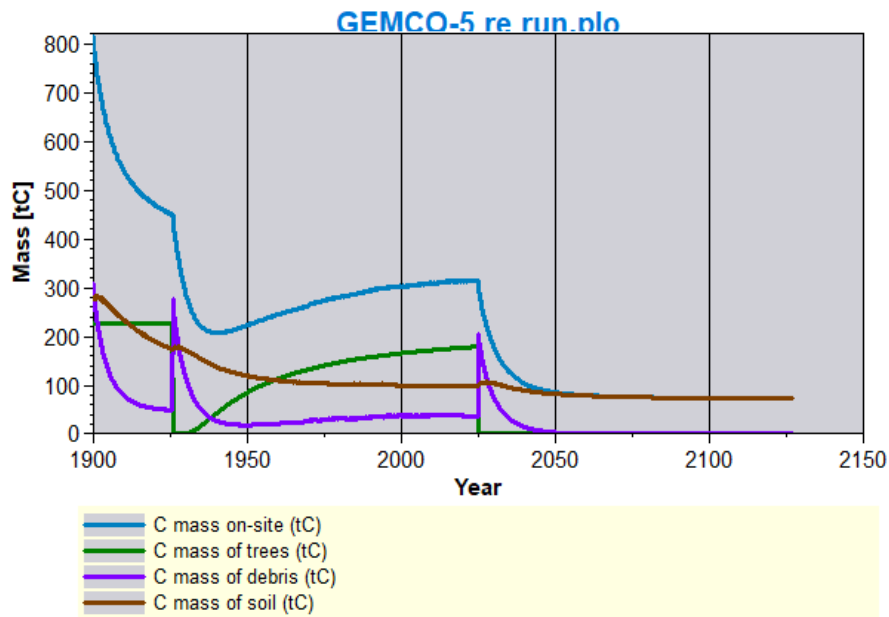
Results if using FullCAM methodology employed in development of TAGG approach

Source: TAGG, 2013, Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects
 Section: "2.5.2 FullCAM Configuration"

Model Start 01-January-1900
 Clearing 31-December-1925
 Planting 01-January-1926
 Results date 01-January-2026 <- assumption of maturity after 100 years
 Model end 31-December-2126

Veg type **Eucalyptus Tall Open Forest**
 Location 136.4433611 13.90237

Results:



	C mass or tCO2	
01-January-1900	808.24888	2963.579
01-December-2024	314.75170	1154.09
31-December-2126	72.700050	266.5669

Total GHG from Clearing

1070.182	3924.002
364.6736	1337.137
174.4077	639.4948

Discussion

The initial (1900) value is consistent with the value to the left.
 The 100-year planting (2026) value is approximately half that.
 The 200-year planting (2126) value is slightly higher than the 100-year value.
 The trend is upwards but slow, unclear if/when it would reach the initial value.
 It is unclear why that is the case. Investigation into FullCAM's models would be required.

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 The justification of conservatism is more defensible than one of consistency with an unexplained method.

TAGG approach

Couldn't find the "Transport authorities greenhouse group (TAGG) Greenhouse Gas Assessment Workbook for Road Projects"

Found: TAGG, 2013, Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects

The vegetation clearing modelling approach is described in Appendix C

Appendix C is a GHD report from 2012

This uses 2020 version of FullCAM and related datasets.

The model point is approximate middle point of the length of the New Clearing pipe line.

The method heavily reduces the granularity of that data, and generalises it.

The outcome was a lookup table based on vegetation class and potential maximum biomass class.

A conservative approach was used, so the results using this approach would likely be overestimated.

Conclusion

The method to the left will be used.

Justification: That method uses newer and more granular data.

GEMCO-5 re run.plo (GEMCO-5)

About Configuration Timing Data Builder Site Trees Soil Initial Conditions Events Output Windows Exp

Regime Editing ?

New... Clone... ▲

Edit... Delete ▼

regimes in queue 3
unique 1 ?

Dec 1925
New Regime

Jan 1926
New Regime

~ 1204 months

Jan 2025
New Regime

Event Editing

New... Clone...

Edit... Delete

Sort by system

Only show simulating events

Sort by whether simulating

Status
Ready

Initial conditions
Tree:Eucalyptus Tall Open Forest

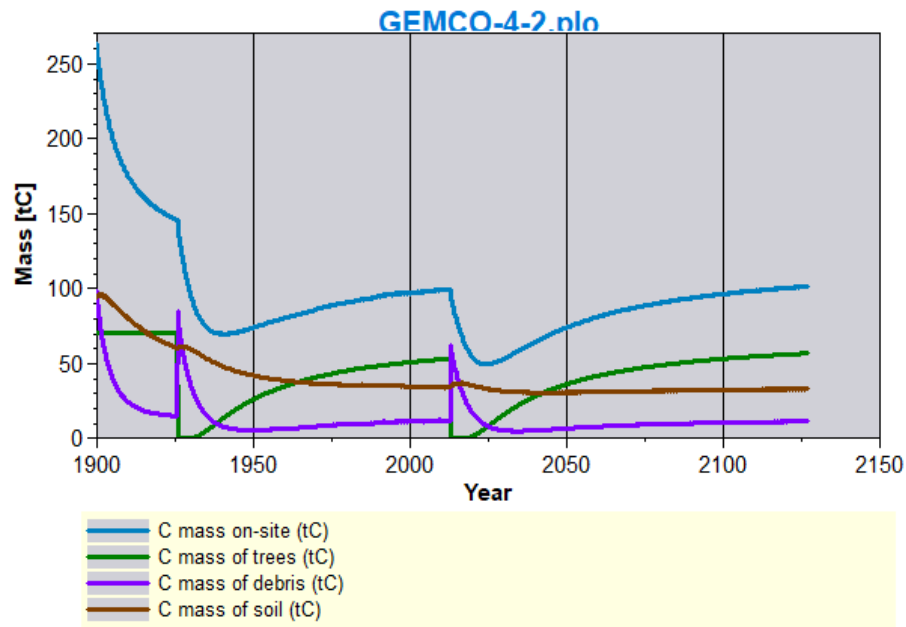
Date	Name
31 Dec 1925	Thin (clearing)
1 Jan 1926	Plant trees: natural regeneration in regeneration systems
1 Jan 2025	Initial clearing: no product recovery

Results if using FullCAM methodology employed in development of TAGG approach

Source: TAGG, 2013, Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects
 Section: "2.5.2 FullCAM Configuration"

Model Start 01-January-1900
 Clearing 31-December-1925
 Planting 01-January-1926
 Results date 01-January-2026 <- assumption of maturity after 100 years
 Model end 31-December-2126

Veg type **Eucalyptus Tall Open** Forest
 Regrowth Native
 Location 136.4346962 13.85879
Results:



	C mass or tCO2	
01-January-1900	261.93338	960.4224
01-December-2024	49.921908	183.047
31-December-2126	101.70762	372.928

Discussion

The initial (1900) value is consistent with the value to the left.
 The 100-year planting (2026) value is approximately half that.
 The 200-year planting (2126) value is slightly higher than the 100-year value.
 The trend is upwards but slow, unclear if/when it would reach the initial value.
 It is unclear why that is the case. Investigation into FullCAM's models would be required.

Conclusion

The result to the left, consistent with initial conditions, will be used.
 The justification of conservatism is more defensible than one of consistency with an unexplained method.

TAGG approach

Couldn't find the "Transport authorities greenhouse group (TAGG) Greenhouse Gas Assessment Workbook for Road Projects"

Found: TAGG, 2013, Supporting Document for Greenhouse Gas Assessment Workbook for Road Projects

The vegetation clearing modelling approach is described in Appendix C

Appendix C is a GHD report from 2012

This uses an older version of FullCAM and related datasets.

The model point is approximate middle point of the length of the regrowth area in off-lease and lease areas.

The method heavily reduces the granularity of that data, and generalises it.

The outcome was a lookup table based on vegetation class and potential maximum biomass class.

A conservative approach was used, so the results using this approach would likely be overestimated.

Conclusion

The method to the left will be used.

Justification: That method uses newer and more granular data.

GEMCO-4-2.plo (GEMCO-5)

About | Configuration | Timing | Data Builder | Site | Trees | Soil | Initial Conditions | **Events** | Output Windows

Regime Editing

New... Clone... Edit... Delete

regimes in queue 5
unique 1

Dec 1925
New Regime

Jan 1926
New Regime

~ 1058 months

Jan 2013
New Regime

~ 12 months

Jan 2014

Event Editing

New... Clone... Edit... Delete

Sort by system
 Only show simulating events
 Sort by whether simulating

Status
Ready

Initial conditions
Tree:Eucalyptus Tall Open Forest

Date	Name
31 Dec 1925	Thin (clearing)
1 Jan 1926	Plant trees: natural regeneration in regeneration systems
1 Jan 2013	Initial clearing: no product recovery
1 Jan 2014	Plant trees: natural regeneration in regeneration systems
1 Jan 2025	Initial clearing: no product recovery

Waste Estimates (Construction)

Source: Estimates made by Tom Jeffries, client couldn't provide

	2 bins per week (months)	1 bin per week(months)	total volume M3
total months of project	12		
7m3 general C&D waste		6	6 504
240L General waste		8	4 19.2
240L recycling		6	6 17.28
			540.48

Waste Estimates (Deconstruction)

Source: Estimates made by Tom Jeffries, client couldn't provide

Description	Activity	Data	Units	Comments
DN1000 PN10 PE100 co-extruded white HDPE	Pipe	25000.2	m	reused as pipe on island
DN1400 PN10 PE100	Pipe	1059.75	m	reused as pipe on island
Precast concrete tank - 20 kL	Concrete	12.295	t	reused as tank
Precast concrete tank - 576 kL	Concrete	141.9788015	t	reused as tank
Pipe concrete collar weights - concrete collars	Concrete	1159	t	landfill
Pipe concrete collar weights - concrete bases	Concrete	488	m ³	landfill
Pipe concrete collar weights - SS2507 stainless bolts	Steel	119.5815828	kg	landfill
Outfall tank location - solar powered skid	Equipment	76977.90944	\$	reused for similar purpose
Rock for back-filling wave-zone at port	Rock	6280.31	m ³	left in situ or reshaped

density of concrete 2995 kg/m³

to landfill

Description	Activity	Data	Units	Comments
DN1000 PN10 PE100 co-extruded white HDPE	Pipe	7437		landfill
DN1400 PN10 PE100	Pipe	619		landfill
Pipe concrete collar weights - concrete collars	Concrete	1159	t	landfill
Pipe concrete collar weights - concrete bases	Concrete	1461.56	t	landfill
Pipe concrete collar weights - SS2507 stainless bolts	Steel	0.119581583	t	landfill
total waste	to	10677	t	
Scope 3 emission factor (t CO ₂ -e/t)		0.2	t CO ₂ -e/t	
Total waste emissions		2135.30455	t CO ₂ -e	

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Water consumption per employee during construction of a road project. 26 kL/year

Implies 2.166667 kL/month/person



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