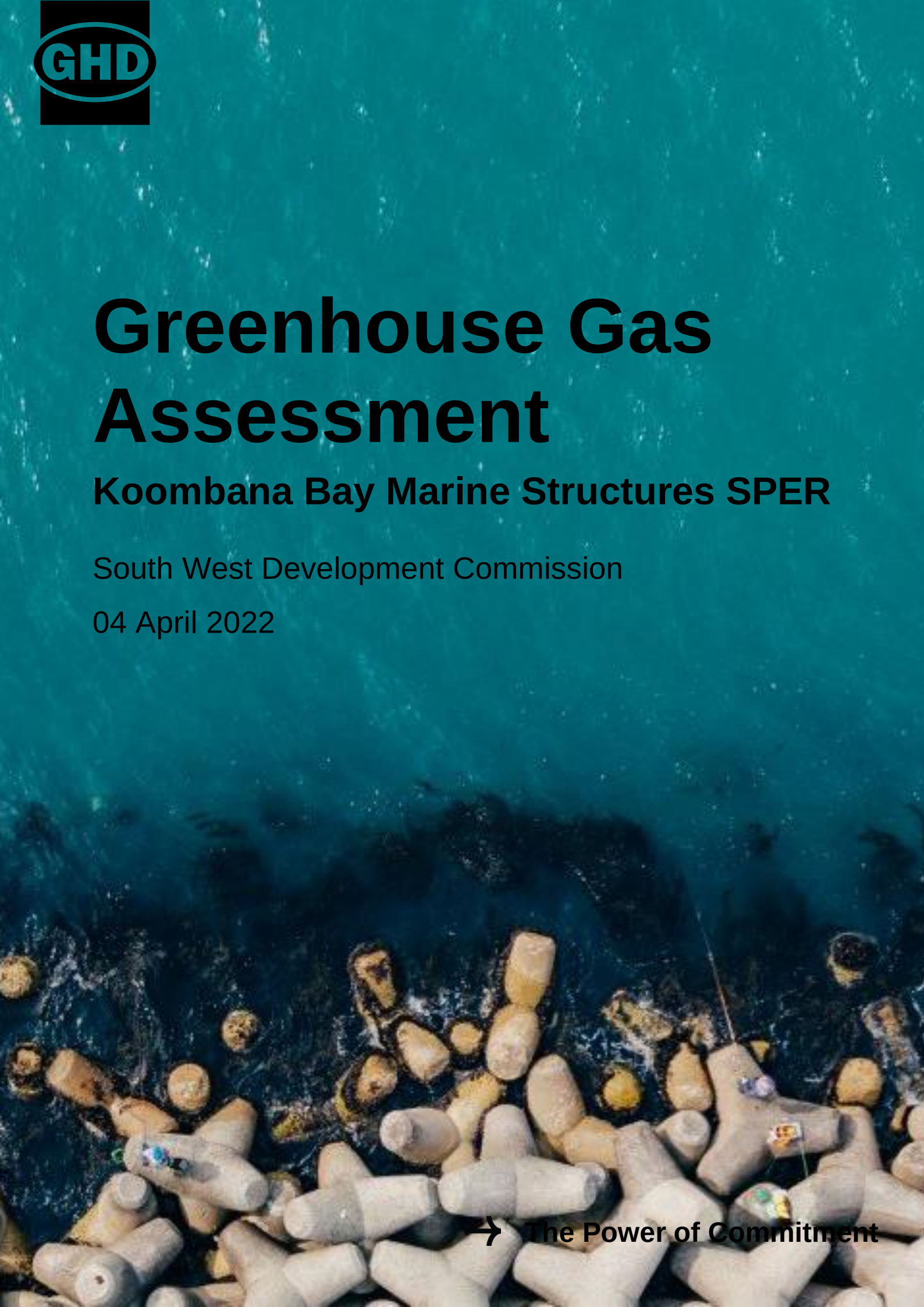
Greenhouse Gas Assessment

Koombana Bay Marine Structures SPER

South West Development Commission

04 April 2022



The Power of Commitment

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Executive summary

The South West Development Commission (SWDC) is the proponent for the Koombana Bay Marine Structures (KBMS) proposal. In March 2015 the SWDC referred the KBMS to the Western Australia Environmental Protection Authority (EPA), which determined the KBMS Proposal to be assessed at the level of "Strategic Proposal" (Public Environment Review or SPER). The EPA approved an Environmental Scoping Document (ESD) for the KBMS SPER (Assessment Number 2049) on 26 June 2015.

The KBMS strategic proposal aims to construct and operate the following marine structures within Koombana Bay:

1. Casuarina Boat Harbour (CBH) development.
2. Koombana Bay Sailing Club (KBSC) marina.
3. Dolphin Discovery Centre (DDC) finger jetty.

Collectively, the three (3) individual marine structures (Casuarina Boat Harbour, KBSC marina and the DDC finger jetty) are referred to as the KBMS strategic proposal.

The purpose of this report is to provide an estimate of Scope 1 greenhouse gas (GHG) emissions resulting from the construction and operation of each KBMS derived proposal to assess the requirement for the development of a GHG management plan (GHGMP), as per the GHG Factor Guideline (EPA 2020). The threshold for the requirement to prepare a GHG management plan is currently set at 100,000 tonnes carbon dioxide equivalent (tCO_2-e) per annum under the *Environmental Protection Act 1986* (WA). This is currently the same as the threshold criteria for designation of a large facility under the Australian Government's Safeguard Mechanism.

The scope of the assessment only included direct emissions (i.e. Scope 1 emissions) resulting from the KBMS derived proposals, specifically the CBH redevelopment, KBSC marina and DDC finger jetty. Indirect emissions, (i.e. Scope 2 emissions from the generation of purchased energy) and upstream and downstream emissions (i.e. Scope 3 emissions) were not accounted for in this report.

Based on the available data, using the National Greenhouse and Energy Reporting (NGER) factors and derived emission factor for seagrass, it is estimated the KBMS Strategic Proposal will emit a total of 23,105 tCO_2-e through construction and operation over the life of the asset (Table ES 1), with an average of 113 tCO_2-e attributed to operational emissions annually.

Table ES 1 Total GHG emissions for the KBMS proposal

Phase	Source	Total emissions (tCO_2-e)			Total
		CBH Redevelopment	KBSC Marina	Dolphin Discovery Centre	
Construction	Construction - Stationary	4,472	1,332	347	6,152
	Construction - Transport	2,063	812	172	3,047
	Construction - Vegetation clearing	158	2,473	9	2,639
Operation	Operation - Stationary	4,692	1,563	521	6,776
	Operation - Transport	3,094	1,140	258	4,492
Total construction		6,692	4,617	528	11,838
Total operation		7,786	2,703	779	11,268
Total construction and operation		**14,478**	**7,320**	**1,307**	**23,105**

This places the KBMS Strategic Proposal significantly below the 100,000 tCO_2-e per year threshold where a proposal is required to prepare a GHGMP, as outlined in the *Greenhouse Gas Emissions Factor Guideline* (EPA 2020). On this basis the Strategic Proposal will not be required to prepare a GHGMP to meet the requirements under the *Environmental Protection Act 1986*.

As the scope of this investigation did not include Scope 2 emissions, an assessment of the requirement to report under the NGER Scheme established under the *National Greenhouse and Energy Reporting Act 2007* and *National Greenhouse and Energy Reporting Regulations 2008* was not able to be directly evaluated as only scope 1 emissions were estimated. However, given that the KBMS strategic proposal has average annual scope 1 operational emissions (113 tCO_2-e) significantly below the designated thresholds for single facilities (>25,000 tCO_2-e per annum) and for controlling operations (>50,000 tCO_2-e), it is highly unlikely to be required to report under the NGER scheme.

This report is subject to, and must be read in conjunction with, the limitations set out in section 1.4 and the assumptions and qualifications contained throughout the Report.

Acronyms

Acronym	Definition
BHD	Backhoe Dredge
CA	Climate Active
CBH	Casuarina Boat Harbour
CSD	Cutter Suction Dredge
DDC	Dolphin Discovery Centre
DOT	Department of Transport
EPA	Environmental Protection Authority
GHG	Greenhouse Gas(es)
GHGMP	Greenhouse Gas Management Plan
GWP	Global Warming Potential
ISO	International Organization for Standardization
KBMS	Koombana Bay Marine Structures (the strategic proposal)
KBSC	Koombana Bay Sailing Club
NGA Factors	Australian National Greenhouse Accounts Factors 2021
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
NGER Regulations	National Greenhouse and Energy Reporting Regulations 2008
NGER	National Greenhouse and Energy Reporting
SWDC	South West Development Commission
TBW	Transforming Bunbury's Waterfront
tCO_2-e	Tonne of Carbon Dioxide equivalent
TSHD	Trailer Suction Hopper Dredge
WBCSD	World Business Council for Sustainable Development
WRI	World Resources Institute

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1. Introduction

1.1 Background

The South West Development Commission (SWDC) is the proponent for the Koombana Bay Marine Structures (KBMS) proposal. In March 2015 the SWDC referred the KBMS to the Western Australia Environmental Protection Authority (EPA), which determined the KBMS Proposal to be assessed at the level of “Strategic Proposal” (Public Environment Review or SPER). The EPA approved an Environmental Scoping Document (ESD) for the KBMS SPER (Assessment Number 2049) on 26 June 2015.

The KBMS proposal (or the strategic proposal) is located within the City of Bunbury, about 174 kilometres (km) south of Perth, Western Australia. The marine structures subject to the KBMS strategic proposal are situated within Koombana Bay which neighbours the Bunbury Central Business District and the Marlston North residential and waterfront developments. Figure 1 illustrates the indicative KBMS proposal.

The KBMS strategic proposal aims to construct and operate the following marine structures within Koombana Bay:

1. Casuarina Boat Harbour (CBH) development.
2. Koombana Bay Sailing Club (KBSC) marina.
3. Dolphin Discovery Centre (DDC) finger jetty.

Collectively, the three (3) individual marine structures (CBH, KBSC marina and the DDC finger jetty) are referred to as the KBMS strategic proposal. Individually, and because they will be constructed over different timescales, the three (3) individual marine structures are referred to as future “derived proposals”. This is consistent with the Environmental Protections Authority’s assessment process and terminology under the *Environmental Protection Act 1986*.

Figure 1 Indicative KBMS strategic proposal

1.1.1 General description of KBMS strategic proposal

A general description of the KBMS strategic proposal is provided in Table 1.

Table 1 General strategic proposal description

Strategic proposal title	Koombana Bay Marine Structures
Strategic proponent name	South West Development Commission
Short description	The strategic proposal is for the construction and operation of small craft marine infrastructure in Bunbury, south-west Western Australia. The strategic proposal components include dredging, dredge spoil disposal, piling, land reclamation and breakwater and groyne construction. The proposed marine infrastructure includes construction and operation of jetties, boat ramps and boat pens. The proposed future derived proposals under the strategic proposal are: – **Casuarina Boat Harbour**: The components include dredging, dredge spoil disposal, piling, land reclamation and construction and operation of a breakwater, wharf, jetties and boat pens. – **Koombana Bay Sailing Club Marina**: The components include dredging, dredge spoil disposal, piling, land reclamation, and construction and operation of two breakwaters, jetties and boat pens. – **Dolphin Discovery Centre Finger Jetty**: Construction and operation of a finger jetty up to 110 metres long. The derived proposal construction will be undertaken in stages. The marine infrastructure is located adjacent to, or in close proximity to existing infrastructure in Koombana Bay, Bunbury.

1.1.2 Identified derived proposal description and elements

A description and elements of the KBMS derived proposals are provided in Table 2.

Table 2 Identified derived proposal description and elements

Casuarina boat harbour This derived proposal includes a dredging and dredge spoil disposal component, a piling component, land reclamation and construction of a breakwater and revetment walls. The marine infrastructure includes the construction and operation of floating jetties, boat ramps and boat pens.		
Proposal element	**Location / Description**	**Maximum Extent, Capacity or Range**
Physical elements		
Development Envelope	Figure 1	Up to 40 ha
(Indicative) Casuarina Boat Harbour (CBH) disturbance footprint	Figure 1	Up to 32 ha within CBH disturbance footprint
Breakwater	Figure 1	Up to 3.5 ha within CBH disturbance footprint
Reclamation	Figure 1	Up to 3.5 ha within CBH disturbance footprint
Marine infrastructure		Floating jetties, boat ramps and boat pens within CBH disturbance footprint.
Koombana Bay Sailing Club marina This derived proposal includes a dredging component, a piling component, land reclamation (including onshore dredge spoil disposal) and construction of a breakwater. The marine infrastructure includes the construction and operation of floating jetties, boat ramps and boat pens.		
Proposal element	**Location / Description**	**Maximum Extent, Capacity or Range**
Physical elements		
Development Envelope	Figure 1	Up to 16 ha
(Indicative) Koombana Bay Sailing Club (KBSC) disturbance footprint	Figure 1	Up to 10 ha within KBSC disturbance footprint
Breakwater	Figure 1	Up to 2.5 ha within KBSC disturbance footprint
Reclamation	Figure 1	Up to 2 ha within KBSC disturbance footprint
Marine infrastructure		Floating jetties, boat ramps and boat pens within KBSC disturbance footprint

Dolphin Discovery Centre finger jetty This derived proposal includes a finger jetty, a piling component and a temporary onshore construction laydown area.		
Proposal element	**Location / Description**	**Maximum Extent, Capacity or Range**
Physical elements		
Development Envelope	Figure 1	Up to 0.5 ha
(Indicative) Dolphin Discovery Centre (DDC) jetty disturbance footprint	Figure 1	Up to 0.15 ha within DDC disturbance footprint
Marine infrastructure		Jetty up to 110 metres long
Rehabilitation - not applicable		
Commissioning - not applicable		
Decommissioning - not applicable		
Other elements which affect extent of effects on the environment – not applicable		
Proposal Time	Maximum project life	100 years
	Construction phase	Construction time frames yet to be determined (estimated to be 4 years in total for the purposes of this assessment)
	Operations phase	100 years

1.2 Purpose of this report

The purpose of this report is to provide an estimate of Scope 1 greenhouse gas (GHG) emissions resulting from the construction and operation of each KBMS derived proposal described in Section 1.1.2 to assess the requirement for the development of a GHG management plan (GHGMP), as per the GHG Factor Guideline (EPA 2020).

The threshold for the requirement to prepare a GHGMP is currently set at 100,000 tonnes carbon dioxide equivalent per annum under the *Environmental Protection Act 1986* (WA). This is currently the same as the threshold criteria for designation of a large facility under the Australian Government's Safeguard Mechanism.

1.3 Limitations

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

GHD otherwise disclaims responsibility to any person other than SWDC 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 (refer section(s) 3.2 of this report), which were approved for use by the SWDC prior to use in emissions estimation work. GHD disclaims liability arising from any of the assumptions being incorrect.

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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. Carbon reporting

Carbon accounting is the process of identifying and measuring the amount of GHG, measured in tonnes carbon dioxide equivalents (tCO_2-e), emitted by an entity. Carbon reporting is the process of reporting on that accounting.

Apart from the facility and corporate thresholds for scope 1 and 2 emissions established under the National Greenhouse and Energy Reporting (NGER) scheme, the safeguard mechanism also requires large emitters whose net emissions exceed the 100,000 tCO_2-e safeguard threshold, to keep their emissions at or below emissions baselines. The Clean Energy Regulator administers the NGER Act, legislative instruments, and related policies and processes.

2.1 Consolidation approach

Before deciding which emission sources should be counted, it is necessary to determine the 'consolidation approach' prior to establishing the 'emissions boundary' for the reporting organisation. The consolidation approach refers to how a reporting organisation decides what is in its boundary.

The control approach that has been used in the development of this inventory is operational control. In our experience, this is the typical approach taken by similar operations when estimating their operational and construction related carbon inventories.

2.2 Emissions boundary

The reporting boundary for this inventory has been prepared by following the approach of the Australian Government's Climate Active Carbon Neutral Standard for Organisations (Climate Active standard). The Climate Active program is the most commonly used approach for Australian organisations to certify their carbon neutral status, and it is based on the GHG Protocol and NGER Measurement Determination.

The emissions inventory we have prepared includes a variety of emissions sources that we have deemed "relevant" and "material" to SWDC's operations.

2.2.1 Relevance

The Climate Active standard states emissions sources considered to be relevant, whether or not they fall within the reporting organisation's boundary, must be included in the emissions boundary (subject to materiality). The purpose of this report, however, is to provide an estimate of Scope 1 greenhouse gas (GHG) emissions resulting from the construction and operation of each KBMS derived proposal described in Section 1, therefore only Scope 1 emissions have been considered relevant.

2.2.2 Materiality

Different standards stipulate different definitions and thresholds for materiality. An organisation can determine materiality themselves, but if reporting under a specific scheme, then materiality is determined by the scheme's requirements and standards.

GHD has calculated the GHG emissions inventory of KBMS strategic proposal using the methods and standards outlined in sections 2.3 and 3. The materiality thresholds have been adopted based on the approach utilised to estimate the GHG emissions.

The thresholds applicable to the KBMS inventory are contained in Table 3.

Table 3 Materiality thresholds used in the GHG assessment of the KBMS proposal

Emission Scope	Standard/Method	Threshold
Scope 1	NGER Regulation	1 kL consumption of liquid fuel (diesel, ULP, LPG etc.)
Scope 2	NGER Regulation	20,000 kWh purchased electricity consumption
Scope 3	Climate Active Standard	An emission source that constitutes 1% or more of the total carbon account is considered to be material. In applying the 1% materiality threshold, the total amount of emissions to be non-quantified must not exceed 5% of the total carbon account.

All Scope 1 emissions sources other than those mentioned in section 3.3 have been considered material for the purposes of this report.

Under Climate Active, an emissions source that constitutes 1% or more of the total carbon account is material. For an emissions inventory of the size of the KBMS strategic proposal, the materiality threshold would therefore be approximately 231 tCO_2-e when considering the construction and operation over the life of the asset, and 1.13 tCO2-e when applied to annual operational emissions.

2.3 Policy and reference documents

The GHG assessment was undertaken in accordance with the principles of ISO 14064-2 and the general principles for estimating emissions in the NGER and GHG Protocol. The following documents were used for the purposes of defining appropriate methods for quantification of emissions from individual sources:

- *National Greenhouse and Energy Reporting Act 2007* (NGER Act)
- National Greenhouse and Energy Reporting (Measurement) Determination 2008
- Australian National Greenhouse Accounts (NGA) Factors 2021
- The Climate Active Carbon Neutral Standard for Organisations (Climate Active Standard)

We have based our approach for compiling this emissions inventory on the “Greenhouse Gas Protocol”, as developed by the World Business Council For Sustainable Development (WBCSD) and World Resources Institute (WRI).

The Scope 1 emission factors for diesel oil and heavy fuel oil were taken from the National Greenhouse Accounts (NGA) Factors 2021 derived from NGER Measurement Determination 2008.

3. Methodology

3.1 Scope of the assessment

This GHG assessment only assessed direct emission (Scope 1 emissions) resulting from the KBMS derived proposals, specifically the CBH redevelopment, KBSC marina and DDC finger jetty.

Indirect emissions (Scope 2 emissions) from the generation of purchased energy, as well as upstream and downstream emissions (Scope 3 emissions), were not accounted for in this report.

3.2 Assumptions

The following assumptions have been made with respect to the emissions assessment (Table 4). These assumptions were developed from information provided by the SWDC, Department of Transport (2022), M.P. Rogers & Associates (2022), previous project experience and publicly available information, and were considered acceptable by the SWDC prior to use in the GHG assessment model.

References for assumptions derived from external sources are provided in Appendix A.

Table 4 Greenhouse gas emissions assessment assumptions

Type	Number	Assumption
Workers	51	CBH: Expected peak total staff throughout construction
	21	KBSC: Expected peak total staff throughout construction
	12	Dolphin Discovery Centre: Expected peak total staff throughout construction
Offices and site Amenities	-	Sourced from the South West Interconnect System electrical transmission network - therefore no Scope 1 emissions
Standard hours of operation	-	6:00am to 4:00pm (10 hours), 6 days per week
Operation period	100	Years, to coincide with 100-year design life
Hours of operation for dredging	-	As per "Specifications for Turbidity/TSS and Sedimentation Modelling of KBMS SPER Dredging, Reclamation and Breakwater Construction Activities" dated 25 January 2022, dredging is a 24-hour operation CBH Phase 1 and a 12-hour operation for CBH Phase 2 and KBSC Marina
Maintenance dredging	5	CBH: ± 10,000 m³ every 5 years
		KBSC: ± 1,100 m³ every 5 years
Maintenance dredging	4.2%	CBH: Operational fuel consumption will be a proportion of construction fuel usage based on maintenance dredging quantity compared to initial dredging quantity = (10,000 / [130,000 +110,000]) = 4.2% every 5 years
		KBSC: Operational fuel consumption will be a proportion of construction fuel usage based on maintenance dredging quantity compared to initial dredging quantity (1,100 / 26,000) = 4.2% every 5 years
Fuel consumption	-	Fuel consumption in the Trailer Suction Hopper Dredger (TSHD) Modi R (Rohde-Nielsen ND) is assumed to be a proportion of a similar TSHD (Ports North 2014) with a fuel consumption of 626.1 L/hr = (4,361 / 6,826) * 980
		Cutter Suction Dredge fuel consumption noted as 320 L/hr (Hansel 2021)
		Outboard motor for crew boat fuel consumption noted as 14.7 L/hr (Boat Fuel Economy 2022)
		All other fuel consumption rates taken from numbers advised by Department of Transport (2022), MP Rogers & Associates (2022), and previous projects completed by GHD
Seagrass	322.0	Seagrass is estimated to contain 322 tonnes CO_2-e per hectare (ha) (Reef Catchments 2015, Readfearn, G. 2021).

Maintenance of jetties, breakwaters, finger jetties and boat pens	1.5%	Excluding dredging fuel consumption, operational fuel consumption will be 1.5% of construction fuel consumption. This is consistent with the forecast maintenance budget of between 1% and 2%.
Distance travelled	-	Light vehicles assumed to travel 20 km daily Trucks assumed to travel 10 km daily
Construction period	-	48 weeks for northern breakwater 22 weeks for eastern breakwater 69 days for western breakwater 6 months to construct CBH Phase 1 boat pens and floating jetties 4 months to construct CBH Phase 2 revetment walling 2 years to construct CBH Phase 2 boat pens and floating jetties 6 months to construct KBSC boat pens and floating jetties 6 months to construct DDC finger jetty 30 days to dredge for CBH Phase 1 via TSHD 85 days to dredge for CBH Phase 2 via BHD 12 weeks to dredge for KBSC via CSD
Construction and design	-	No dewatering is required No nightworks are permitted (except for TSHD dredging), therefore lighting towers are not required except where noted No drilling or piling required in breakwater construction Crew boat uses a Honda 40HP 4 stroke outboard motor Crew boat required during piling, construction of breakwaters and dredging

3.3 Exclusions

Specific Scope 1 exclusions from this GHG assessment include:

- Emissions associated with the leakage of hydrofluorocarbons. The Proposal may use small quantities of hydrofluorocarbons for refrigeration and air conditioning during construction and operation. However, the associated emissions are likely to be negligible compared with other emissions from the development and therefore were excluded from the assessment.
- Emissions associated with the use of shielding gas for welding. Based on the materials to be used, it is anticipated that tungsten inert gas or flux core arc welding will be used to join sections of pipe on this Proposal. Argon is typically used as a shielding gas in such instances, and it has negligible global warming potential (GWP). Emissions associated with the combustion of fuel to power mobile welding equipment have been covered by this assessment.
- Emissions relating to decommissioning of the Proposal are not included in this assessment.

3.4 Calculations

The calculation procedures used to create the emissions inventory were as follows:

- The scope for the GHG assessment was defined that considered possible GHG emission sources of carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4).
- Relevant instances of energy use and emissions from construction and operations were identified and then evaluated for inclusion in Scope 1 (as per the assessment boundary in Section 3.1).
  - Relevant activity data for stationary and transport (i.e. mobile) plant and equipment was identified for construction and operation, and emissions factors were selected and applied; and
  - The total area of removed (i.e. permanent loss) aquatic vegetation (e.g. seagrass) was identified and appropriate emission factors were selected and applied.
- Total and annual GHG emissions for the Proposal during construction and operation phases were determined.
- Emission values for each of the derived proposals as well as the total for the KMBS strategic proposal were tabulated.

4. Greenhouse gas emissions inventory

4.1 Casuarina Boat Harbour redevelopment

Total estimated life of asset GHG emissions for the CBH redevelopment are 14,478 tCO_2-e, with 6,692 tCO_2-e and 7,786 tCO_2-e emitted during its construction and operation, respectively (Table 5). This equates to an estimated 1,673 tCO_2-e per year during the four years of construction and 78 tCO_2-e per year during operation. The operational life is assumed to be 100 years from date of construction completion.

This data is presented graphically in Figure 2.

Table 5 Casuarina Boat Harbour Redevelopment construction and operational emissions

Phase	Source	Total GHG Emissions (t CO_2-e)	Average total emissions per year (t CO_2-e)
Construction	Stationary	4,472	1,118
	Transport	2,063	516
	Vegetation clearing	158	39
Operation	Stationary	4,692	47
	Transport	3,094	31
Total construction		6,692	1,673
Total operation		7,786	78
	Total construction and operation	**14,478**	

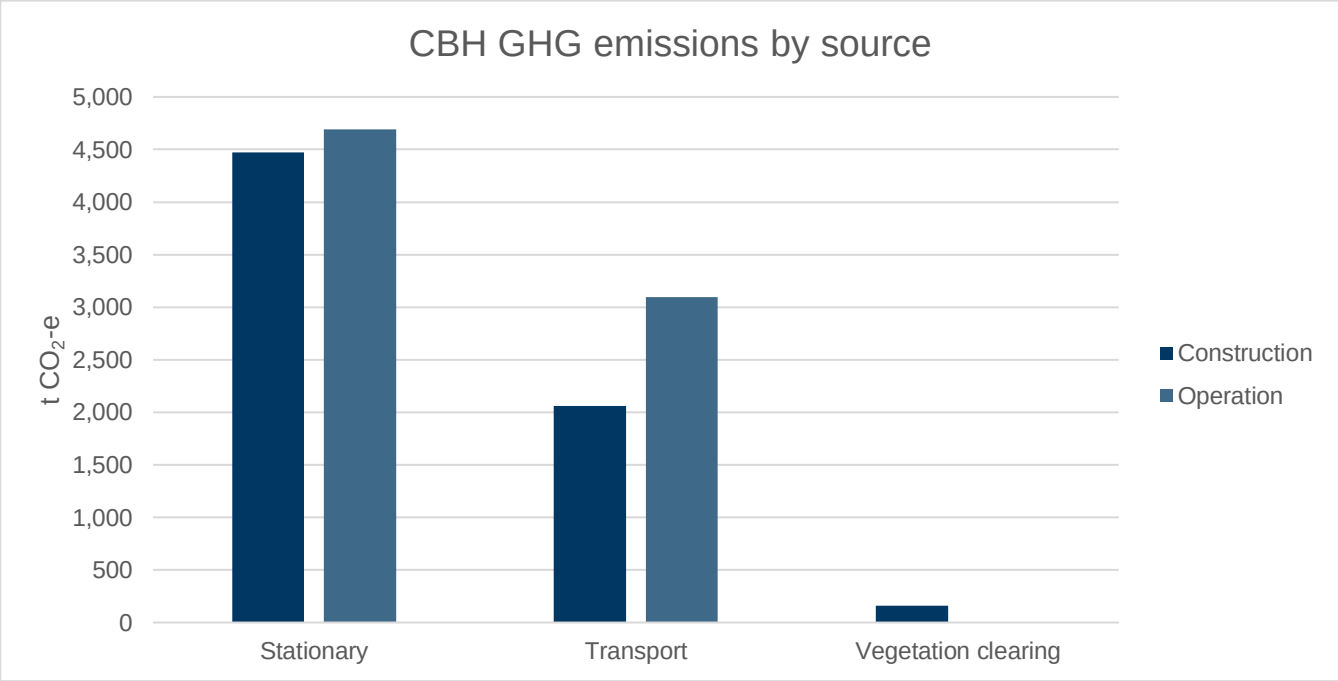

Figure 2 Casuarina Boat Harbour redevelopment greenhouse gas emissions by source

Detailed calculation that informed these estimates are provided in Appendix A.

4.2 Koombana Bay Sailing Club marina

Total estimated life of asset GHG emissions for the KBSC Marina are 7,320 tCO_2-e, with 4,617 tCO_2-e and 2,703 tCO_2-e emitted during its construction and operation, respectively (Table 6). This equates to an estimated 1,154 tCO_2-e per year during the four years of construction and 27 tCO_2-e per year during operation. The operational life is assumed to be 100 years from date of construction completion.

This data is presented graphically in Figure 3.

Table 6 Koombana Bay Sailing Club Marina construction and operational emissions

Phase	Source	Total GHG Emissions (t CO_2-e)	Average total emissions per year (t CO_2-e)
Construction	Stationary	1,332	333
	Transport	812	203
	Vegetation clearing	2,473	618
Operation	Stationary	1,563	16
	Transport	1,140	11
Total construction		4,617	1,154
Total operation		2,703	27
	Total construction and operation	**7,320**	

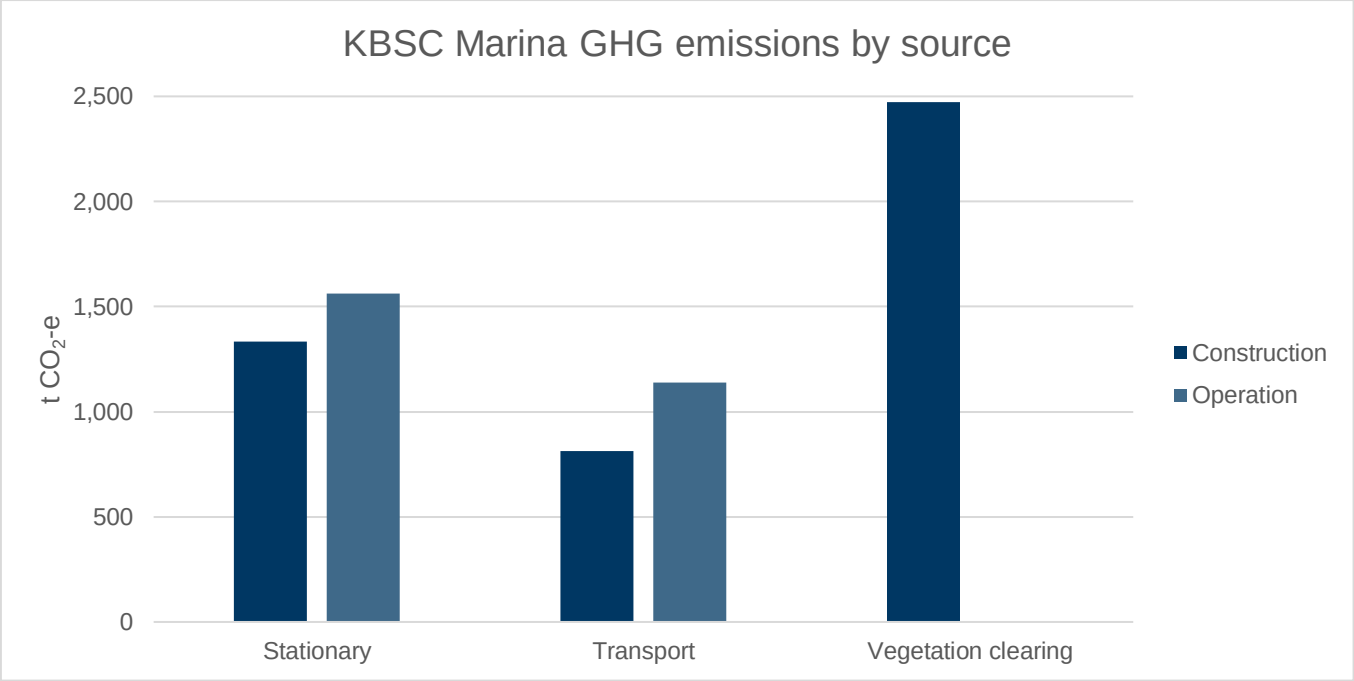

Figure 3 Koombana Bay Sailing Club Marina greenhouse gas emissions by source

Detailed calculations that informed these estimates are provided in Appendix A.

4.3 Dolphin Discovery Centre finger jetty

Total estimated life of asset GHG emissions for the DDC Finger Jetty are 1,307 tCO_2-e, with 528 tCO_2-e and 779 tCO_2-e emitted during its construction and operation, respectively (Table 7). This equates to an estimated 56 tCO_2-e per year during the four years of construction and 3 tCO_2-e per year during operation. The operational life is assumed to be 100 years from date of construction completion.

This data is presented graphically in Figure 4.

Table 7 Dolphin Discovery Centre Finger Jetty construction and operational emissions

Phase	Source	Total GHG Emissions (t CO_2-e)	Average total emissions per year (t CO_2-e)
Construction	Stationary	43	11
	Transport	172	43
	Vegetation clearing	9	2
Operation	Stationary	65	1
	Transport	258	3
Total construction		223	56
Total operation		322	3
	Total construction and operation	**546**	

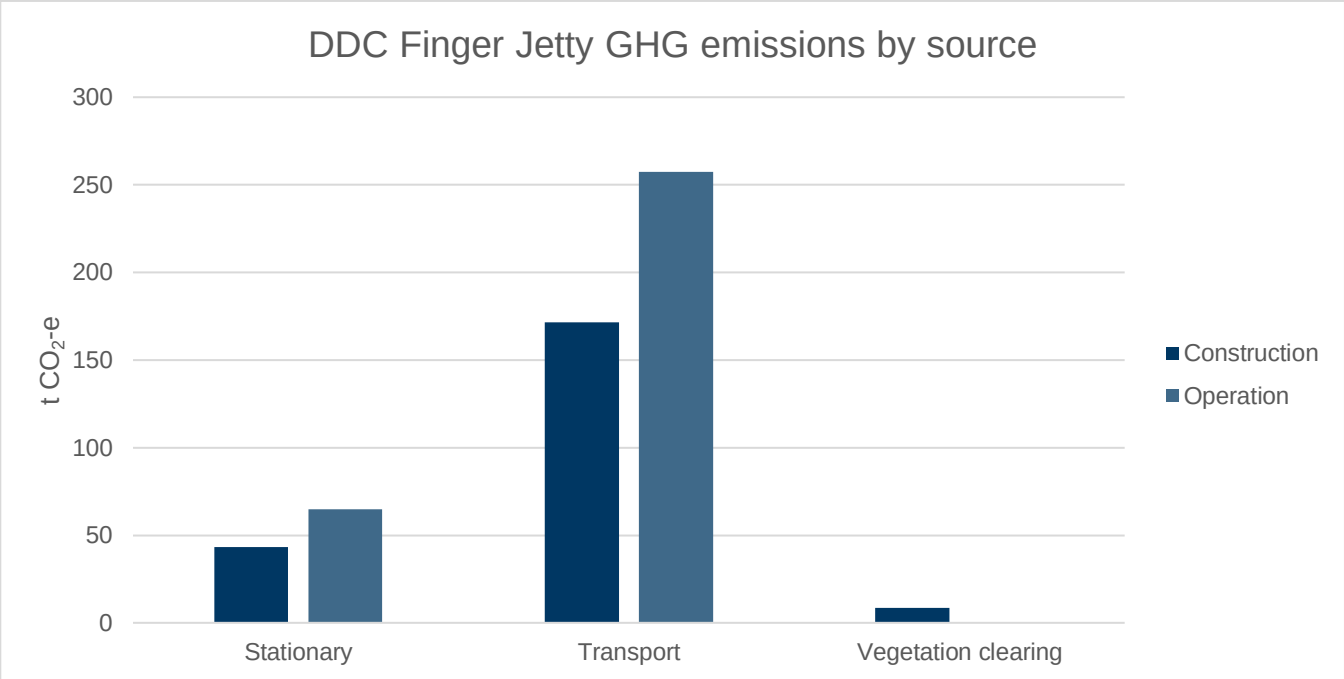

Figure 4 Dolphin Discovery Centre Finger Jetty greenhouse gas emissions by source

Detailed calculations that informed these estimates are provided in Appendix A.

4.4 Koombana Bay Marine Structures strategic proposal

Total estimated life of asset GHG emissions for the entire KBMS Strategic Proposal are 22,344 tCO_2-e, with 11,533 tCO_2-e and 10,811 tCO_2-e emitted during its construction and operation, respectively (Table 8). This equates to an estimated 2,883 tCO_2-e per year during the four years of construction and 108 tCO_2-e per year during operation. The operational life is assumed to be 100 years from date of construction completion.

This data is presented graphically in Figure 5. A breakdown of the emissions by derived proposal is presented in Figure 6.

Table 8 Koombana Bay Marine Structures strategic proposal construction and operational emissions

Phase	Source	Total GHG Emissions (t CO_2-e)	Average total emissions per year (t CO_2-e)
Construction	Stationary	5,847	1,462
	Transport	3,047	762
	Vegetation clearing	2,639	660
Operation	Stationary	6,319	63
	Transport	4,492	45
Total construction		11,533	2,883
Total operation		10,811	108
	Total construction and operation	**22,344**	

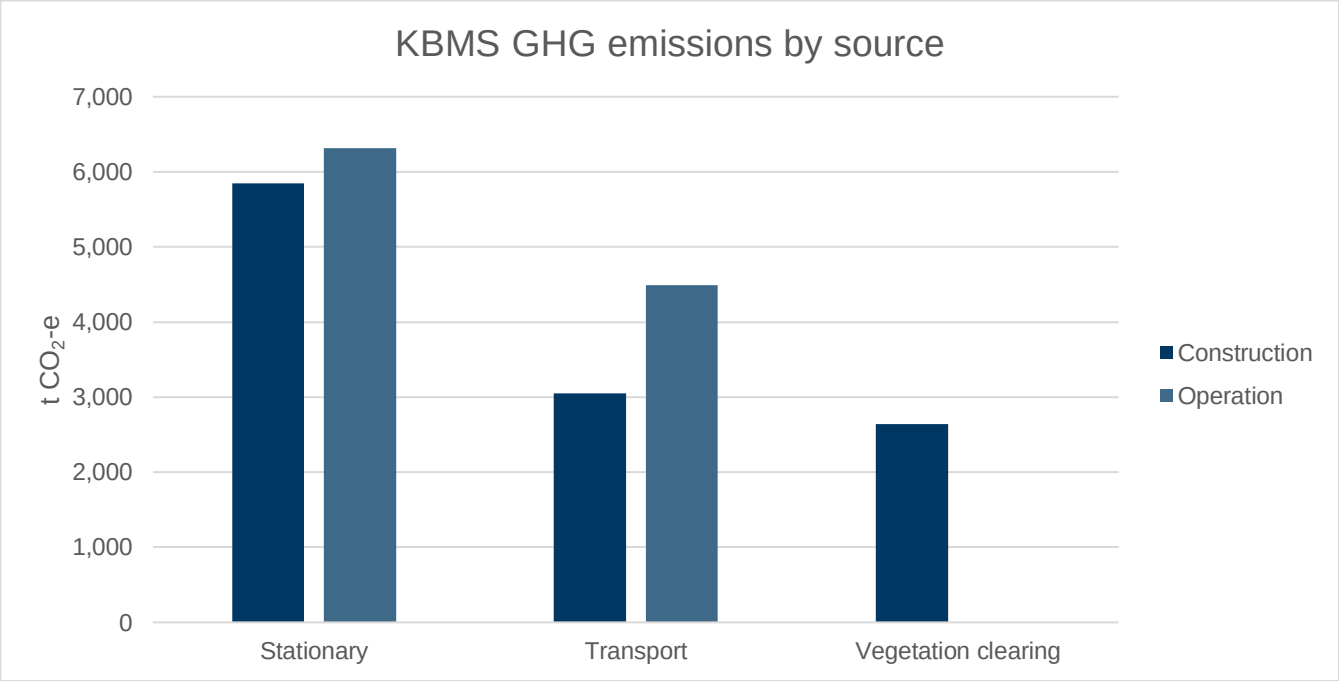

Figure 5 Koombana Bay Marine Structures strategic proposal greenhouse gas emissions by source

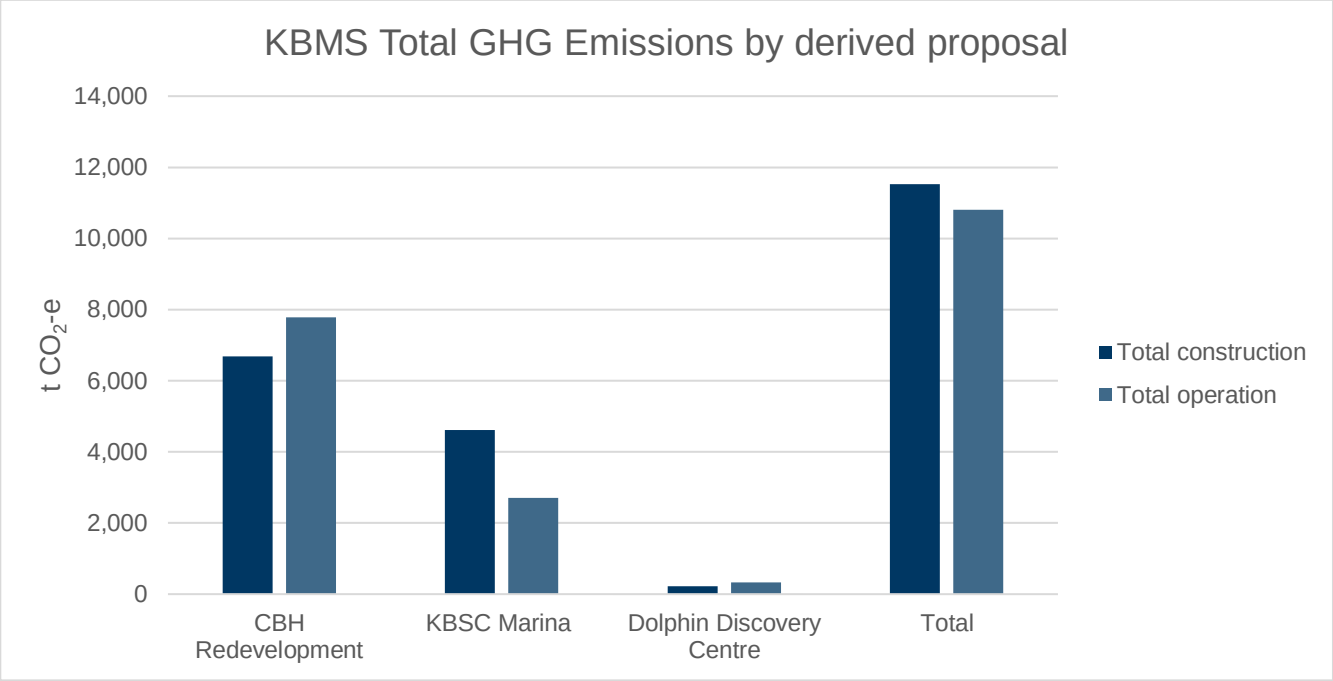

Figure 6 ***Total greenhouse gas emissions for the Koombana Bay Marine Structures project per derived proposal***

Detailed calculations that informed these estimates are provided in Appendix A.

5. Discussion

The KBMS Strategic Proposal is estimated to emit a total of 22,344 tCO_2-e over the life of the assets through construction and operation, with an average of 108 tCO_2-e emitted during each year of operation (Table 8).

This places the KBMS Strategic Proposal significantly below the 100,000 tCO_2-e per year threshold where a proposal is required to prepare a GHGMP. Based on this assessment, the project is unlikely to be required to prepare a GHGMP or undertake NGERs reporting throughout operation.

As Scope 2 emissions were not evaluated in this commission, an assessment of the requirement to report under the NGER Scheme established under the *National Greenhouse and Energy Reporting Act 2007* and *National Greenhouse and Energy Reporting Regulations 2008* was not able to be made. However, given that the KBMS strategic proposal has average annual Scope 1 emissions (108 tCO_2-e) significantly below the designated thresholds for single facilities (>25,000 tCO_2-e per annum) and for controlling operations (>50,000 tCO_2-e), it is highly unlikely to be required to report under the NGER scheme.

6. Conclusions

Based on available data and information, application of NGER factors and a derived emission factor for seagrass, the KBMS Strategic Proposal is estimated to emit a total of 22,344 tCO_2-e over the life of the asset inclusive of construction and operations, with an average of 108 tCO_2-e emitted during each year of operation.

This places the KBMS Strategic Proposal significantly below the 100,000 tonnes per year threshold where a proposal is required to prepare a GHGMP, as outlined in the *Greenhouse Gas Emissions Factor Guideline* (EPA 2020). As such, the Strategic Proposal is highly unlikely to require a GHGMP to meet the requirements under the *Environmental Protection Act 1986*. This also indicates that the KBMS strategic proposal is not likely to be required to report under the NGER scheme.

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Appendix A

Detailed calculations

Greenhouse Gas Inventory

Greenhouse Gas Assessment - Emissions/Energy Source Breakdown for construction and operation of the Casuarina Boat Harbour Redevelopment derived proposal

Estimates are based on the activites as outlined on the 'Casuarina Boat Harbour' tab

Phase	Activity Type	Fuel / Energy Commodity	Units	Quantity	Energy Consumed (GJ)	Scope 1 Emissions (t CO_2 -e)	Scope 1 Emissions (t CO_2)	Scope 1 Emissions (t CH_4)	Scope 1 Emissions (t N_2O)
Construction	Liquid Fuels - Stationary	1. Diesel Oil	kL	730.4	28,193	1,979	1,971	3	6
Construction	Liquid Fuels - Stationary	3. Heavy Fuel Oil	kL	850.2	33,754	2,492	2,484	1	7
Construction	Liquid Fuels - Transport	2. Diesel Oil	kL	759.1	29,302	2,063	2,048	3	12
Construction	Vegetation clearing	4. Seagrass	ha	0.5	0	158	158	0	0
Operation	Liquid Fuels - Stationary	1. Diesel Oil	kL	964.9	37,246	2,615	2,604	4	7
Operation	Liquid Fuels - Stationary	3. Heavy Fuel Oil	kL	708.5	28,129	2,077	2,070	1	6
Operation	Liquid Fuels - Transport	2. Diesel Oil	kL	1,138.7	43,953	3,094	3,072	4	18
									0
		Total during construction			91,249	6,534	6,503	7	24
		Total during operation			109,328	7,786	7,746	9	31
		Total over construction and 100 year design life			**200,577**	**14,320**	**14,249**	**16**	**55**

Greenhouse Gas Assessment - Emissions/Energy Source Breakdown for construction and operation of the Koombana Bay Sailing Club Marina derived proposal

nbana Bay Sailing Clu Estimates are based on the activites as outlined on the 'KBSC Marina' tab

Phase	Activity Type	Fuel / Energy Commodity	Units	Quantity	Energy Consumed (GJ)	Scope 1 Emissions (t CO_2 -e)	Scope 1 Emissions (t CO_2)	Scope 1 Emissions (t CH_4)	Scope 1 Emissions (t N_2O)
Construction	Liquid Fuels - Stationary	1. Diesel Oil	kL	252.5	9,745	684	681	1	2
Construction	Liquid Fuels - Stationary	3. Heavy Fuel Oil	kL	221.2	8,781	648	646	0	2
Construction	Liquid Fuels - Transport	2. Diesel Oil	kL	298.8	11,535	812	806	1	5
Construction	Vegetation clearing	4. Seagrass	ha	7.7	-	2,473	2,473	0	0
Operation	Liquid Fuels - Stationary	1. Diesel Oil	kL	377.4	14,568	1,023	1,018	1	3
Operation	Liquid Fuels - Stationary	3. Heavy Fuel Oil	kL	184.3	7,318	540	539	0	1
Operation	Liquid Fuels - Transport	2. Diesel Oil	kL	419.4	16,191	1,140	1,132	2	6
									0
		Total during construction			30,061	2,145	2,134	2	8
		Total during operation			38,076	2,703	2,689	3	11
		Total over construction and 100 year design life			**68,136**	**4,847**	**4,822**	**6**	**19**

Greenhouse Gas Inventory

Greenhouse Gas Assessment - Emissions/Energy Source Breakdown for construction and operation of the Dolphin Discovery Centre finger jetty derived proposal

Dolphin Discovery Ce Estimates are based on the activites as outlined on the 'DDC Finger Jetty' tab

Phase	Activity Type	Fuel / Energy Commodity	Units	Quantity	Energy Consumed (GJ)	Scope 1 Emissions (t CO_2 -e)	Scope 1 Emissions (t CO_2)	Scope 1 Emissions (t CH_4)	Scope 1 Emissions (t N_2O)
Construction	Liquid Fuels - Stationary	1. Diesel Oil	kL	16	614	43	43	0	0
Construction	Liquid Fuels - Transport	2. Diesel Oil	kL	63	2,439	172	170	0	1
Construction	Vegetation clearing	4. Seagrass	ha	0.0	-	9	9	0	0
Operation	Liquid Fuels - Stationary	1. Diesel Oil	kL	24	921	65	64	0	0
Operation	Liquid Fuels - Transport	2. Diesel Oil	kL	95	3,658	258	256	0	1
		Total during construction			3,053	223	222	0	1
		Total during operation			4,579	322	320	0	2
		Total over construction and 100 year design life			**7,632**	**546**	**542**	**1**	**3**

Greenhouse Gas Assessment - Emissions/Energy Source Breakdown for construction and operation of the Koombana Bay Marine Structures strategic proposal

mbana Bay Marine Str Estimates are based on the sum of the emissions from each of the dervied proposals noted above

Phase	Activity Type	Fuel / Energy Commodity	Units	Quantity	Energy Consumed (GJ)	Scope 1 Emissions (t CO_2 -e)	Scope 1 Emissions (t CO_2)	Scope 1 Emissions (t CH_4)	Scope 1 Emissions (t N_2O)
Construction	Liquid Fuels - Stationary	1. Diesel Oil	kL	998.8	38,552	2,706	2,695	4	8
Construction	Liquid Fuels - Stationary	3. Heavy Fuel Oil	kL	1,071.4	42,535	3,141	3,131	2	9
Construction	Liquid Fuels - Transport	2. Diesel Oil	kL	1,121.1	43,276	3,047	3,025	4	17
Construction	Vegetation clearing	4. Seagrass	ha	8.2	-	2,639	2,639	0	0
Operation	Liquid Fuels - Stationary	1. Diesel Oil	kL	1,366.2	52,735	3,702	3,686	5	11
Operation	Liquid Fuels - Stationary	3. Heavy Fuel Oil	kL	892.8	35,446	2,617	2,609	1	7
Operation	Liquid Fuels - Transport	2. Diesel Oil	kL	1,652.9	63,802	4,492	4,460	6	26
									0
		Total during construction			124,363	8,894	8,850	10	34
		Average total per year during construction			31,091	2,223	2,213	2	8
		Total during operation			151,983	10,811	10,755	13	43
		Average total per year during operation			1,520	108	108	0	0
		Total over construction and 100 year design life			**276,346**	**19,705**	**19,605**	**23**	**77**
		Average total per year during construction and operation			**2,709**	**189**	**192**	**0**	**1**

Factors

Source	Fuel combusted / used	Emission Factor kg CO_2-e/GJ				Energy Content Factors		NGER Measurement Determination Reference (Version F2021L00740)
		CO_2	CH_4	N_2O	Total	GJ per Unit		
Liquid Fuels - Stationary	1. Diesel Oil	69.9	0.1	0.2	70.2	38.6	kL	Table 3
Liquid Fuels - Transport	2. Diesel Oil	69.9	0.1	0.4	70.4	38.6	kL	Table 4
Liquid Fuels - Stationary	3. Heavy Fuel Oil	73.6	0.0	0.2	73.84	39.7	kL	Table 3
Vegetation Clearing	4. Seagrass	322,000	0.0	0	322,000	-	ha	Refer to tabs - assumptions

Casuarina Boat Harbour redevelopment - assumptions and calculations

General Assumptions

Type	Number	Assumption
GHG Scopes	-	Only Scope 1 emissions as defined by the Greenhouse Gas Protocol are included in this assessment
Workers	51	Expected peak total staff throughout construction
Offices and site Amenities	-	Sources from the SWIS network - therefore no Scope 1 emissions
Maintenance dredging	5	± 10,000m³ every 5 years
Maintenance dredging	4.2%	Operational fuel consumption will be a proportion of construction fuel usage based on maintenance dredging quantity compared to initial dredging quantity = (10,000 / [130,000 +110,000]) = 4.2% every 5 years
Fuel consumption	626.1	Fuel consumption in the Tail Suction Hopper Dredger Modi R is assumed to be a proportion of a similar TSHD with a fuel consumption of 626.1 L/hr = (4361 / 6826) * 980 (Ports North 2014, Rhode-Nielsen ND) Outboard motor fuel consumption noted as 14.7 L/hr (Boat Fuel Economy 2022) All other fuel consumption rates taken from numbers advised by Department of Transport (2022), MP Rogers & Associates (2022), and previous projects completed by GHD
Seagrass	322.0	Seagrass is estimated to contain 322 tonnes CO_2-e per hectare (Reef Catchments 2015, Readfearn, G. 2021)
Standard hours of operation	-	6:00am to 4:00pm (10 hours), 6 days per week
Hours of operation for dredging	-	As per "Specifications for Turbidity/TSS and Sedimentatin Modelling of KBMS SPER Dredging, Reclamation and Breakwater Construction Activities" dated 25 January 2022, dredging24-hour operation CBH Phase 1 and a 12-hour operation for Phase 2
Maintenance of breakwaters, finger jetties and boat pens	1.5%	Excluding dredging fuel consumption, operational fuel consumption will be 1.5% of construction fuel consumption. This is consistent with the forecast maintenance budget of between 1% and 2%.
Distance travelled	-	Light vehicles assumed to travel 20 km daily Trucks assumed to travel 10 km daily
Construction period	-	30 days to dredge 48 weeks for northern breakwater 6 months to construct Phase 1 boat pens and floating jetties 4 months to construct Phase 2 revetment walling 2 years to construct Phase 2 boat pens and floating jetties
Construction and design	-	No dewatering is required No nightworks are permitted, therefore lighting towers are not required except where noted No drilling or piling required in breakwater construction Crew boat uses a Honda 40HP 4 stroke outboard motor
Operation period	100	Years, to coincide with 100 year design life

Casuarina Boat Harbour redevelopment - assumptions and calculations

Construction emissions: Plant and equipment fuel usage

0

Activity	Number	Type	Site Duration (Days)	Source type	Fuel Type	Fuel Consumption	Fuel consumption units	Work Force	Assumed operation use (%/day or km/day)	Distance travelled / Hours of operation	Total Fuel Used (L)
General	1	Water Cart	624	Liquid Fuel - Transport	Diesel	10.0	L/hr	1	30%	1,872	18,720
	3	Light vehicles	624	Liquid Fuel - Transport	Diesel	15.0	L/100km	3	20	12,480	561,600
Phase 1											
(TSHD) Dredge 130,000 m³ materia (24 hour operation)	1	Trailing Suction Hopper Dredge Ship includes the Hoppers (Modi R - 4,361 kW)	30	Liquid Fuel - Stationary	Heavy fuel oil	626.1	L/hr	20	80%	576	360,635
	2	Lighting tower (3kW)	30	Liquid Fuel - Stationary	Diesel	0.7	L/hr	1	80%	576	806
	1	Crew boat	30	Liquid Fuel - Stationary	Diesel	14.7	L/hr	3	80%	576	8,467
Construct Outer Northern Breakwater 3.3 ha	1	Long Reach Excavators (Large)	288	Liquid Fuel - Stationary	Diesel	40.0	L/hr	1	80%	2,304	92,160
	1	Long Reach Excavators (Medium)	288	Liquid Fuel - Stationary	Diesel	35.0	L/hr	1	60%	1,728	60,480
	1	Trucks (Semi tip tray)	288	Liquid Fuel - Transport	Diesel	30.0	L/100km	1	10	2,880	86,400
	1	Front End Loaders	288	Liquid Fuel - Transport	Diesel	25.0	L/hr	1	60%	1,728	43,200
New jetties and Boat Pens	1	Crane	156	Liquid Fuel - Stationary	Diesel	15.0	L/hr	1	60%	936	14,040
	1	Crew boat (40HP)	156	Liquid Fuel - Stationary	Diesel	14.7	L/hr	3	60%	936	13,759
	1	Pile Driver	156	Liquid Fuel - Stationary	Diesel	19.0	L/hr	1	60%	936	17,784
Phase 2											
Revetment walling	1	Long Reach Excavators	104	Liquid Fuel - Stationary	Diesel	40.0	L/hr	1	60%	624	24,960
	1	Trucks	104	Liquid Fuel - Transport	Diesel	30.0	L/100km	1	10	1,040	31,200
	1	Front End Loaders	104	Liquid Fuel - Transport	Diesel	25.0	L/hr	1	60%	624	15,600
New jetties and Boat Pens	2	Crane	624	Liquid Fuel - Stationary	Diesel	15.0	L/hr	2	60%	3,744	112,320
	1	Crew boat	624	Liquid Fuel - Stationary	Diesel	14.7	L/hr	3	60%	3,744	55,037
	2	Pile Driver	624	Liquid Fuel - Stationary	Diesel	19.0	L/hr	2	60%	3,744	142,272
(BHD) Dredge 110,000 m³ material	2	(BackHoe Dredge) Long Reach Excavators mounted on barge	85	Liquid Fuel - Stationary	Heavy fuel oil	100.0	L/hr	2	80%	1,632	326,400
	2	Lighting tower (3kW)	85	Liquid Fuel - Stationary	Diesel	0.7	L/hr	1	80%	1,632	2,285
	1	Barge (Split Hopper)	85	Liquid Fuel - Stationary	Heavy fuel oil	100.0	L/hr	1	80%	1,632	163,200
	1	Pontoon (300HP)	85	Liquid Fuel - Stationary	Diesel	113.0	L/hr	1	80%	1,632	184,416
10,000m³ high TBT Disposed of onshore	1	Long Reach Excavators	5	Liquid Fuel - Stationary	Diesel	40.0	L/hr	1	80%	40	1,600
	2	Moxy carts	5	Liquid Fuel - Transport	Diesel	30.0	L/hr	2	80%	40	2,400

Casuarina Boat Harbour redevelopment - assumptions and calculations

Construction emissions: Vegetation clearing

Activity	Area	Units
Clearing of seagrass	0.49	ha

Summary Table: Construction emissions due to plant and equipment

Activity Type		Fuel Type	Quantity (kL)
Liquid Fuel - Stationary		Diesel	730
Liquid Fuel - Stationary		Heavy Fuel Oil	850
Liquid Fuel - Transport		Diesel	759

Summary Table: Operation emissions due to plant and equipment

Activity Type		Fuel Type	Quantity (kL)
Liquid Fuel - Stationary		Diesel	965
Liquid Fuel - Stationary		Heavy Fuel Oil	709
Liquid Fuel - Transport		Diesel	1,139

Koombana Bay Sailing Club - Assumptions and Calculations

General Assumptions

Type	Number	Assumption
GHG Scopes	-	Only Scope 1 emissions as defined by the Greenhouse Gas Protocol are included in this assessment
Workers	21	Expected peak total staff throughout construction
Offices and site Amenities	-	Sourced from the SWIS network
Maintenance dredging	5	± 1,100m³ every 5 years
Maintenance dredging	4.2%	Operational fuel consumption will be a proportion of construction fuel usage based on maintenance dredging quantity compared to initial dredging quantity (1,100 / 26000) = 4.2% every 5 years
Fuel consumption	-	Cutter Suction Dredge Barge fuel consumption noted as 320 L/hr (Hansel 2021) Outboard motor fuel consumption noted as 14.7 L/hr (Boat Fuel Economy 2022) All other fuel consumption rates taken from numbers advised by Department of Transport (2022), MP Rogers & Associates (2022), and previous projects completed by GHD.
Seagrass	322.0	Seagrass is estimated to contain 322 tonnes CO_2-e per hectare (Reef Catchments 2015, Readfearn, G. 2021)
Standard hours of operation	-	6:00am to 4:00pm (10 hours), 6 days per week
Hours of operation for dredging	-	As per "Specifications for Turbidity/TSS and Sedimentatin Modelling of KBMS SPER Dredging, Reclamation and Breakwater Construction Activities" dated 25 January 2022, dredging for the Koombana Bay Sailing Club will occur 6 days per week, for 12 weeks, 12 hours per day.
Maintenance of breakwaters, finger jetties and boat pens	1.5%	Excluding dredging fuel consumption, operational fuel consumption will be 1.5% of construction fuel consumption. This is consistent with the forecast maintenance budget of between 1% and 2%.
Distance travelled	-	Light vehicles assumed to travel 20 km daily Trucks assumed to travel 10 km daily
Construction period	-	22 weeks for eastern breakwater 69 days for western breakwater 6 months to construct boat pens and floating jetties 12 weeks to dredge
Construction and design	-	No dewatering is required No nightworks are permitted, therefore lighting towers are not required No drilling or piling required in breakwater construction Crew boat only required during construction of breakwalls and dredging
Operation period	100	Years, to coincide with 100 year design life

Koombana Bay Sailing Club - Assumptions and Calculations

Construction emissions: Plant and equipment fuel usage 0

Activity	Number	Type	Site Duration days	Source type	Fuel Type	Fuel Consumption	Fuel consumption units	Work Force	Assumed operation use (%/day or km/day)	Distance travelled / Hours of operation	Total Fuel Used (L)
General	1	Water Cart	46	Liquid Fuel - Transport	Diesel	10	L/hr	1	30%	138	1,380
	2	Light vehicles	273	Liquid Fuel - Transport	Diesel	15	L/100km	2	20	5,460	163,800
	1	Crew boat	273	Liquid Fuel - Stationary	Diesel	40	L/hr	3	60%	1,638	65,520
Eastern Breakwater Construction	1	Long Reach Excavators (Medium)	132	Liquid Fuel - Stationary	Diesel	40	L/hr	1	60%	792	31,680
	1	Standard Excavator	132	Liquid Fuel - Stationary	Diesel	75	L/hr	1	60%	792	59,400
	1	Trucks	132	Liquid Fuel - Transport	Diesel	30	L/100km	1	10	1,320	39,600
	1	Front End Loaders	132	Liquid Fuel - Transport	Diesel	25	L/hr	1	60%	792	19,800
Western Breakwater Construction (Including revetment wall)	1	Long Reach Excavators (Medium)	69	Liquid Fuel - Stationary	Diesel	75	L/hr	1	60%	414	31,050
	1	Standard Excavator	69	Liquid Fuel - Stationary	Diesel	75	L/hr	1	60%	414	31,050
	1	Trucks	69	Liquid Fuel - Transport	Diesel	30	L/100km	1	10	690	20,700
	1	Front End Loaders	69	Liquid Fuel - Transport	Diesel	25	L/hr	1	60%	414	10,350
Install Jetties, Boat Pens & ramps	1	Crane	156	Liquid Fuel - Stationary	Diesel	15	L/hr	1	60%	936	14,040
	1	Pile Driver	156	Liquid Fuel - Stationary	Diesel	19	L/hr	1	60%	936	17,784
Dredge 26,000m³	1	Cutter Suction Dredge (1500kW)	72	Liquid Fuel - Stationary	Heavy fuel oil	320	L/hr	1	80%	691	221,184
	2	Moxy carts	72	Liquid Fuel - Transport	Diesel	30	L/100km	2	10	720	43,200
	2	Lighting towers (3KW)	72	Liquid Fuel - Stationary	Diesel	0.7	L/hr	2	80%	1,382	1,935

Koombana Bay Sailing Club - Assumptions and Calculations

Construction emissions: Vegetation clearing

Activity	Area	Units
Clearing of seagrass	7.68	ha

Summary Table: Construction emissions due to plant and equipment

Activity Type		Fuel Type	Quantity (kL)
Liquid Fuel - Stationary		Diesel	252
Liquid Fuel - Stationary		Heavy Fuel Oil	221
Liquid Fuel - Transport		Diesel	299
Liquid Fuel - Transport		Heavy Fuel Oil	-

Summary Table: Operation emissions due to plant and equipment

Activity Type		Fuel Type	Quantity (kL)
Liquid Fuel - Stationary		Diesel	377
Liquid Fuel - Stationary		Heavy Fuel Oil	184
Liquid Fuel - Transport		Diesel	419
Liquid Fuel - Transport		Heavy Fuel Oil	-

Dolphin Discovery Centre Finger Jetty - Assumptions and Calculations

General Assumptions

Type	Number	Assumption
GHG Scopes	-	Only Scope 1 emissions as defined by the Greenhouse Gas Protocol are included in this assessment
Workers	14	Expected peak total staff throughout construction
Offices and site Amenities	-	Sourced from the SWIS network
Fuel consumption	-	Outboard motor fuel consumption noted as 14.7 L/hr Source: https://www.boat-fuel-economy.com/honda-outboard-fuel-consumption-liters All other fuel consumption rates taken from numbers advised by Department of Transport, MP Rogers & Associates and previous projects
Seagrass	322.0	Seagrass is estimated to contain 322 tonnes CO_2-e per hectare (Reef Catchments 2015, Readfearn, G. 2021)
Standard hours of operation	-	6:00am to 4:00pm (10 hours), 6 days per week
Maintenance of jetty	1.5%	Excluding dredging fuel consumption, operational fuel consumption will be 1.5% of construction fuel consumption. This is consistent with the forecast maintenance budget of between 1% and 2%.
Distance travelled	-	Light vehicles assumed to travel 20 km daily Trucks assumed to travel 10 km daily
Construction period	-	6 months to construct finger jetty
Construction and design	-	No dewatering is required
Operation period	100	Years, to coincide with 100 year design life

Activity	Number	Type	Site Duration days	Source type	Fuel Type	Fuel Consumption	Fuel consumption units	Work Force	Assumed operation use (%/day or km/day)	Distance travelled / Hours of operation	Total Fuel Used (L)
General	1	Water Cart	156	Liquid Fuel - Transport	Diesel	10	L/hr	1	30%	468	4,680
	1	Light vehicles	156	Liquid Fuel - Transport	Diesel	15	L/100km	2	20	3,120	46,800
	1	Crew boat	156	Liquid Fuel - Stationary	0	120	L/hr	3	60%	936	112,320
Install Piles	1	Pile Driver	78	Liquid Fuel - Stationary	Diesel	19	L/hr	1	60%	468	8,892
	1	Crane	78	Liquid Fuel - Stationary	Heavy fuel oil	15	L/hr	3	60%	468	7,020
Concrete Deck Placement	1	Crane	78	Liquid Fuel - Stationary	Diesel	15	L/hr	3	60%	468	7,020
	1	Truck	78	Liquid Fuel - Transport	Diesel	15	L/100km	1	10	780	11,700

Dolphin Discovery Centre Finger Jetty - Assumptions and Calculations

Construction emissions: Vegetation clearing

Activity	Area	Units
Clearing of seagrass	0.027	ha

Summary Table: Construction emissions due to plant and equipment

Activity Type		Fuel Type	Quantity (kL)
Liquid Fuel - Stationary		Diesel	16
Liquid Fuel - Transport		Diesel	63

Summary Table: Operation emissions due to plant and equipment

Activity Type		Fuel Type	Quantity (kL)
Liquid Fuel - Stationary		Diesel	24
Liquid Fuel - Transport		Diesel	95

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The Power of Commitment