

Senator Sarah Hanson-Young, Chair

Questions on notice – Infrastructure Australia

Please provide the following documents:

- A) the two program packages taken forward to the Stage 3 business case with Infrastructure Australia;
- B) all current proponents for the Middle Arm Industrial Hub;
- C) any assessment of the feasibility of the project by Infrastructure Australia (including assessment of the Northern Territory Government's submissions to Infrastructure Australia);
- D) any cost-benefit analysis undertaken of the project;
- E) proposed equity arrangements for the project;
- F) any business case for the project.

Response:

In response to item 'C' (feasibility assessments), please see the attached documents, previously released under a separate Freedom of Information Request, which includes the Stage 2 submission received by Infrastructure Australia, and the feedback Infrastructure Australia provided to the Northern Territory Government.

In response to item 'B' (current proponents), outside of information which has been publicly referred to by the Northern Territory Government, Infrastructure Australia does not currently hold this information. This will need to be requested from the Northern Territory Government.

In response to items 'A' (program packages), 'D' (cost-benefit analysis), 'E' (equity) and 'F' (business case) —

As detailed in [Infrastructure Australia's Assessment Framework](#) (p.72), Infrastructure Australia commits to all proponents that proposal information submitted confidentially to us will not be released or published by us without the proponent's written consent. This commitment to confidentiality is to ensure that the Commonwealth has access to all of the information it needs from a jurisdiction to inform its investment decision.

Providing the requested information would be in breach of confidentiality arrangements and damaging to Commonwealth-State relations. It is recommended that these documents be requested from the Northern Territory Government.



Schedule of documents

Applicant: [REDACTED]
 Decision date: **11 October 2023**
 FOI reference number: **2023-06 and 07**
 Documents: **Middle Arm Sustainable Development Precinct**

Doc ref	Date of document	Document description	Decision and exemption provision
1	26 Mar 2023	Common User Infrastructure at Middle Arm Sustainable Development Precinct Stage 2 Submission to Infrastructure Australia	Partial release. Section 22(1) matters not relevant to the FOI request have been redacted including names of agency and third party employees. Pages 44, 46: Section 47B – exempt from disclosure in part. Redacted matters are withheld on the basis that information was communicated in confidence by or on behalf of the NT Government to IA. If released the information may cause damage to Commonwealth-State relations, in particular may adversely affect the development of future the Commonwealth-State project.
	Appendices to document 1		
a)	15 July 2021	Workshop materials	p108 – release in part – Redacted matters are withheld on the basis that information was communicated in confidence by or on behalf of the NT Government to IA. If released the information may cause damage to Commonwealth-State relations, in particular may adversely affect the development of future the Commonwealth-State project (section 45B).
b)		Climate considerations	p118 – release in full
c)		Infrastructure Projects MCA-1 and MCA-2 Results	p120 – release in full
d)		Project Working Group credentials.	p171 – not released. Redacted matters are withheld on the basis that information was communicated in confidence by or on behalf of the NT Government to IA. If released the information may cause damage to Commonwealth-State relations, in particular may adversely affect the development of future

Doc ref	Date of document	Document description	Decision and exemption provision
			the Commonwealth-State project (section 45B).
e)		Stakeholder Initial Feed back	p174 – release in full
f)		Industry survey and aggregated responses	p175 – release in full
g)		Methodology and Assumption	p179 – release in full
h)		Rapid CBA assumptions .	p184 – release in full
i)		Benefit result summary	p188 – release in full
j)		Capex costs	p189– release in full
k)		Real value of benefits and costs results summary	p192 – release in full
l)		Middle Arm Sustainable Development Projects	p193 – release in full
m)	various	Letters of support from possible proponents	<p>p194: partial release – third party agreed to the release of the letter of support.</p> <p>Remainder of the letters exempt from disclosure under section 45 – names and letters of support provided by potential third party proponents.</p> <p>Additionally the release of such material would cause harm not only to the third parties but such if released may cause damage to Commonwealth-State relations, in particular may adversely affect the development of future of a Commonwealth-State project (s47).</p> <p>Section 22(1) matters not relevant to the FOI request have been redacted including names of agency and third party employees.</p>
2	27 July 2023	IA Stage 2 Assessment Feedback	Release in full.

Common User Infrastructure at Middle Arm Sustainable Development Precinct

Stage 2 Submission to Infrastructure Australia

Department of Infrastructure, Planning and Logistics

Middle Arm Sustainable Development Precinct



THE
NORTHERN
TERRITORY
BOUNDLESS POSSIBLE

Strategic location • Enabled infrastructure • Environmental approvals • Ecosystem approach



Document title	Common User Infrastructure at Middle Arm Sustainable Development Precinct
Contact details	Department of Infrastructure, Planning and Logistics
Approved by	
Date approved	25 November 2022

Version	Date	Author	Changes made
1.0	4 January 2022		Draft
2.0	22 February 2022		Updated draft for urgent issue to Australian Government
3.0	31 August 2022		Draft for DIPL review
4.0	17 October 2022		Revision – DIPL comments addressed
5.0	26 March 2023		Revision – Climate impact included

Acronyms	Full form
APPEA	Australian Petroleum Production and Exploration Association
DCMC	Department of Chief Minister and Cabinet
DEPWS	Department of Environment, Parks and Water Security
DIPL	Department of Infrastructure, Planning and Logistics
DISER	Department of Industry, Science, Energy and Resources
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications
DITT	Department of Industry, Tourism and Trade
DRLUP	Darwin Regional Land Use Plan
EIS	Environment Impact Statement
EY	Ernst Young
IA	Infrastructure Australia
NT	Northern Territory
PMC	Prime Minister and Cabinet
PWG	Power Water Corporation

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Executive Summary

In February 2021, the Middle Arm Sustainable Development Precinct (MASDP) Stage 1 submission was reviewed and accepted by Infrastructure Australia (IA) as a national priority in the Infrastructure Priority List. The purpose of this document is to build on the existing Stage 1 Submission and present the development and assessment of a number of Project options developed as part of Stage 2.

Project Context

Australia has a rich resource base in energy, minerals, rare earths and solar irradiance, key inputs into 21st century life. Despite this rich endowment, Australia's manufacturing sector has declined as a proportion of Australia's GDP from 14% in 1990 to just 6% in 2020¹. Australia exports raw materials and purchases back value-added goods which is both a lost opportunity to capture value and creates supply chain risks that have been demonstrated by the COVID-19 pandemic and geopolitical conflict constraining access to some resources.

The abundance of natural gas, mineral deposits, and renewable energy inputs available in the Northern Territory (the Territory, or the NT) is a unique prospect for Australia to reverse this trend. Developing a value-adding minerals, energy and resources manufacturing hub at Middle Arm in Darwin Harbour will contribute enormously to Australia's economic growth and security and enhance the Northern Territory's economic, fiscal and environmental sustainability.

Minerals and energy resources are critical drivers of the Australian economy, contributing to around 8% of gross domestic product (GDP) and 75% of the country's exports². Growing demand for mineral and energy resources is expected as global energy consumption is predicted to increase by 55% between 2005 and 2030³.

Darwin is already an export hub of significance for gas, as the closest proximate port to exponentially growing markets to Australia's north. If the promise of these resource endowments; essential to modern life, can be brought on to service demand, there is an opportunity for Darwin to play a redefined role in the region.

Accelerating geopolitical uncertainty is creating further need to develop and deliver products with provenance to our partners. At the European Raw Materials Alliance launch in 2020, EU Commissioner, Thierry Breton, highlighted the need to forge major partnerships with Australia and Canada to ensure a diverse supply of critical materials⁴. Additionally, in 2020, the US president signed an executive order to address supply chain threats caused by reliance on critical mineral imports. The range of legal and policy responses will likely influence US supply chain behaviours to ensure a more resilient, diverse, and secure sourcing approach⁵. The Territory has a significant resource opportunity with some of Australia's largest deposits in non-ferrous metals (zinc, copper, lead, tungsten), battery and high-technology minerals (lithium, rare earths and vanadium), fertiliser commodities (phosphate and potash), gold and uranium⁶.

As an energy exporter, Australia will continue to play an important role in the international energy arena and strategic energy partner to the region, a role that will expand beyond our liquified natural gas (LNG) exports, to solar and renewable hydrogen within the next decade.

Expected increases in energy consumption, and how governments and companies consume and generate energy over the coming years raise social concerns over emissions related to energy products. In 2021, Australia announced Australia's Long-Term Emissions Reduction to reach net zero emissions by 2050. This plan focuses on implementing a technology-led approach to transfer current carbon-intensive industries and develop low-cost clean energy alternatives. Investment in sectors which release significant CO2 emissions can be mitigated through the use of

¹ Manufacturing, value added (% of GDP) - Australia | Data (worldbank.org), Accessed in 2022

² Ausimm - Australian mining industry (ausimm.com), 2022

³ BBC Bitesize - The rising demand for energy , Accessed in 2022

⁴ Speech by Commissioner Breton - European Raw Materials Alliance, 2020

⁵ Executive Order 13953 - Executive Office of the President, 2020

⁶ Northern Territory Government, 2022

technology, such as Carbon Capture, Utilisation and Storage (CCUS), which are essential factors in enabling low-emission energy technologies such as hydrogen and ammonia⁷.

Blue and green hydrogen production and export are exploitable opportunities for the Territory with existing export capabilities, natural gas and some of the world's highest solar irradiance. More than 126 countries, covering 51% of global emissions, have committed to achieving net zero emissions by 2050, including Australia's major trading partners such as Germany, Japan, the United Kingdom, South Korea, and China. Over 2,000 of the largest public companies are working towards reaching net zero emissions targets, including those operating in carbon-intensive industries such as Inpex, Santos, BP and Origin Energy. Renewable hydrogen is one of the crucial decarbonisation approaches to achieving net zero emission targets⁸.

Encouraging diverse investment in an industrial precinct to support gas and minerals processing, and the hydrogen industry requires a suite of common-user infrastructure to achieve the greatest outcome. Access to wharfs, jetties and marine infrastructure, road connectivity, and integrated renewable power and water, as well as carbon capture reticulation infrastructure will lay the foundations for a future proofed manufacturing precinct that captures maximum value of natural gas, minerals and solar resources closest to markets. A common user approach is efficient, supports mid-tier innovators by decreasing initial capital costs, and accelerates the activation of a precinct by delivering input and logistics certainty.

Study Area

Darwin is an existing globally significant liquefied natural gas (LNG) hub, with Darwin LNG (Santos) and Ichthys LNG (INPEX) processing facilities located south of Darwin on the Middle Arm Peninsula. Middle Arm Peninsula is adjacent to deep-water, the Marine Supply Base, East Arm Port and the future ship lift facility which is cementing Darwin's role as a service and supply hub for Ichthys LNG, the Prelude FLNG (Shell) and the Darwin LNG (Santos) projects.

The Northern Territory is supported logistically, with regional infrastructure connecting it to adjacent states through transcontinental road and rail networks, and by access to the Eastern State's gas distribution network through the Northern Gas Pipeline to Mount Isa.

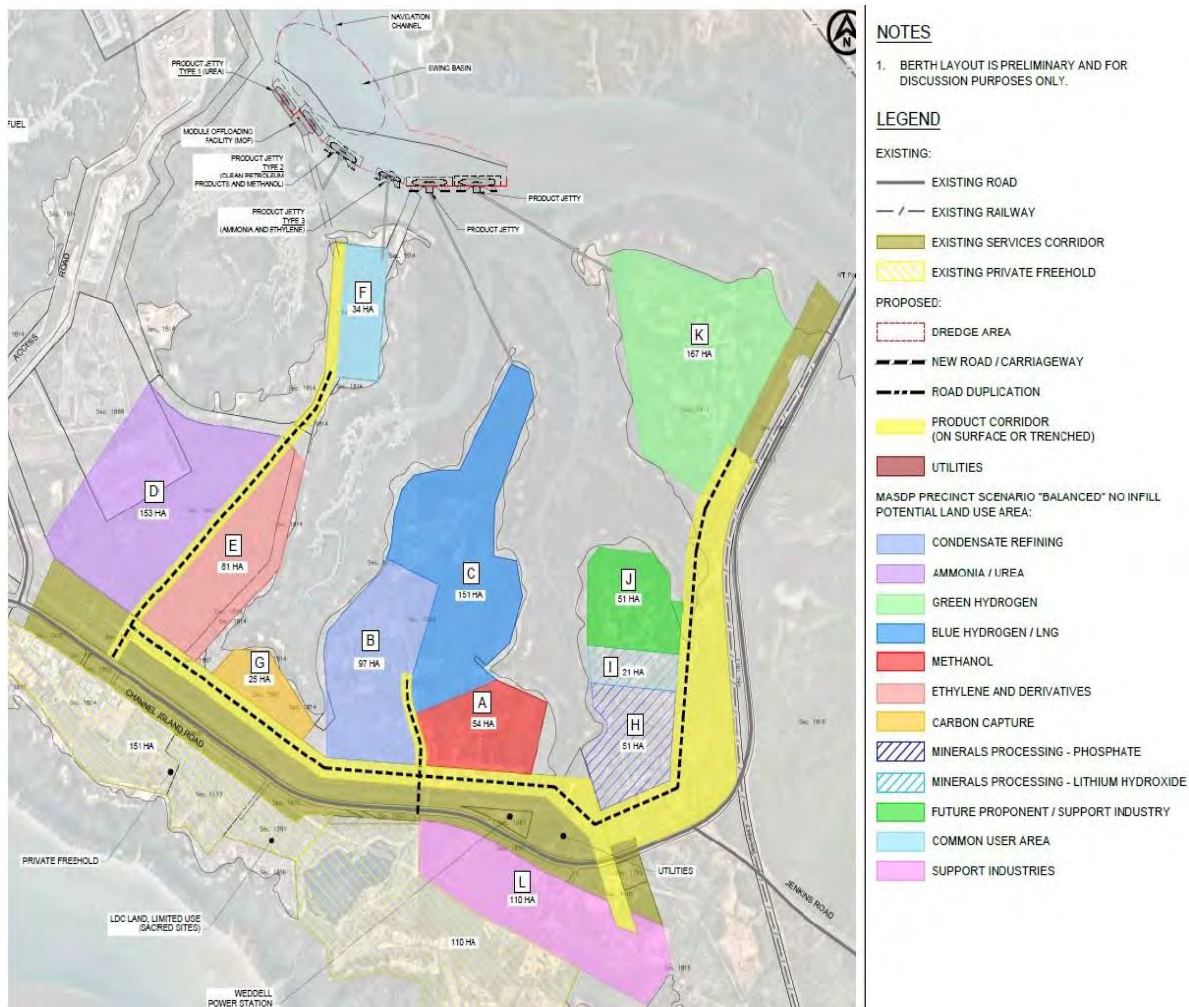
Darwin has an experienced local workforce that can support the construction of manufacturing facilities, as demonstrated through the high local content in delivery of the INPEX processing plant, and with the amenities of a capital city.

The Middle Arm Peninsula has potential to deliver up to 1,650 hectares of land for gas (including hydrogen) and strategic minerals industrial development, with a further 550 hectares of available land for support industries

⁷ Commonwealth of Australia - Global Resources Strategy Commodity Report: Liquefied Natural Gas, 2022

⁸ The Northern Territory Government - Northern Territory renewable hydrogen master plan, 2021

Figure 1: Middle Arm Sustainable Development Precinct study area⁹



⁹ Provided by DIPL

Project Problem and Opportunity Statements

Building on the assessment of strengths and weaknesses under the 'do minimum' Base Case, the Project Working Group (PWG) identified three key problems and three opportunities.

Figure 2: Problem and Opportunity statements¹⁰

Problem 1 (P1) Lack of common user industrial scale marine and land-based infrastructure accessible by investment- ready developed land for manufacturing and export	Opportunity 1 (Opp.1) Exporting products with increased beneficiation improves economic sustainability and national economic growth
Problem 2 (P2) Infrastructure to access inputs is non-existent, constrained or requires development to support the activation of national policy objectives (modern manufacturing, energy transition, critical minerals and supply chain resilience)	Opportunity 2 (Opp.2) The precinct has an opportunity to be an early mover in developing a modern, net zero capable manufacturing hub (in a first world environmental regime) for future focused minerals and energy closest to growing market demand
Problem 3 (P3) Security of supply for energy and modern minerals is a sovereignty issue	Opportunity 3 (Opp.3) The Territory has the fundamentals to deliver a diverse range of energy sources to lead energy transition to lower emissions on the pathway net zero

A set of objectives were established for the Project that aim to align with the problem and opportunity statements. The Project's six key objectives are listed below.

Figure 3: Project objectives¹¹

(Obj. 1) De-risk private investment to enable energy transition towards net zero
(Obj. 2) Use private and public investment to provide the necessary infrastructure to accelerate and increase the value adding of the Territory resources and emerging industries
(Obj. 3) Unlock the utility of strategic land and leverage existing infrastructure
(Obj. 4) Underpin economic sustainability of the Territory and broader growth of national economy
(Obj. 5) Develop more resilient national supply chains
(Obj. 6) Support common user, future proofed infrastructure

¹⁰ [REDACTED] workshop outcomes

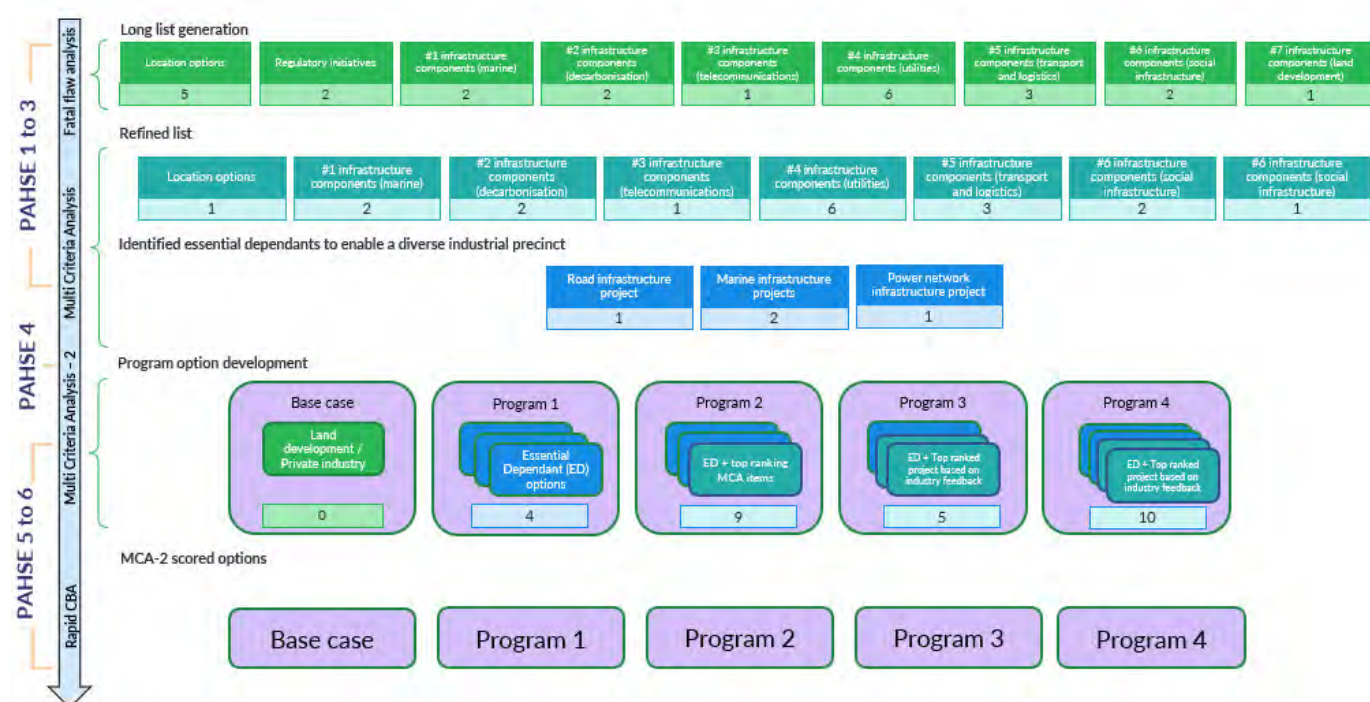
¹¹ Stakeholder workshop outcomes and strategic context and opportunities investigation

Approach to Project Identification and Evaluation

The overall approach to Project identification and evaluation was workshopped and developed by the PWG. The process to develop a project option long-list and arrive at a short-list of packaged options can be categorised into five phases of work:

- Phase 1: Long-list of common-user infrastructure related assets and associated supporting activities were identified as options;
- Phase 2: Stakeholder consultation process undertaken to validate and determine which common-user infrastructure assets best suit the precinct;
- Phase 3: Infrastructure Australia's projects multi-criteria analysis (MCA) was used to inform the Program Package identification;
- Phase 4: Program Package identification;
- Phase 5: Program Package options MCA-2; and
- Phase 6: Program Packages underwent an economic appraisal via a Rapid Cost-Benefit Analysis (Rapid CBA).

Figure 4: Program option development concept¹²



Recommendations

Through undertaking the six Phases outlined above, the following Project Packages were shortlisted. It is recommended to Infrastructure Australia that the shortlist be considered for further assessment and consideration as part of a Stage 3 Business Case submission.

¹² Prepared by EY

Figure 5: Program Package short-list

Rank	Program options
1	<p>Program 2:</p> <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure • CCUS manifold and supporting infrastructure • Transit system and parking • Digital subterranean cabling to support digital communications • Channel Island upgrade • Residential land release and costs to support additional workers accommodation
2	<p>Program 1:</p> <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure
3	<p>Program 4:</p> <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure • CCUS manifold and supporting infrastructure • Transit system and parking • Digital subterranean cabling to support digital communications • Channel Island upgrade • Residential land release and costs to support additional workers accommodation • Wastewater handling and treatment facility
4	<p>Program 3:</p> <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure • Wastewater handling and treatment facility

1. Strategic context and opportunity

Australia's opportunity to capitalise on the Northern Territory's resources and strategic location advantage requires significant investment to develop a diverse and sustainable industrial precinct enabled by common-use infrastructure.

Australia's manufacturing sector has declined as a proportion of Australia's GDP from 14% in 1990 to just 6% in 2020¹³. The COVID-19 pandemic has highlighted global supply chain fragility. Australia needs a healthy and proportionate manufacturing sector as a matter of national economic security. The abundance of natural gas, derivatives, mineral deposits and renewable energy inputs and availability in the Northern Territory is a unique prospect for Australia to reverse this trend through developing a value-adding manufacturing hub at Middle Arm in Darwin Harbour, which will contribute enormously to Australia's economic growth and enhance the Northern Territory's economic and fiscal sustainability.

A manufacturing hub would deliver construction and operational jobs, expand Australia's skill base and reduce dependence on imports while improving exports. Investment in enabling infrastructure will provide some of the necessary pre-conditions for the private sector to make final investment decisions to make the vision of a world class gas production, manufacturing and services hub by 2030 come to fruition.

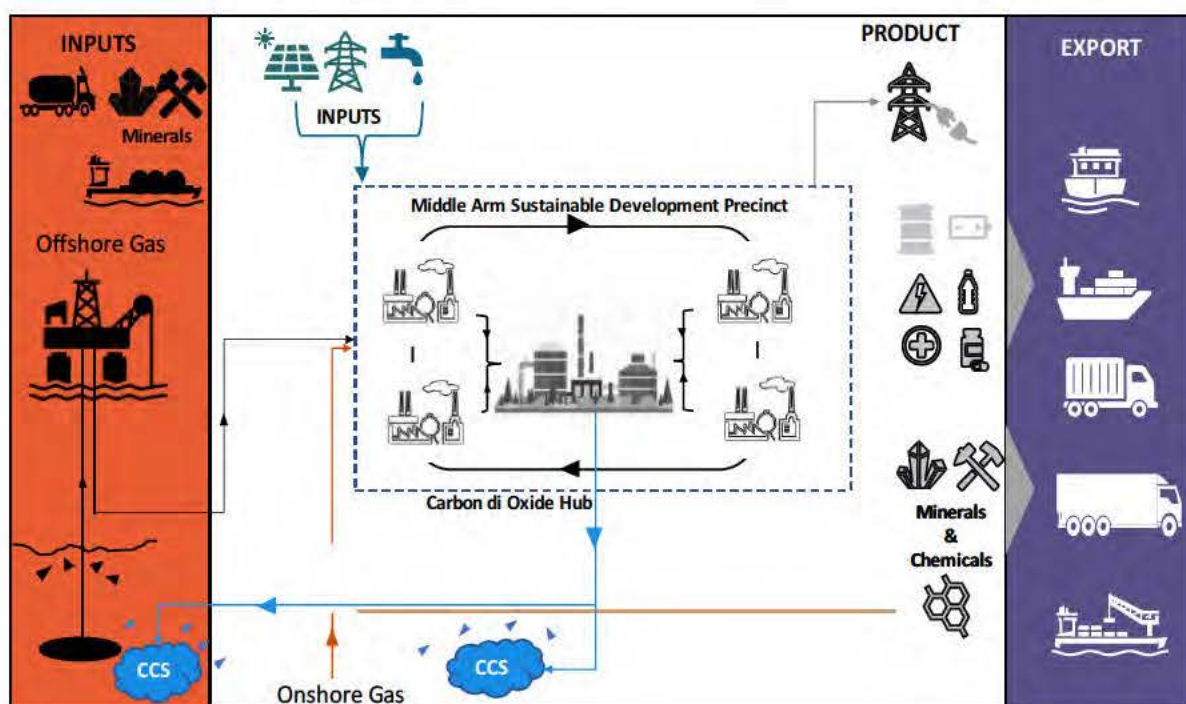
1.1 A diverse and sustainable industry precinct

An industrial precinct to support gas and minerals processing, and the hydrogen industry requires access to port and marine infrastructure, road and rail connectivity and integrated renewable power and water headworks as well as carbon capture reticulation infrastructure. It is evident that the types of industry developed at a precinct could be combined. The industry types share many synergies in required common user infrastructure that would be beneficial and drive an effective use of infrastructure.

Synergies in the colocation of the industry types and enabling infrastructure requirements is summarised in Figure 6 below. This shows a schematic representation of the Precinct, the industry type, inputs or feedstocks required and its outputs/products and methods of transportation of those products.

¹³ Manufacturing, value added (% of GDP) - Australia | Data (worldbank.org), Accessed in 2022

Figure 6: Middle Arm Sustainable Development Precinct industry enablement¹⁴



1.2 Global competitive landscape

1.2.1 Mineral and energy resources

Minerals and energy resources are key drivers of the Australian economy, contributing to around 8% of gross domestic product (GDP) and 75% of the country's exports¹⁵.

Mining is critical to providing the raw materials upon which modern society depends, and demand growth is expected to be exponential for materials that will support the energy transition. A growing population, increasing urbanisation rate, and rapid growth of economies is driving demand for energy resources, energy consumption is expected to increase by 55% between 2005 and 2030¹⁶.

Global demand for mineral and energy resources is projected to increase over the coming decades, driven by growing populations, technological development and environmental performance improvement. By 2030, the demand for natural resources is expected to increase significantly, with an estimated 67% increase in liquefied natural gas (LNG) and 24% increase in copper between 2018 and 2030, as shown in Figure 7. Increases align with expectations as these products are essential for the energy, transport, aerospace, defence, medical, automotive and telecommunications sectors.

¹⁴ Provided by DIPL

¹⁵ AusIMM - Australian mining industry (ausimm.com), 2022

¹⁶ BBC Bitesize - The rising demand for energy, Accessed in 2022

Figure 7: Forecasting Growth in World Demand of Selected Commodities¹⁷

	2018	2030	Growth
LNG (million tonnes)	318	530	+67%
Iron Ore (million tonnes)	2,107	2,372	+13%
Gold (thousand ounces)	148,620	172,906	+16%
Refined copper (thousand tonnes)	24,373	30,274	+24%
Finished nickel (thousand tonnes)	2,328	2,992	+29%
Aluminium (thousand tonnes)	62,382	94,884	+52%
Zinc (thousand tonnes)	14,664	18,858	+29%
Metallurgical Coal (thousand tonnes)	326	458	+41%
Thermal Coal (million tonnes)	1,053	1,214	+15%

The majority of demand will come from the emerging Asian markets. By 2030, more than half of the world's economic output will be from Asia, which is expected to consume 40% of its energy, and more than 3.5 billion people will enter the global middle class¹⁸.

1.2.2 Decarbonisation

The Australian annual CO₂ emissions increased by 11.4% in 2020 compared with 351.82 million tonnes emissions in 2000¹⁹. Northern Territory's total emissions were 20.7 million tonnes in 2019 leading to a 46.5% increase on 2005 levels. This significant increase was driven by the strong growth in mining and exports²⁰.

In 2021, the former Australian government released Australia's Long Term Emission Reduction Plan to achieve a net zero emission target by 2050. The current Australian Government's climate bill enshrines into law two national greenhouse gas emissions targets: a 43% cut below 2005 levels by 2030²¹, and a reduction to "net zero" by 2050.

Developing sustainability in minerals and energy sources sector is critical in order to achieve emissions reduction and reach the net zero emission target. The Australian government has identified and prioritised six low emissions technologies as the critical pathway to achieve the Australian net zero goal, as shown Figure 8²². A coordinated and

¹⁷ Department of Industry, Science, Energy and Resources - The Australian resources sector - significance and opportunities, Accessed in 2022

¹⁸ Department of Industry, Science, Energy and Resources - The Australian resources sector - significance and opportunities, Accessed in 2022

¹⁹ Our World in Data - Australia: CO₂ Country Profile, Accessed in 2022

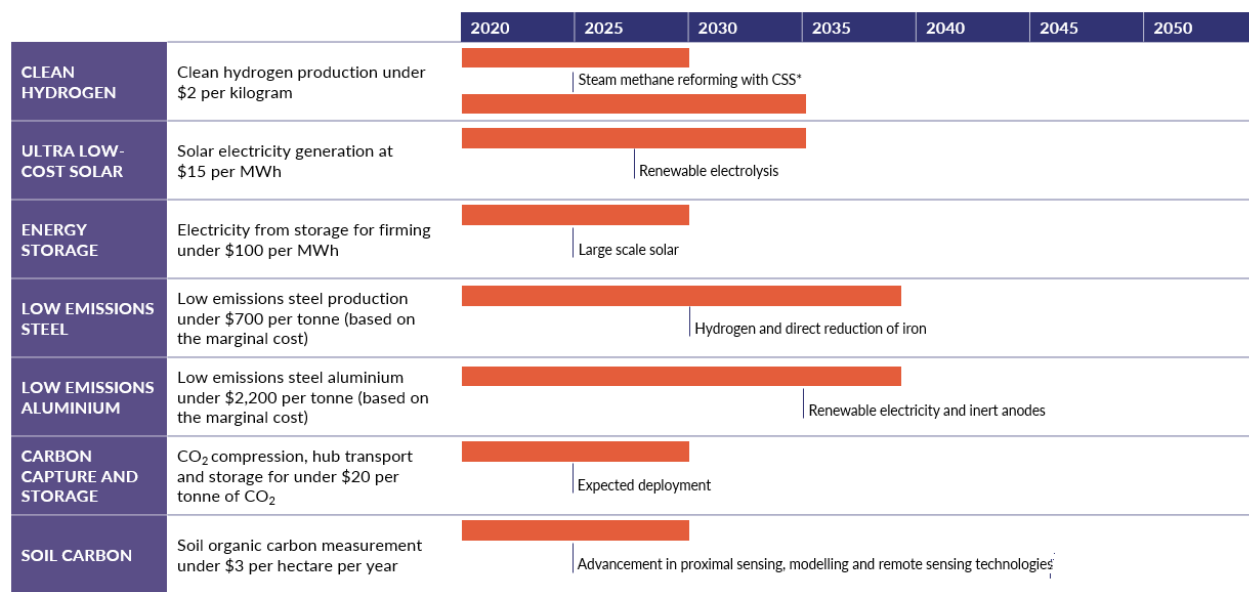
²⁰ Department of Industry, Science, Energy and Resources - State and territory greenhouse gas inventories: annual emissions, 2019

²¹ Australia's climate change targets will become law. What happens now? | Climate crisis | The Guardian, 2019

²² Australia's long-term emissions reduction plan, 2021

collaborative approach will be required to implement these technologies. Therefore, the government must cooperate with companies to develop a sustainable economy.

Figure 8: Priority Technologies and Economic Stretch Goals²³



The global transition to Net zero will drive growth for minerals and rare earths present in abundance in the Northern Territory. This coupled with Australia's well developed environmental regulation regime is an opportunity to promote sustainable and carbon minimised products.

1.2.3 Supply chain resilience

Product shortages, transportation problems, and the capacity and security of logistic systems exacerbated by Covid-19 have highlighted structural weaknesses in Australian supply chains. This is evidenced by the 37% of businesses reporting that they were experiencing supply chain disruptions in February 2022²⁴, in particular the minerals sector. A majority of companies affected are mining companies located in regional areas primarily as this sector heavily relies upon supply chains for input resources, as well as its outputs of products to both domestic and international customers.

Australia needs a healthy and proportionate supply chain as a base to support Australian economic recovery and national economic security. To address this need, the Department of Industry, Science, Energy and Resources (DISER) released a \$107.2 million supply chain resilience initiative and a \$1.3 billion Modern Manufacturing Initiative. The government will use these initiatives to support projects within 6 National Manufacturing Priority areas, including Resources Technology & Critical Minerals Processing and clean energy²⁵.

1.2.4 Strategic trade and regional relationships

Geopolitical tensions are resetting trade objectives around the globe. Our allies are seeking defence related inputs where its origin and access can be assured. Australia's neighbours are building and diversifying relationships, for example Singapore is looking to import Australian solar which will lessen its dependence on other sovereign sources of energy.

Darwin Harbour is a key enabler for the national and Northern Territory economy. Darwin is recognised as a globally significant liquefied natural gas (LNG) export hub, with exports generating more than a fifth of the Territory's Gross

²³ Australia's long-term emissions reduction plan, 2021

²⁴ Australian Bureau of Statistics - Business Conditions and Sentiments, 2022

²⁵ Department of Industry, Science, Energy and Resources - Our Modern Manufacturing Strategy, Accessed in 2022

State Product. The Territory supplies more than 10 percent of Japan and Taiwan's annual global gas imports and with international disruption to gas supplies due to the war in Ukraine, the LNG industry is set to grow²⁶.

This changing environment creates opportunities for Australian resource development and value adding.

1.3 Landscape of global demand and supply

1.3.1 Minerals and rare earths

1.3.1.1 Global demand

The World Bank Group reports that the supply of critical minerals is essential for major clean energy technologies such as electric vehicles and wind turbines. Based on 2020 requirements, demand for these minerals could increase 500% by 2050 as the world moves to lower energy emissions²⁷.

The global population is expected to reach 9.8 billion people by 2050, and 11.2 billion by 2100²⁸. This growth will see cities built at an unprecedented rate as some of Australia's nearest neighbours enter a phase of rapid urbanisation. The material inputs for this population growth will drive demand for resources.

Geopolitical conflict and risk is driving vast militarisation programs, which, when coupled with supply chain sovereignty requirements, distorts the free trade of commodities, and places a potential premium on commodities. This is expected to drive additional demand for Australian products in particular.

1.3.1.2 Global supplies

To respond to the rapidly growing demand, many countries have been implementing programs and initiatives to support the development of critical minerals. At the beginning of 2021, the mining industry has more than 13,000 active capital projects with a total investment of approximately \$1.18 trillion. China led the way in developing mining projects with over \$85 billion of investments in 2021. The Russian government also approved \$1.5 billion to develop 11 rare earth mining projects. During the same period, there were 29 projects undertaken in U.S. and Canada²⁹.

Australia has several advantages in global commodities markets, including proximity to the Asian market, abundant reserves of resources, a highly skilled workforce and a regulated business trading environment. Australia has the potential to capture a portion of this growing global demand and maintain its share in the global commodities market, which could potentially create 24,000 jobs in the resource sector, resulting in a 10% increase in resource employment³⁰.

²⁶ Northern Territory Gas Strategy | Our Territory Gas Strategy, Accessed in 2022

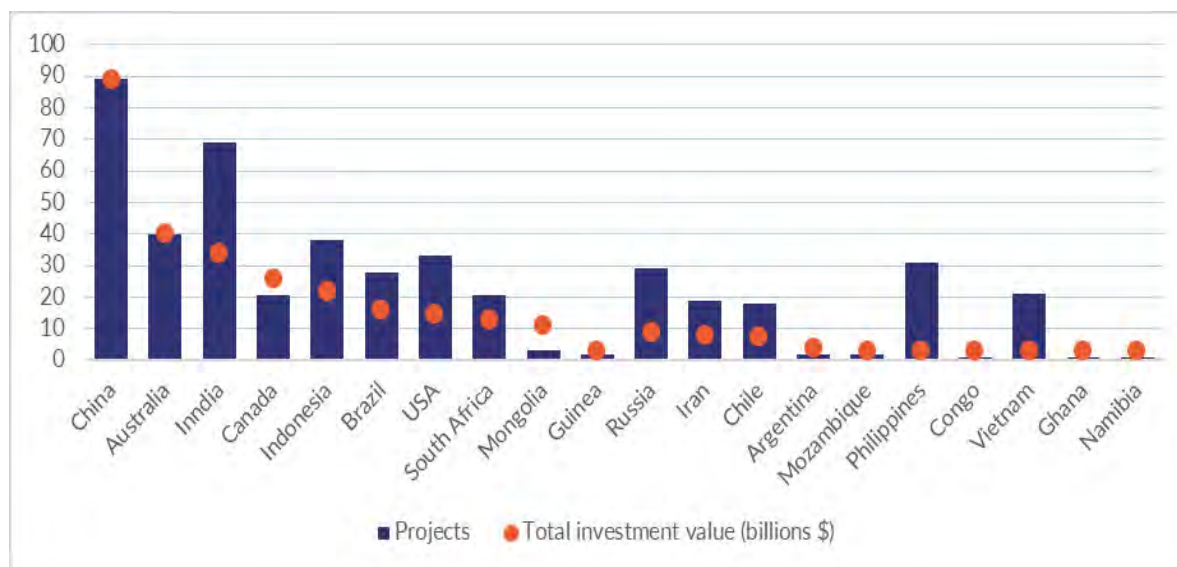
²⁷ Mineral Production to Soar as Demand for Clean Energy Increases (worldbank.org), 2020

²⁸ World population projected to reach 9.8 billion in 2050, and 11.2 billion in 2100 | United Nations

²⁹ E & MJ - 2021 Global Mining Investment Outlook, 2021

³⁰ Department of Industry, Science, Energy and Resources - The Australian resources sector - significance and opportunities, Accessed in 2022

Figure 9: Top 20 Countries for Mining Project Development 2021³¹



1.3.2 Gas and LNG

1.3.2.1 Global demand

LNG is ranked as Australia's third-largest commodity export by value, with exports of 77.7 million tonnes, contributing \$30.5 billion to the economy in 2020-21³². The oil and gas industry directly employed 276,900 Australians in February 2022, and hundreds of thousands of Australians' jobs depended on the supply of this commodity³³. Natural gas is also an essential input to the country, contributing to around a quarter of the national energy consumption. The growing demand for global gas and LNG is expected to be 30% by 2040, with the potential market in the Asia Pacific region growing 82% over the same period³⁴, as shown in Figure 10. Driven by population growth and increased direct investment in Asia, the Asia-Pacific region has been identified as a region with high demand for gas refined products, as shown in Figure 11. Australia's minerals sector can capture this growth trend to maximise profits by advancing downstream gas treatment.

³¹ E & MJ - 2021 Global Mining Investment Outlook, 2021

³² Department of Industry, Science and Resources - The Australian LNG industry , Accessed in 2022

³³ Australian Bureau of Statistics - Labour Force, Australia, Detailed, 2022

³⁴ Australia's Global Resources Statement - Reliable, Responsible, Ready for the Future, 2021

Figure 10: LNG Demand Growth in Australia's High Potential Markets³⁵

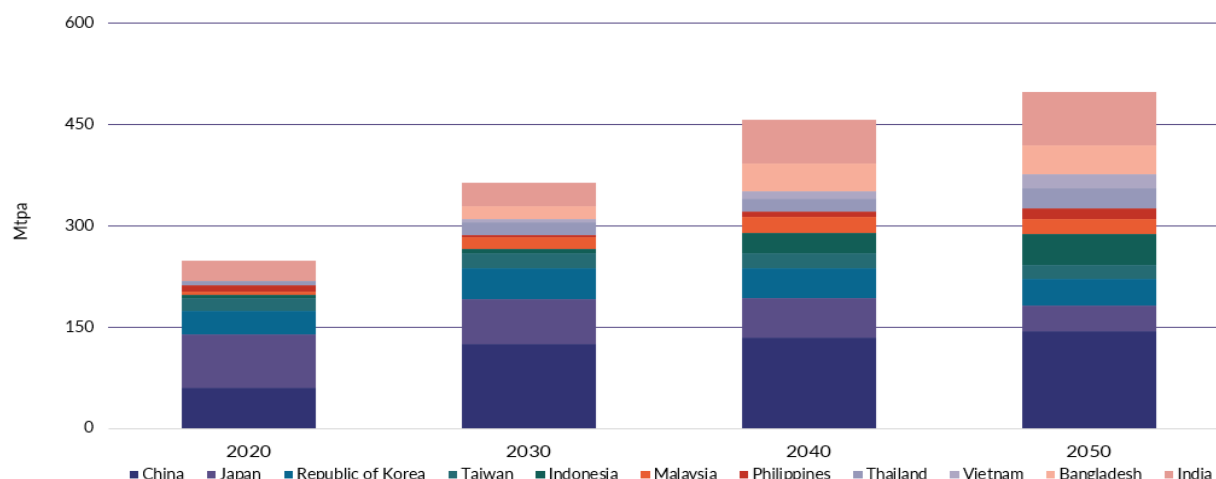
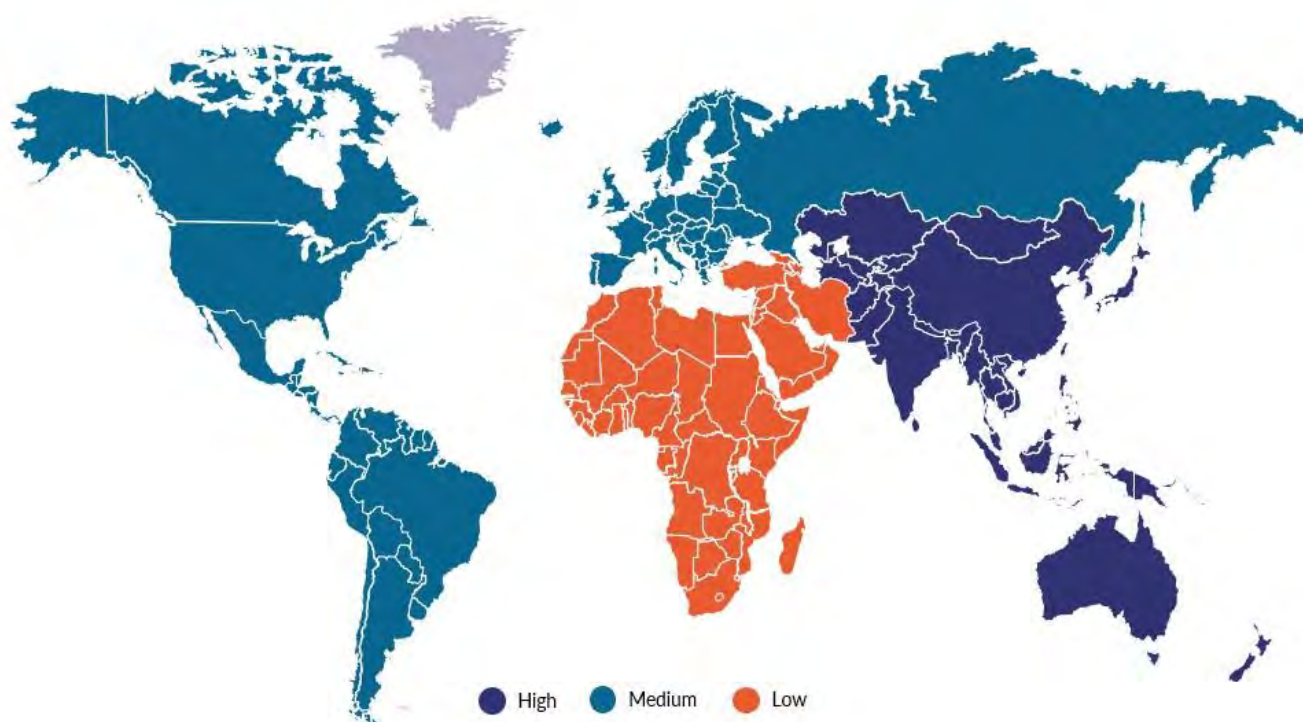


Figure 11: Oil & Gas Downstream Market – Growth Rate by Region, 2020-2025³⁶



1.3.2.2 Global supply

Australia's competitors have made significant investments in gas and LNG, as illustrated in Figure 12. For example, Qatar invested US\$29 billion in the North Field East project in 2020. The project is expected to bring massive growth in LNG exports to Qatar by increasing LNG production capacity to 110 million tonnes annually by 2025³⁷. Therefore,

³⁵ Global Resources Strategy Commodity Report: Liquefied Natural Gas, 2022

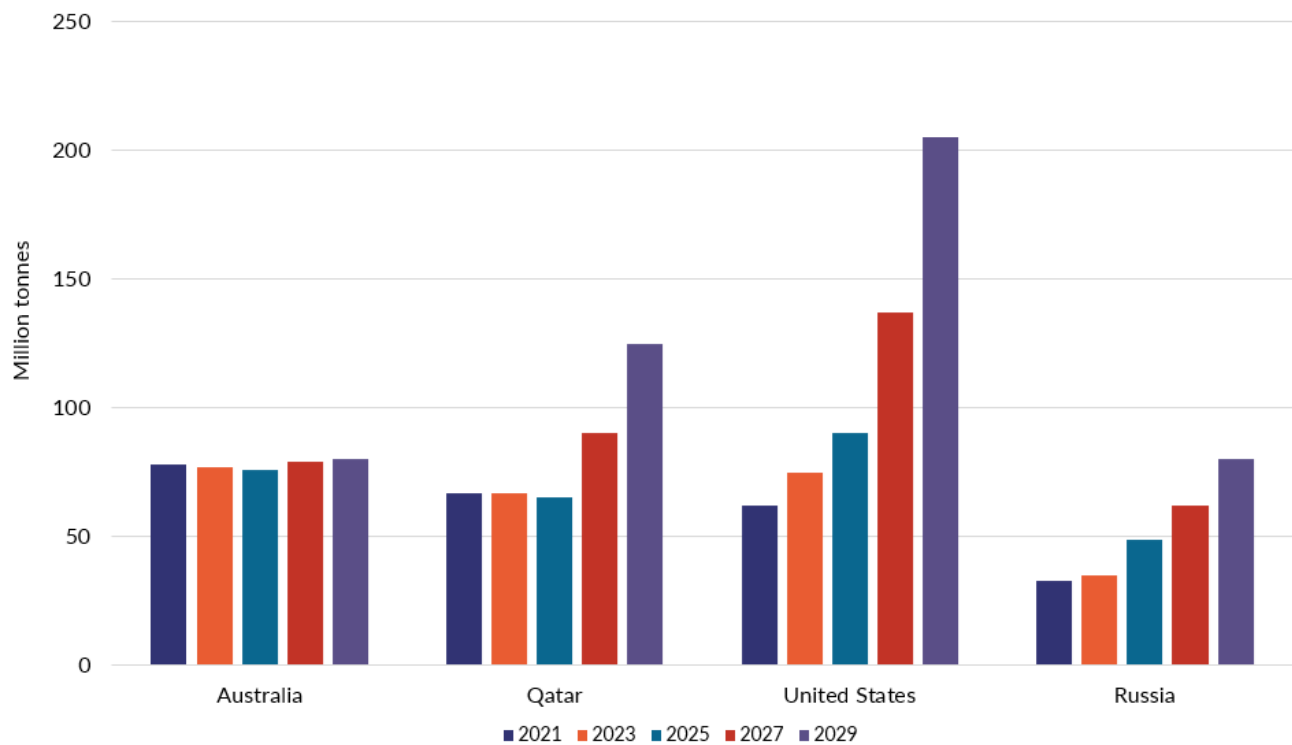
³⁶ Mordor Intelligence - Oil & Gas Downstream Market 2022, Accessed in 2022

³⁷ ieconomy.io - Qatar Invested \$ 29 Billion for LNG , 2021

the Australian government needs to invest in this sector and improve its common-used infrastructure before relinquishing its position as a significant LNG exporter.

In 2021, Australia announced Australia’s Long-Term Emissions Reduction to reach net zero emissions by 2050. This plan focuses on implementing a technology-led approach to transfer current carbon-intensive industries and develop low costs clean energy. Similarly, effective emission reduction management is a critical success factor for the future of gas and LNG. Carbon capture and storage will be vital in this management plan through direct capturing, sequestering at the production source, and separating and storing CO₂. LNG, combined with Carbon Capture Utilisation and Storage (CCUS), are essential factors in enabling low-emission energy technologies such as hydrogen and ammonia³⁸. Achieving these objectives is key to Australia’s role as a technology leader in reducing emissions.

Figure 12: Forecasted LNG Exports by Country³⁹



1.3.3 Hydrogen energy

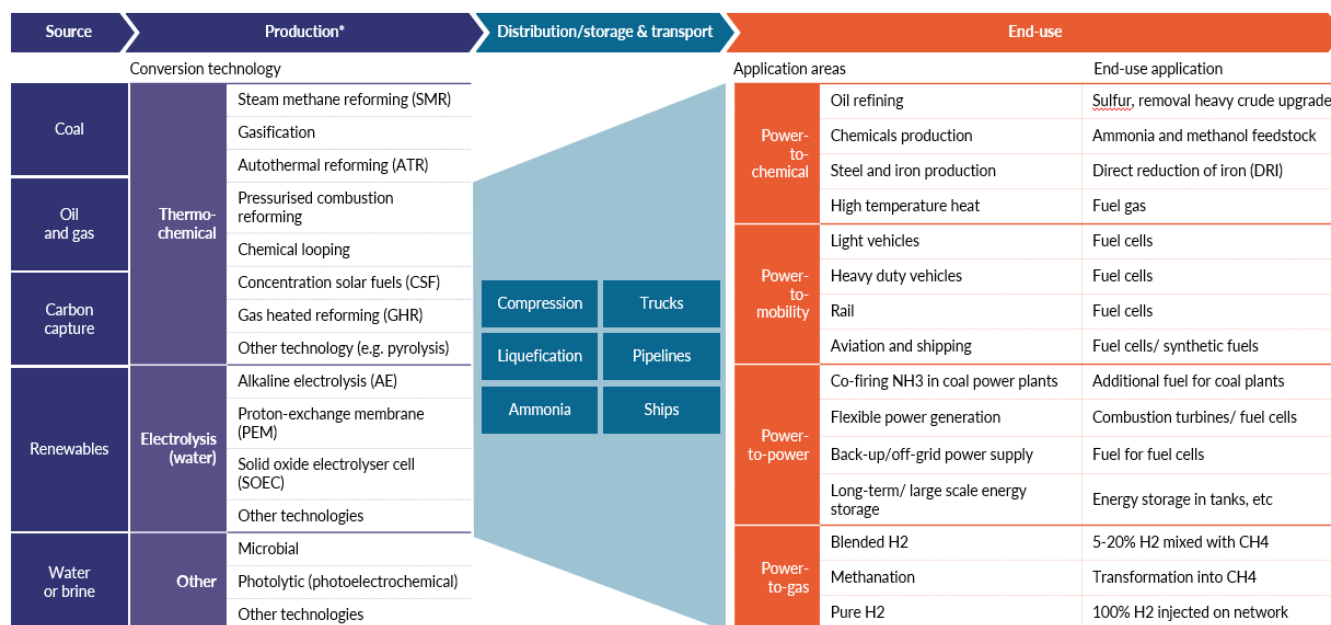
Hydrogen is a transformative fuel. There are three main ways to produce clean hydrogen from water. One method is the decomposition of water molecules. The other two methods extract hydrogen through the reaction of fossil fuels or gas, which requires carbon capture and storage to capture the carbon emissions produced by this process.

Hydrogen energy can be delivered through existing gas networks or transported by trucks and ships as gas or liquid (ammonia). Renewable energy can be widely used, such as fuel for transportation or heating, and feedstock for other industrial processes, as shown in Figure 13. Hydrogen technology has the potential to reduce customers' electricity costs and enhance Australia's energy security and resilience by reducing dependence on liquid fuel imports, therefore positioning Australia to export hydrogen, to underpin the energy security of our neighbours.

³⁸ Global Resources Strategy Commodity Report: Liquefied Natural Gas , 2022

³⁹ Global Resources Strategy Commodity Report: Liquefied Natural Gas , 2022

Figure 13: Hydrogen Technology Landscape⁴⁰



1.3.3.1 Global demand

More than 126 countries, covering 51% of global emissions, have committed to achieving net zero emissions by 2050, including Australian major trading partners such as Germany, Japan, the United Kingdom, South Korea, and China. Over 2000 of the largest public companies are working towards reaching net zero emissions targets, including those operating in carbon-intensive industries such as Inpex, Santos, BP and Origin Energy. Renewable hydrogen is one of the crucial decarbonisation approaches to achieving this net zero emission target⁴¹. Based on analysis by the Bloomberg NEF, global demand for hydrogen could increase from 90 million tonnes in 2020 to 696 million tonnes in 2050 under a strong international emissions reduction scenario⁴².

The Asia Pacific market is currently valued at approximately US\$130 billion and is projected to grow at a CAGR of 9.2% by 2025 to reach US\$201 billion⁴³. Some of Australia's largest trading partners, Japan, South Korea and China, have committed to switching to hydrogen energy resources in their energy systems to reach their decarbonisation goals. Australia has several advantages, including the existing relationships and locational advantage, to fulfil this growing demand for hydrogen in Asian countries. By harnessing its capacity to produce surplus renewable hydrogen energy Australia will be able to supply the international market⁴⁴. In the long run, the total value of domestic demand for hydrogen is expected to be \$1.7 billion in 2030, equal to 64% to 77% of Australian total exporting value (AU\$2.2 billion), under a moderate hydrogen demand scenario estimated by ACIL Allen⁴⁵. Remote communities can access clean hydrogen generation for only AU\$100 per MWh, around a quarter of the energy cost of a diesel generator per MWh⁴⁶. In the Low Emissions Technology Statements, the Australian government has launched a National Hydrogen Strategy, including stretching the wholesale cost target of hydrogen to AU\$2 per kg enduring Australia's access to a clean and affordable energy resource⁴⁷.

⁴⁰ Department of Industry, Science and Resources - Australia's National Hydrogen Strategy, 2019

⁴¹ Northern Territory renewable hydrogen master plan, 2021

⁴² BNEF - Hydrogen Economy Outlook, 2020

⁴³ H2X Global, Global Hydrogen Demand, Accessed in 2022

⁴⁴ Acil Allen Report - Opportunities for Australia from Hydrogen Exports, 2018

⁴⁵ Acil Allen Report - Opportunities for Australia from Hydrogen Exports, 2018

⁴⁶ H2X Global, Global Hydrogen Demand, Accessed in 2022

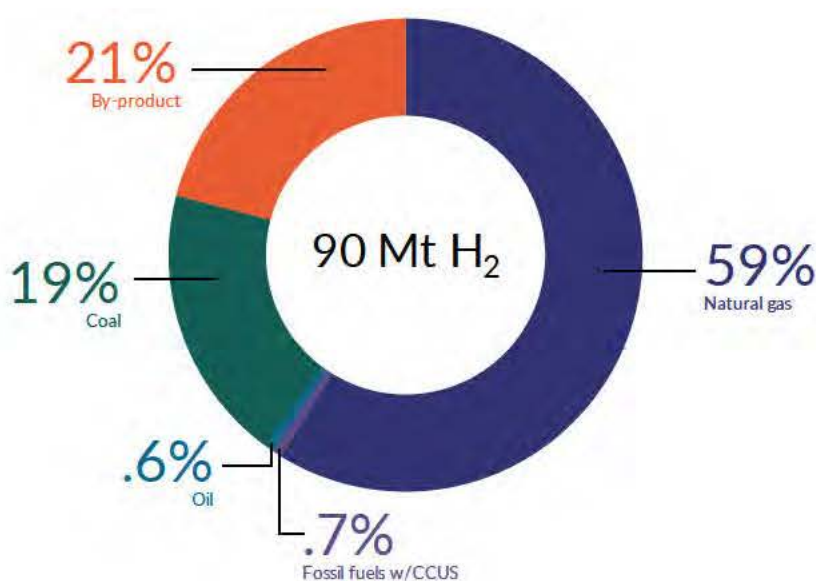
⁴⁷ Australian Renewable Energy Agency - Australia's pathway to \$2 per kg hydrogen, 2020

1.3.3.2 Global supply

In 2020, total non-low emission hydrogen production was around 90 Mt, with natural gas accounting for 59% of production. However, hydrogen produced from fossil fuels, which accounts for only 0.7% of global production in 2020, generated around 900 Mt of direct CO₂ emissions, equivalent to the combined emissions of the United Kingdom and Indonesia, as shown in Figure 14⁴⁸.

As many countries are working towards decarbonisation goals, emissions generated from hydrotreating must be mitigated. The International Energy Agency has estimated that 2030's target low-emission hydrogen production in a net zero-emission scenario will total 140 Mt, 80 Mt from electrolysis, and 60 Mt from natural gas with carbon capture utilisation storage. Based on projects under construction or planned, projected production from currently planned projects would be only two-thirds of this target⁴⁹. As countries worldwide face pressure to develop decarbonised economies, many seek to import green hydrogen to meet their energy needs. More than 30 countries have committed or made significant investments to advance the hydrogen industry, with a total of US\$70 billion in multiple projects in 2021. For example, Wuhan in China aims to become a global hydrogen city with 30 to 100 hydrogen fuelling stations by 2025. The annual production of hydrogen fuel cells is estimated to be over US\$15.6 billion. As Figure 12 shows, Australia is identified as a top green hydrogen exporter to the highly demanding Asian market among all the strong competitors with many advantages. Based on Acil Allen's forecast, Australia's potential hydrogen exports are between 15.22 TWH and 68.45 TWH, contributing about AU\$806 million to AU\$3,625 million to the Australian economy and creating around 1439 to 5754 full-time equivalent employees (FTE) jobs by 2030⁵⁰.

Figure 14: Sources of Hydrogen Production, 2020⁵¹



⁴⁸ Global Hydrogen REVIEW 2021

⁴⁹ Global Hydrogen REVIEW 2021

⁵⁰ Acil Allen Report - Opportunities For Australia from Hydrogen Exports, 2018

⁵¹ Global Hydrogen REVIEW 2021

Table 1: Estimated Hydrogen Import Price in 2025, A\$/KG H₂⁵²

Importing country	Exporting country	Production costs						Liquefaction costs	Loading cost	Shipping cost (a)	CIF
		Electrolyser cost	Stack replacement cost	O&M costs	Electricity cost	Water cost	Total				
Japan	Australia	0.41	0.09	0.11	1.87	0.02	2.50	1.30	0.45	0.36	4.61
	Norway	0.47	0.09	0.11	1.95	0.01	2.63	1.39	0.49	0.92	5.43
	Qatar	0.45	0.09	0.14	1.44	0.03	2.14	1.42	0.53	0.48	4.57
	USA	0.43	0.08	0.12	2.03	0.02	2.67	1.28	0.52	0.68	5.16
Korea	Australia	0.41	0.09	0.10	1.87	0.02	2.49	1.30	0.45	0.38	4.62
	Norway	0.47	0.09	0.11	1.95	0.01	2.63	1.39	0.49	0.89	5.40
	Qatar	0.45	0.09	0.14	1.44	0.03	2.14	1.42	0.53	0.45	4.54
	USA	0.43	0.08	0.12	2.03	0.02	2.67	1.28	0.52	0.71	5.19
Singapore	Australia	0.41	0.09	0.10	1.87	0.02	2.49	1.30	0.45	0.28	4.52
	Norway	0.47	0.09	0.11	1.95	0.01	2.63	1.39	0.49	0.71	5.22
	Qatar	0.45	0.09	0.12	1.44	0.03	2.14	1.42	0.53	0.27	4.36
	USA	0.43	0.08	0.12	2.03	0.02	2.67	1.28	0.52	0.87	5.34
China	Australia	0.41	0.09	0.10	1.87	0.02	2.49	1.30	0.45	0.38	4.62
	Norway	0.47	0.09	0.11	1.95	0.01	2.63	1.39	0.49	0.87	5.38
	Qatar	0.45	0.09	0.14	1.44	0.03	2.14	1.42	0.53	0.43	4.52
	USA	0.43	0.08	0.12	2.03	0.02	2.67	1.28	0.52	0.75	5.22

Note: CIF refer to costs, insurance and freight basis shipping (i.e. Cost landed in buyer's country), FOB is free on-board basis at export terminals (i.e. the buyer pays for shipping)

⁵² Acil Allen Report - Opportunities for Australia from Hydrogen Exports, 2018

1.4 Domestic competitive landscape

1.4.1 Overview of the Territory exporting advantage

The Port of Darwin's proximity to international markets gives the Northern Territory a geographical advantage to access the shortest and quickest route from Australia to potential product markets throughout Asia. Darwin has established modern and high-quality transport systems and infrastructure, including a bulk commodity port with a direct connection to a national freight railway corridor running the length of the Territory. Additionally, a well-established gas distribution network, transcontinental road, and rail networks directly connect to other adjacent states.

Darwin is also home to two of the nation's largest liquid natural gas processing facilities, LNG (Santos) and Ichthys LNG (INPEX). Darwin has already been established as a world-scale LNG export hub, with access to world-class onshore and offshore gas processing. Through current minerals exporting, the Northern Territory has already entered the international minerals market and developed stable and trusted trade relationships with many neighbouring Asian countries, supporting further demand for Northern Territory products.

While a relatively small population, the Territory boasts a world class capital city, and an experienced local workforce to support the construction and operation of manufacturing facilities.

Future water security is being addressed by the Adelaide River Off-stream Water Storage Solution (AROWS) solution and logistics by the Freight and Logistics Hubs being developed along the Northern Territory spine. Gas inputs to support manufacturing and blue hydrogen as a precursor to green hydrogen are underpinned by the extremely promising Beetaloo Sub-basin and offshore reserves.

1.4.2 Mineral resources in the Territory

The Northern Territory is abundant with several world-class natural mineral resources, with some of Australia's most significant deposits (uranium, zinc-lead, bauxite, gold, phosphates, manganese). The total production value exceeds \$2 billion, as shown below in Figure 15.

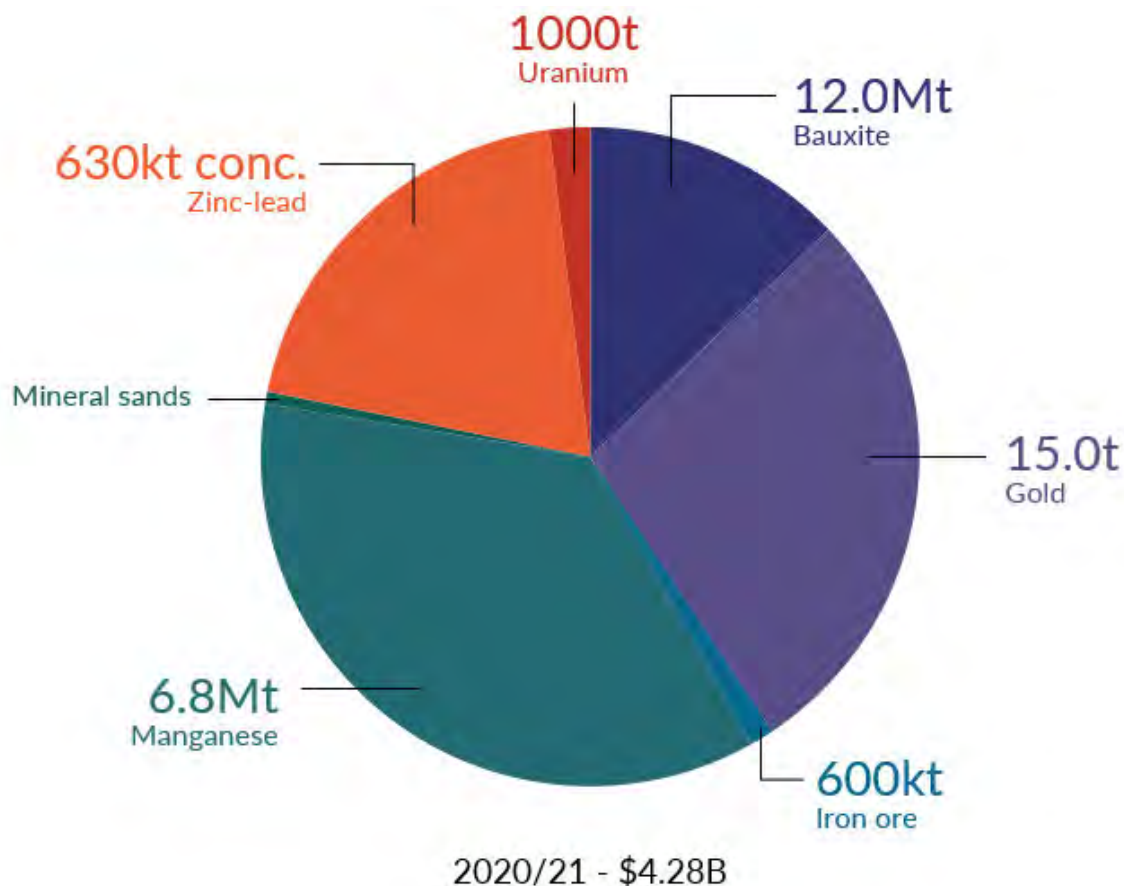
The Territory is the world's second-largest producer of manganese, accounting for 15% of global demand⁵³. It also reserves around 30% of all uranium known in Australia⁵⁴. With such prolific mineralisation, the Territory's mineral production contributed approximately \$4.3 billion to GSP in 2020-21⁵⁵.

⁵³ Geoguide - Manganese Reserves and Production Worldwide, 2020

⁵⁴ Nasdaq - 8 Countries with the Largest Uranium Reserves , 2017

⁵⁵ the Territory Budget - Mining and manufacturing, 2022

Figure 15: the Territory minerals production by value 2020-2021⁵⁶



The Territory has a strong pipeline of developing mining projects with six major operating mines and several smaller operations currently operating in the Territory, including 21 new projects in the approval process. As of July 2022, the forecast capital expenditure of these projects is over \$7.3 billion, with the potential to generate 5,400 construction jobs and up to 4,100 operational jobs once approved and launched⁵⁷.

1.4.2.1 Potential mineral resources in the Territory

Despite years of exploration and mining, the region still has significant mineral fields under-explored and under-developed compared to most other states. There are opportunities for private investors, as shown below in Figure 16. The Northern Territory Government (the Government or NTG) has been focusing on unlocking mining resources and exploring new areas of the territory for exploration. In 2018, the Government announced a total of \$26 million 'Resourcing the Territory Initiative'. Over four years (2018-2022), the Government will support resource exploration in the Territory and underpin private sector exploration success. This most prominent and ambitious the Territory initiative has been extended, increasing annual funding from the current \$6.5 million to \$9.5 million⁵⁸. In 2020, the Northern Territory Government partnered with Geoscience Australia and other states to launch a four-year "Exploring for the Future" program to develop unexplored minerals, energy and groundwater resources. This program aims to attract exploration investment through engineering, and mitigate the risk of the NT's major undeveloped greenfield areas⁵⁹.

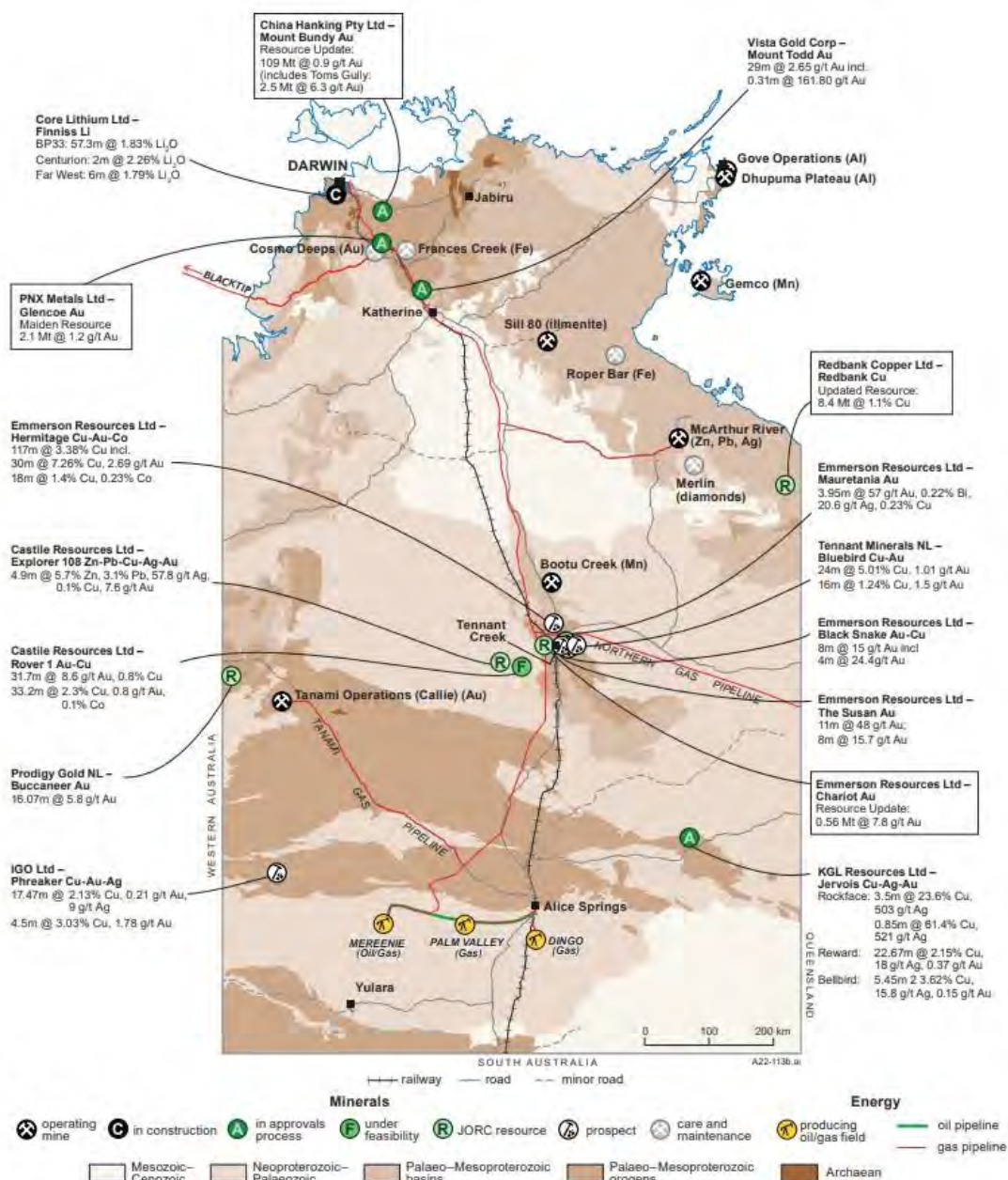
⁵⁶ NTGSRec2022-004.pdf, 2022

⁵⁷ Resourcing the Territory - Developing Projects, 2022

⁵⁸ Resourcing the Territory - About Resourcing the Territory , 2022

⁵⁹ BlewettAGES2017_presentation.pdf, 2017

Figure 16: Northern Territory Exploration Highlights⁶⁰



Several potential mineral resources have been discovered in the Tennant Creek, Barkly and Gulf regions. The Territory government has co-founded several exploration projects in the east of the Territory, with two ground gravity surveys about to commence.

1.4.3 Gas resources in the Territory

Darwin is a considerable contributor to the liquid natural gas (LNG) market through the existing hub. The Darwin LNG and Ichthys LNG projects supply more than 10% of Japan's annual global gas imports⁶¹.

⁶⁰ A22-113b_RTT_ExplorationHighlights_Mar2022_Header, 2022

⁶¹ Department of the Chief Minister and Cabinet - Northern Territory gas strategy: five point plan, 2022

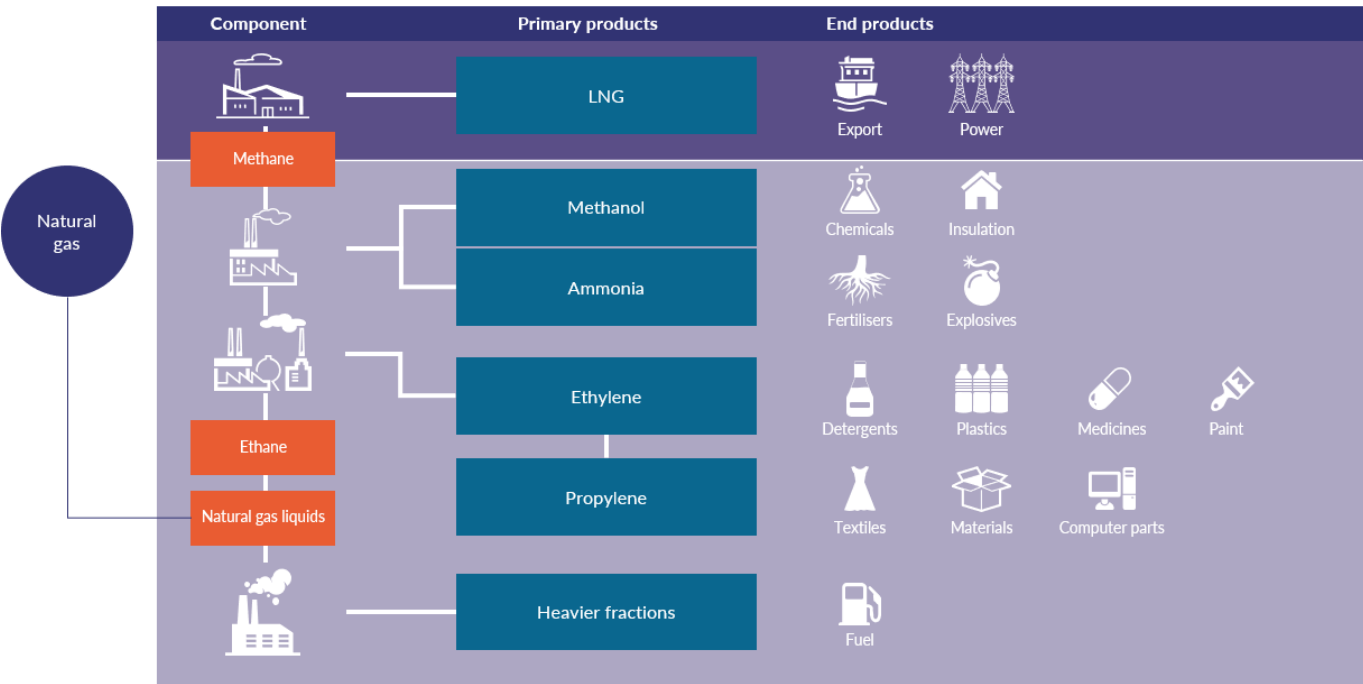
Darwin LNG (Santos) and Ichthys LNG (INPEX) onshore processing facilities are located south of Darwin on the Middle Arm Peninsula, as well as offshore platforms of DLNG, Ichthys and Shell Prelude. Middle Arm Peninsula is adjacent to deep-water, the Marine Supply Base, East Arm Port and the future ship lift facility, cementing Darwin's role as a service and supply hub for Ichthys LNG, the Prelude FLNG (Shell) and the Darwin LNG (Santos) projects. Therefore, Darwin is now well positioned to attract more investors to explore offshore and onshore gas further. The NTG have been undertaking petroleum acreage releases, with 38 exploration licences for petroleum granted onshore in the Northern Territory⁶².

In the Northern Territory region of Beetaloo Sub-basin, around 500 trillion cubic feet of potential natural gas has been investigated in shale alone, exceeding 527,000 PJ. This discovery is approximately 1,000 times Australia's current annual domestic consumption⁶³, allowing Australian consumers to access cheaper and reliable gas and oil liquids over the next few decades. Discoveries and potential gas and oil developments will ensure national gas and oil security from global disruptors such as COVID-19 and geopolitical instability.

According to industry analysis, developing this resource could potentially create 6,300 jobs and generate AU\$18- \$36.8 billion in 2040, spurring the growth of a new low-carbon industry⁶⁴.

Petroleum exploration activities and programs in Beetaloo Sub- Basin are progressing, with 20 exploration wells being drilled by joint venture investors, including Santos, Tamboran Resources and Empire Energy⁶⁵. The potential for liquefied natural gas recovery from the onshore Beetaloo Sub-Basin project is an opportunity for future production of ethane-based products such as plastics, paints, polymers and rubber as well as, the opportunity to produce liquid fuels that support Australia's energy security. Figure 17 shows the opportunity to refine and process high-value raw materials along the value chain to meet the growing demand for downstream gas products in Asia. It creates new opportunities for relevant industrial development, employment, education and training.

Figure 17: Potential natural gas downstream products⁶⁶



⁶² Resourcing the Territory - Onshore exploration, 2022
⁶³ Deloitte, Report on the Development of the Beetaloo Sub-basin, 2020
⁶⁴ Resourcing the Territory (nt.gov.au), Onshore exploration, Accessed in 2022
⁶⁵ Resourcing the Territory - McArthur Basin, 2022
⁶⁶ Figure provided by PWG

In addition to onshore reserves, current research suggests 30 trillion cubic feet (Tcf) of offshore gas reserves in the Timor Sea remain undeveloped⁶⁷. In 2021, Santos, as operator of the Barossa joint venture, invested a US\$3.6 billion gas and condensate project, located offshore the Northern Territory, it is the largest investment in Australia's oil and gas sector since 2012. An investment of US\$600 million also been made to extend the current life of LNG facility in Darwin. These two projects could potentially create 600 jobs during the construction phase and generate 350 jobs for the next 20 years of operation⁶⁸.

1.4.4 Renewable energy in the Territory

With more than 30 megajoules of solar radiation per square meter in some areas, the Northern Territory is an ideal place to exploit Australia's geographical advantages in the renewable energy industry⁶⁹. In line with the Net Zero Strategy by 2025, the 'Northern Territory's Road Map to Renewables aims to increase its share of renewable energy from 4% to 50% by 2030. Solar resources are essential for the Territory to reach targets. To achieve this goal, the Northern Territory Government has planned to upgrade its three grids to an installed total of 450 MW renewables by 2030, primarily solar PV, as envisioned in the Roadmap to Renewables Report⁷⁰. The Northern Territory Government has also invested⁷¹;

- \$59 million joint investment with ARENA for the Solar SETuP program providing 10 MW of solar across 25 remote communities
- \$5 million into the Rooftop Solar in Schools program
- \$8.3 million in the 5 MW Alice Springs battery energy storage system
- \$4.5 million in the smart energy grants scheme
- \$30 million battery energy storage system on the Darwin/ Katherine grid.

Large-scale solar installations are already producing power in Katherine and Batchelor (46.2 MWp), with 60 MW solar generation planned to be connected to the Darwin and Katherine transmission lines. This is further enhanced by the Territory Government's decision to install a battery energy storage system to support the existing and planned renewable projects⁷².

1.4.4.1 Potential solar development in NT

Further investment in potential renewable energy is the proposed Sun Cable project investigating the potential of a 17-20GW solar farm with plans to supply Darwin and Singapore with energy. The energy is expected to be transmitted via a 4200km undersea High Voltage Direct Current (HVDC) cable. The use of HVDC to reduce energy loss suffered in traditional transmission infrastructure provides the opportunity to transmit solar energy over long distances. This, along with the 36-42 GWh battery storage facility planned in Darwin, will contribute to this renewable project's energy reliability and security⁷³.

1.4.4.2 Potential hydrogen development in the Territory

Commercial renewable hydrogen production requires multiple inputs such as water, power sources, hydrogen transport and hydrogen storage facilities. Additionally, it needs various external assistance, including hydrogen-related infrastructure, political and technical support, business partnerships, financial access, industrial development and human resources⁷⁴. Darwin has been identified as a prospective hydrogen production hub location by the Australian Government with many competitive advantages in hydrogen energy development:

- World class renewable energy resource in high levels of solar irradiance can be used as clean energy feedstock of hydrogen

⁶⁷ Invest NT – Energy, 2022

⁶⁸ Santos-announces-FID-on-the-Barossa-gas-project-for-Darwin-LNG.pdf, 2021

⁶⁹ Northern Territory Government - Northern Territory renewable hydrogen master plan, 2021

⁷⁰ Northern Territory Roadmap to renewables report, 2017

⁷¹ From Stage 1 submission

⁷² Darwin-Katherine Electricity System Plan, Accessed in 2022

⁷³ Sun Cable - The World's Largest Solar Energy Infrastructure Project, Accessed in 2022

⁷⁴ Northern Territory renewable hydrogen master plan, 2021

- Abundance of energy resources secure the energy input for blue hydrogen production as a pathway to green hydrogen
- Darwin's coastal location provides options for desalination to access water
- Existing world class gas and LNG network meet the basic transportation requirements for hydrogen
- Existing reliable connections, including road, rail and marine linkages to domestic and international locations
- Current and potential mineral projects create opportunities to scale up Territory demand for hydrogen energy

1.4.4.3 Other renewable energy

Darwin's sizeable tidal range has also prompted international companies' interest in potential tidal energy production. Initial studies of a 10 MW system for the Clarence Straits to the north of Glyde Point near Darwin, but these are not considered viable in the medium term⁷⁵. Geothermal energy also has potential in the NT. However, additional development is needed to be regarded as a sustainable energy source in the medium term⁷⁶.

⁷⁵ Science Direct - Assessment of tidal current resources in Clarence Strait, Australia including turbine extraction effects, 2021

⁷⁶ Geothermal energy potential of the Northern Territory, 2007

1.5 Current state of Darwin infrastructure

1.5.1 Prospective project types

A number of gas manufacturing and mineral processing proponents have already invested significantly in pre-feasibility and front-end engineering as part of plans to develop manufacturing and refining projects in the Northern Territory. To date, around \$5.9 billion in potential capital investment has been identified in projects in feasibility stage of development. This value excludes significant LNG expansion from existing operators. It should be noted that while ongoing, operational revenues and expenditure will depend on the specific industries. Without serviced land availability and common user infrastructure it is unlikely that these industries will commence in the short to medium term. Table 2 outlines the prospective project types which align with a balanced scenario of potential MASDP proponents at the time of developing the Stage 2 Submission. Project types have been used as a guide and subject to change as projects become more mature.

Table 2 -Summary of prospective project types⁷⁷

	Project	Inputs	Outputs	Related Projects
1	Carbon capture and storage common-user hub	Waste or by-product streams from SMR and other hydrocarbon processes	Carbon dioxide	Output of Blue Hydrogen Feedstock to Methanol export plant Feedstock to Urea
2	Liquefied Natural Gas (LNG) Train	Natural gas	Liquefied natural gas, carbon dioxide (nitrogen, helium and natural gas liquids as potential by-products)	All except lithium and phosphoric acid.
3	Blue Hydrogen	Natural gas, water	Hydrogen Carbon dioxide	Feedstock to Methanol export plant Feedstock to Ammonia export plant
4	Green Hydrogen	Renewable energy, water	Hydrogen	Feedstock to Methanol export plant Feedstock to Ammonia export plant
5	Ammonia export plant	Hydrogen, Zinc Oxide and air (Nitrogen)	Ammonia, Zinc Sulphide	Output of Hydrogen Feedstock to Urea
6	Methanol export plant	Hydrogen, carbon dioxide OR synthesis gas	Methanol, water	Feedstock from Hydrogen
7	Condensate refinery	Condensate, water, gas, renewable energy	Gasoline, Kerosene, Diesel, Marine, Heavy	
8	Phosphoric acid production facility	Phosphate rock, sulphuric acid	Phosphoric acid, calcium sulphate (gypsum)	Output of Ammonia export plant to produce fertiliser products
9	Ethane cracker	Ethane, propane	Ethylene	
10	Urea	Ammonia, carbon dioxide	Urea	Feedstock from Ammonia export plant Feedstock from Carbon capture and storage common-user hub
11	Lithium Hydroxide	Lithium carbonate, calcium hydroxide	Lithium hydroxide	

⁷⁷ Provided by PWG

1.5.2 Current state of Darwin infrastructure

While the Territory does have some enabling public infrastructure, such as the transcontinental railway, arterial road and port infrastructure, there are limitations to existing enabling public infrastructure. Insufficient serviced and available land adjacent to the existing Darwin port is a barrier to gas and minerals processing on East Arm. These projects require proximity to a loading wharf with the capability to berth vessels up to 80,000DWT and potentially larger in the future. It is impractical and costly to pipe products from Middle Arm to Darwin Port as the only practical route for undersea pipelines to Darwin Port is approximately 15km long and conflicts with existing shipping channels. Additionally, this solution would be unable to support the number of product lines involved with manufacturing which represents a significant barrier to the viability of projects.

Most of the current and existing marine infrastructure (loading wharves and modular off-loading facilities) in the proposed area is private infrastructure, and the location/configuration of this infrastructure prevents its conversion to common-use public infrastructure. Therefore, unlocking marine infrastructure and serviced land to support the development of a gas and minerals refining hub in Darwin and providing common user facilities is essential to support the development of these industries. Investment in common-user public infrastructure to enable a gas and minerals refining hub in Darwin and to provide confidence to gas manufacturing and minerals refining proponents will encourage final investment decisions (FID). This infrastructure is critical to bringing in feedstock for alternative industries and exporting manufactured products to market.

1.5.3 Common use infrastructure requirements to support value adding and manufacturing

Prior to the development of this submission, a high-level assessment of the enabling infrastructure to support downstream gas manufacturing had been conducted by the Northern Territory Government. The Investigations revealed the following critical elements necessary to create the infrastructure needed to harness a multi-user environment include:

- Common user wharf: for export of liquid and solid products, expandable as marine traffic increases
- Common user land side facilities (CUF): to support port operations
- Modular offloading facility (MOF): transport of large pre-assembled modules (PAMS) to be imported for construction of the plants
- Headworks: including roads, product corridors, earthworks and trunk services for the backbone infrastructure to support a new industrial development
- Subdivision works roads, drainage, earthworks, power, water and other services.

1.6 Do minimum base case definition

The Base Case is a 'do minimum' in which existing infrastructure and services are assumed to operate at current performance levels. Major developments are limited to those that have been funded and committed.

To identify initiatives that respond to Government's goals and the original problems and opportunities identified in the Stage 1 submission, the Department of Infrastructure, Planning and Logistics (DIPL) has developed options by conducting a series of open discussions and workshop reviews with key personnel from Northern Territory departments, industry and consultant contractors. A 'do-minimum' scenario has been developed as a base case, which lets the market grow organically without common-use infrastructure supported by Government investment.

Darwin is recognised as a favourable location close to regional markets and therefore desires to make full use of this opportunity.

Under the Base Case:

- Basic land release activities conducted
- The land available at the Site is leased to the private sector
- Existing infrastructure and services are assumed to operate at current levels of performance and major developments are limited to those that have been funded and committed

- Private sector developers develop sites on a standalone basis
- The Government plays only a minor role in the curation, planning and governance of development in this area.

1.7 Problem and opportunity description

A comprehensive assessment in the Stage 1 submission considered the extent to which a 'do minimum' Base Case would enable the achievement of improving the efficiency, sustainability and capacity of the Territory infrastructure development.

The Infrastructure Australia Stage 1 submission was used as a baseline to develop and identify problems and opportunities to inform the precinct objectives. A comprehensive investment logic methodology was workshopped with key stakeholders and the PWG to ensure critical points were captured. The results of this exercise can be seen in Figure 18 below.

Building on a series of workshops and reviews with key stakeholders and the Project Working Group (subject matter experts) the assessment of strengths and weaknesses under the 'do minimum' Base Case. Stakeholders identified three main problems and three opportunities, as outlined below in Figure 18.

Figure 18: Problem and Opportunity statements⁷⁸

Problem 1 (P1) Lack of common user industrial scale marine and land-based infrastructure accessible by investment- ready developed land for manufacturing and export	Opportunity 1 (Opp.1) Exporting products with increased beneficiation improves economic sustainability and national economic growth
Problem 2 (P2) Infrastructure to access inputs is non-existent, constrained or requires development to support the activation of national policy objectives (modern manufacturing, energy transition, critical minerals and supply chain resilience)	Opportunity 2 (Opp.2) The precinct has an opportunity to be an early mover in developing a modern, net zero capable manufacturing hub (in a first world environmental regime) for future focused minerals and energy closest to growing market demand
Problem 3 (P3) Security of supply for energy and modern minerals is a sovereignty issue	Opportunity 3 (Opp.3) The Territory has the fundamentals to deliver a diverse range of energy sources to lead energy transition to lower emissions on the pathway net zero

1.7.1 Problem evidence

The Stage 1 IA submission comprehensively assesses the problems and opportunities to develop a gas manufacturing, minerals refining hub and modern manufacturing precinct in Northern Territory. Stage 1 explicitly focused on the problems caused by a lack of common user infrastructure to enable multi-user processing and manufacturing feed-in and feed-out businesses. Common-user infrastructure provides the mechanisms to seize the opportunity to attract investment through the growing global demand for mineral and downstream products by developing low-cost energy-driven manufacturing.

⁷⁸ [REDACTED] workshop outcomes

The origin of the respective Problem and Opportunity Statements outlined in Figure 18 have been summarised in Table 3 and evidenced in above *Phase 1 Strategic Context and Opportunity* of this report.

Table 3: Problem and Opportunity Causes⁷⁹

Description	Root Cause
Problem 1 Lack of common user industrial scale marine and land	To date there has not been the demonstrated demand for the infrastructure at Middle Arm. The absence of accessible industrial land with marine access and infrastructure restricts smaller, industry participants and projects due to high individual upfront outlay costs, which in turn constrains the demand.
Problem 2 Infrastructure to access inputs is non-existent	Due to the lack of gas, utilities, logistics and workforce infrastructure, individual projects must consider all investment barriers, resulting in higher costs, decreased competitiveness or greater capital requirements for new projects.
Problem 3 Issues of security of supply for energy and modern minerals	Geopolitical volatility, global conflict and COVID-19 highlights fragility across supply chains for critical products. The need for supply chain security for essential commodities and future inputs is necessary.
Opportunity 1 Increase exporting products	Australia's geostrategic location and resource availability could enable significant downstream and manufacturing opportunities to service the exponentially growing Southeast Asian markets.
Opportunity 2 Opportunity to be an early mover in developing a modern, net zero capable manufacturing hub	To maintain pace with consumer demands and reach global environmental targets, renewable energy and the equipment and materials required to deliver green products will require modern, decarbonised industries. The Territory's abundance of solar irradiance and natural resources creates a unique opportunity.
Opportunity 3 Opportunity to lead energy transition to lower emissions on the pathway net zero	The Territory has access and exposure to significant renewable energy sources and LNG producers seeking to decarbonise future products and operations. The MASDP is a rare greenfield in that an efficient and future enabled precinct can be developed in a fit for purpose way.

Three main potential risks have been identified under Base Case:

- There is an increased risk that related Territory and Federal, initiatives and plans are not realised, resulting in lower growth and reduced employment opportunities. This is most likely to manifest as a smaller number of MASDP projects coming on stream and the last marine infrastructure site available on the peninsular developed by one single operator, in effect sterilising the peninsular for further export-oriented value adding projects.
- There is an increased risk that known gas and oil deposits (including the Beetaloo sub basin) remain stranded and that the opportunities identified in Stage 1 (world class mineral deposits, world class renewable resources) are not achieved, are delayed, or are developed in a manner which does not bring benefits to Territorians/Australians.
- There is an increased risk of supply chain disruption for key inputs into modern life including defence and energy transition needs and Australia's strategic relationships in the region, and with our allies diminish.

⁷⁹ IA Stage 1 submission, stakeholder workshop outcomes and strategic context and opportunities investigation

These potential risks provided further justification for Government to lead in providing a suite of common-user infrastructure projects to mitigate the occurrence.

1.8 Project objectives

This section describes the overarching objectives and the desired outcomes of the Project. The Project's objectives and outcomes are reflected in the option assessment framework.

A set of objectives were established for the Project that aim to maximise the benefit of common user infrastructure and align with the problem and opportunity statements that have been outlined above, as well as objectives from a range of stakeholders' perspectives.

The Project's six key objectives are listed in Figure 19.

Figure 19: Project objectives⁸⁰

- 
- (Obj. 1) De-risk private investment to enable energy transition towards net zero
 - (Obj. 2) Use private and public investment to provide the necessary infrastructure to accelerate and increase the value adding of the Territory resources and emerging industries
 - (Obj. 3) Unlock the utility of strategic land and leverage existing infrastructure
 - (Obj. 4) Underpin economic sustainability of the Territory and broader growth of national economy
 - (Obj. 5) Develop more resilient national supply chains
 - (Obj. 6) Support common user, future proofed infrastructure

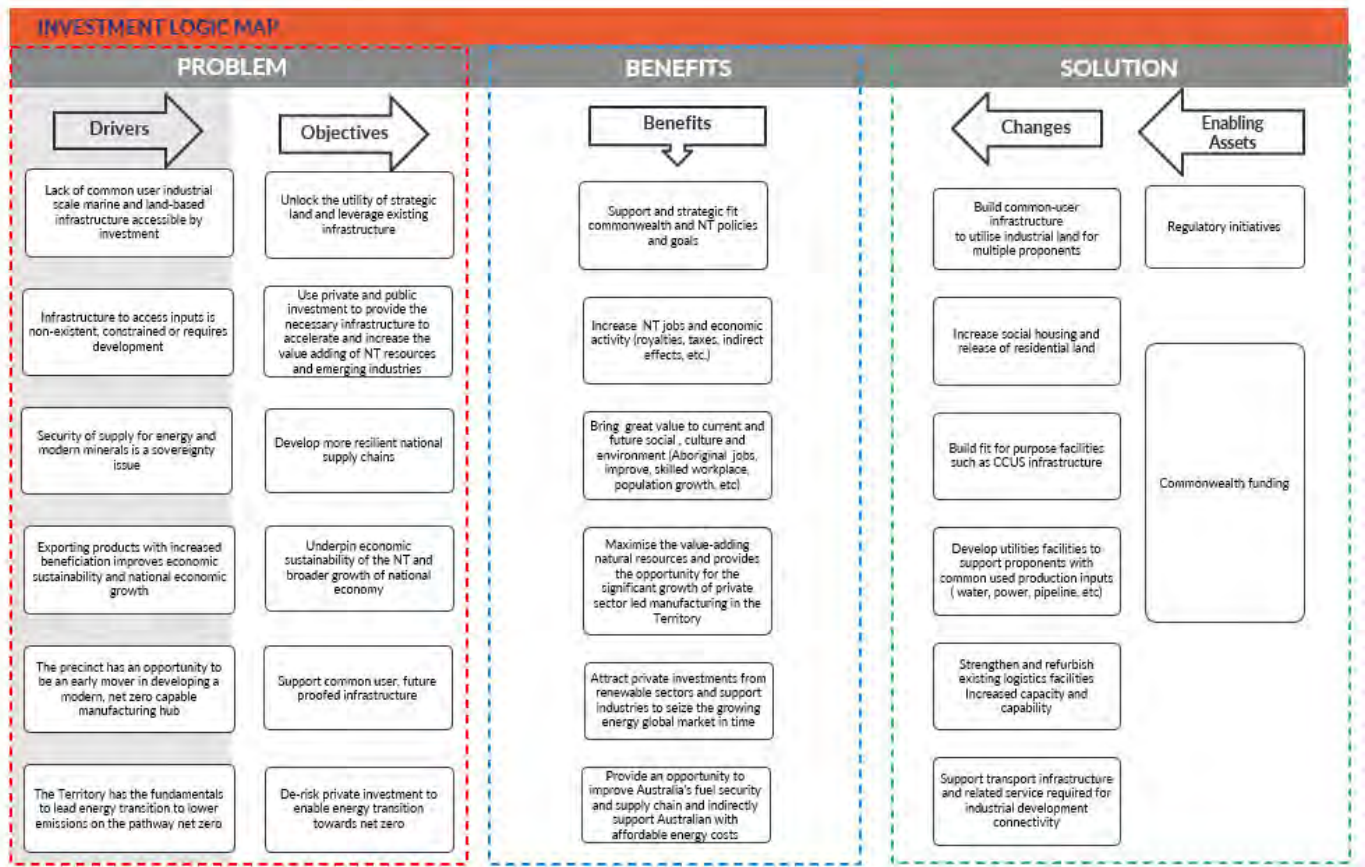
The linkages between project problem, opportunities, and objectives were discovered through an investment logic mapping exercise performed with the project working group and SMEs. The outcome of the workshop is shown in Figure 20 below. Supporting workshop materials can be located in **Appendix A**.

⁸⁰ Stakeholder workshop outcomes and strategic context and opportunities investigation

Figure 20: Investment logic map⁸¹

Investment Logic Mapping – Workshop 1 outcomes

Middle Arm - Infrastructure Australia Stage 2 Submission



⁸¹ Stakeholder workshop outcomes and strategic context and opportunities investigation

2. Initiative identification and evaluation summary

This chapter provides a high-level summary of the process undertaken to generate a comprehensive long-list of infrastructure projects that aimed to address the Project's problems and opportunities.

The long list included various possible infrastructure projects for an investigation to consider across three Program Package options. The suite and scale of infrastructure projects selected in each program were chosen to attract the most diverse mix of industries and investment in the precinct while aligning with the strategic opportunities and objectives.

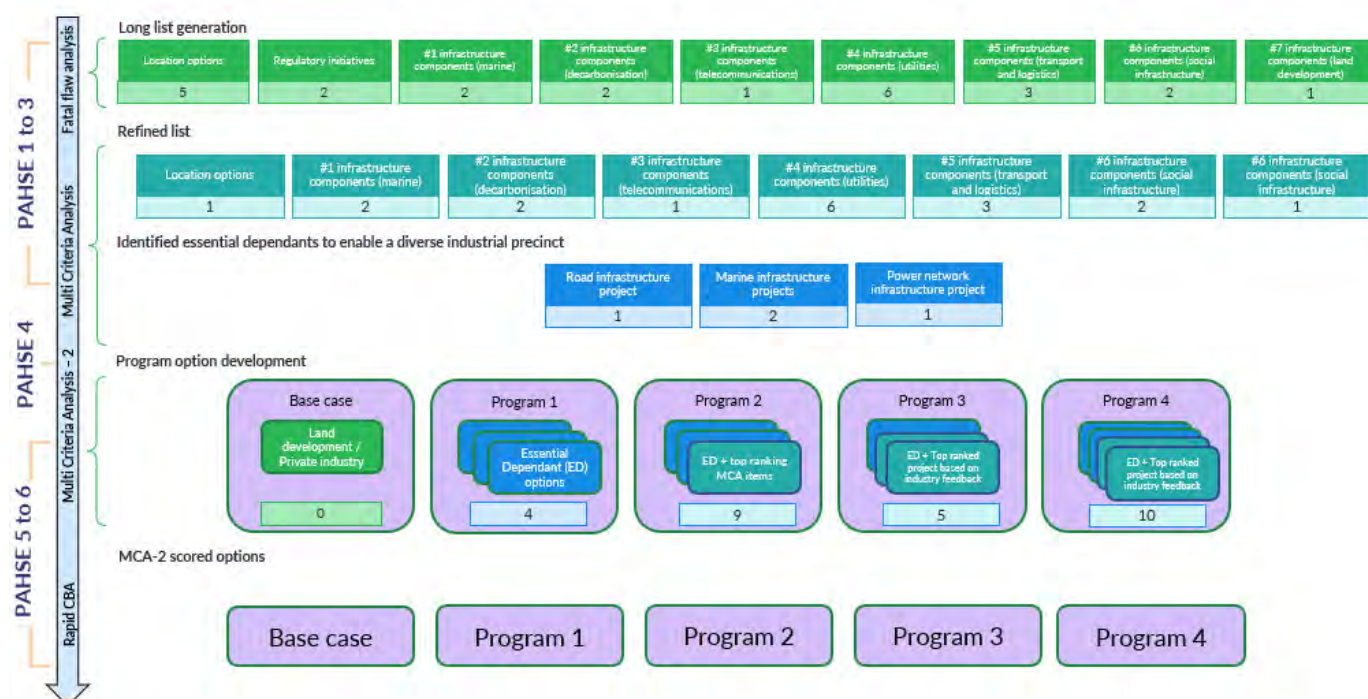
This section also summarises the approach undertaken for assessing the long list of infrastructure project options which includes a Fatal Flaw analysis and a comprehensive MCA analysis, as well as an extensive economic assessment of the short-listed program options that were carried through to the Rapid CBA.

2.1 Approach

Given the nature of current state of the Territory's infrastructure, serviced land and the need to support the development of manufacturing and mineral refining sectors. Each option considered in the optioneering process does not investigate one specific investment, but rather a 'packaged program' of investments that bundles assets throughout the study area. Each Program Package option included various types of assets, all of which aim to address the Project's problems and opportunities defined above.

The overall optioneering methodology for the Stage 2 submission was workshopped and developed by the multiple stakeholders and tested with Project Working Group (PWG). The process to develop a project option long-list and arrive at a short-list of Program Packages can be categorised into six phases of work. Figure 21 provides a conceptual overview of the options evaluation process used for the development and assessment for the Stage 2 submission. Each phase of work is described in detail in the following chapters.

Figure 21: Option Evaluation Process⁸²



⁸² facilitated workshop outcomes

At the time of developing this submission, the sustainable industrial precinct's development was relatively mature conceptually, constraining the potential program optionality which could be considered within the project area. Additional constraints and limitations on where and how common-user infrastructure could be configured and utilised within the project area directed our approach to understand what infrastructure projects could achieve the best investment outcomes for the precinct, Government and the community.

The most comprehensive way to achieve this outcome was to determine the necessary 'essential dependant' infrastructure projects. The items identified as essential dependants were supported by an MCA on the long list and industry survey. The results of these phases would determine the Program Package options, which would then progress to an additional MCA-2 and Rapid CBA.

2.1.1 Phase 1 – Location and infrastructure long list development

The option evaluation process commenced with Phase 1, where a long list of infrastructure and asset class project options were identified for evaluation by the PWG. A fatal flaw analysis was conducted on the precinct location options which were considered to be unfeasible or 'fatally flawed' in the context of the Program.

A fatal flaw is described as a condition or circumstance resulting in an options' development being considered unachievable, i.e. using Taranaki as the site option. The remaining asset class project options progressed through to the Program's first MCA for assessment by the PWG.

2.1.2 Phase 2 – Stakeholder engagement

Phase 2 describes the stakeholder workshops undertaken to receive stakeholder feedback on the long list of infrastructure projects identified during Phase 1, as well as engage with stakeholders to develop MCA criteria and validate the weights of each element. The results of stakeholder consultation were used to develop the Phase 3 Multiple Criteria Analysis.

2.1.3 Phase 3 – Infrastructure projects MCA to inform the Program Packages

Findings from Phase 1-2 were used to inform Phase 3 where the long list of infrastructure projects was assessed and scored in the project's evaluation process MCA. Phase 3 built on the work, criteria and weightings established in Phase 2, and details the process undertaken to determine the MCA's criteria, weightings and scoring methodology as well as the key findings from the MCA workshop.

Findings from Phase 3 were then used to identify and supplement the Program Packages in Phase 4.

2.1.4 Phase 4 – Project packages and program identification

Phase 4 outlines the process undertaken to **identify and evaluate a list of 'Infrastructure Project Packages'**, known as the Program Packages. Each program consisted of a list of infrastructures related projects throughout the identified precinct location.

The Program Package of infrastructure projects were determined by applying the following methods:

- Essential dependant infrastructure: Infrastructure projects determined 'essentially dependant', these projects were identified as the bare minimum projects required to ensure the success of the precinct and achieve the project's objectives.
- A comprehensive MCA analysis was undertaken of the requirements of commonly used infrastructure to support the manufacturing and industrial development of the NT. The MCA considered the economic impacts on the social, cultural and environmental effects on the region and different stakeholders, the feasibility and deliverability of the relevant infrastructure in the selected precinct and the infrastructure project alignment with Northern Territory and national strategic priorities.
 - Where possible, the project team drew on specialised knowledge of the project to date supplemented by quantitative evidence. However, given the nature of the precinct the MCA results are primarily qualitative supported by quantitative evidence.

- Descriptions, reasoning and evidence (where possible) for the results are documented with additional information provided in Appendix B.
- Industry proponent consultations and surveys: A range of key potential proponents for the precinct were approached to gain insight of the most relevant and enabling infrastructure required.

Findings from Phase 4 were then used to identify the Program Packages and underwent an additional MCA-2 and economic appraisal in Phase 5 & 6 respectively.

2.1.5 Phase 5 – Program MCA-2

A second MCA was performed on the Program Package options realised from findings in Phases 1-4. Each identified program was assessed and scored based on a range of criteria developed from the original MCA. The key objectives from Phase 5 were to incorporate costings and benefits to score each program as a package of infrastructure projects.

2.1.6 Phase 6 – Program rapid CBA analysis

The short-listed Project Packages underwent an economic appraisal via a Rapid Cost-Benefit Analysis (Rapid CBA). The Rapid CBA calculated the economic costs and benefits of the short-listed options relative to the Base Case, as defined in Phase 1. Phase 6 includes assumptions, methodologies and sensitivities used to assess each Project Package. Phase 6 concluded by reporting the benefit cost ratio (BCR) and provides the rationale for selection of the preferred project option(s).

3. Phase 1 – Location, industry enablement and long list infrastructure development

3.1 Approach

It was determined that options would be comprised of a Program Package of individual infrastructure projects in the precinct. Given the size and complexity of the development which will enable a manufacturing and refining minerals hub, and various asset types utilised infrastructure, there are a number of asset class investments which have the ability to address the Project's problems and opportunities. Therefore, before investigating the packaging of investments it was prudent to develop and identify a long list of asset class investment types able to address the Project's problems, opportunities and objectives.

The PWG produced an initial range of potential asset and non-asset class investment options that formed an indicative long-list. The long list was informed by various NTG departments, and prospective proponents listed in Table 4, as well as non-capital investments that were deemed appropriate with respect to environmental and sustainability controls.

An options development workshop was conducted with various stakeholders from different departments of the Northern Territory Government. Prior to the workshop, the long list of options was circulated to the project working group (PWG) for initial consideration and feedback.

3.2 Long-list

A range of options, including the Base Case, site options, marine, decarbonisation, utilities, logistics, transport, social related services were selected for further consideration, these are outlined below in Table 4. The long list of items was developed with the PWG, and consultants detailing all possible common-user infrastructure expected to be present in an industrial precinct.

Table 4: Infrastructure project options long-list⁸³

Option Number	Description
Business as usual	
0	Maintain current state – Land development activities and private sector investment only
Site options	
	Elrundie Peninsular
	Middle Arm
	Blackmore
	Taranaki
	Expand East Arm Port
Marine, common-user investments (assets)	
1	Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility
2	Product export jetties
Decarbonisation, common-user investments (assets)	
3	CO2 Common user – Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure – capacity/open access control

⁸³ Northern Territory Government

Option Number	Description
4	CO2 for Inpex and Santos - Carbon capture utilisation and storage (CCUS) infrastructure – for CO2 transmission and supporting infrastructure - manifold to access
Telecommunications and network	
5	Digital subterranean cabling of precinct to support digital communications and automation
Utilities, common-user investments (assets)	
6	Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy
7	High capacity, networked power distribution to Middle Arm connected to DKIS
8	Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen
9	Water desalination solution available for industry proponents
10	Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure
11	Gas pipeline into Middle Arm for proponents to access
Transport and logistics	
12	Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities)
13	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor
14	Shared workforce transport / transit system – including parking and connections to worksites
Social infrastructure	
15	Worker's accommodation to enable MA workers (residential land release and costs)
16	Local emergency response infrastructure – local fire station / medical clinic / EMS
Land development	
17	Beneficial re-use of dredge soil for additional economic land

Comprehensive details of infrastructure options strengths, weaknesses and outcomes are located in Phase 3 section 5.2 of this report.

3.3 Fatal flaw analysis and results

Following the development and discussion of the project option long-list, it was considered prudent to ensure that time and resources were appropriately assigned to the most suitable precinct location in the Territory. Therefore, an assessment of the precinct option locations was undertaken to identify and evidence any locations that have been deemed to be 'fatally flawed'.

A fatal flaw is described as a condition or circumstance resulting in an options' development being considered unachievable, i.e. the flaw is so significant that the option should be removed from further consideration.

The Stage 1 business case outlined the justification for the Northern Territory as the optimal location for a diverse industrial precinct. Darwin is the capital of the Northern Territory and, as such, has the best connections and services to establish a large, new, nationally significant sustainable development precinct. Furthermore, Darwin is the closest port to realise opportunities to Australia's north. The site options must be located in or close to Darwin.

Four site options were identified as being fatally flawed and were therefore from any further investigation. Table 5 outlines these options with Middle Arm being the clear and preferred site location for the precinct to be developed.

Table 5: Project Option Long-list Fatal Flaw Analysis

Description	Fatal flaw description
Site option - Elrundie Peninsular	The size to accommodate full strategic (heavy) industry development is inadequate. It is close to urban population. The current access is limited.
Site option - Blackmore	Large low lying and mangrove margin adjoining Darwin Harbour is likely to have significant limitations for the development of port facilities, requiring either a long jetty or extensive dredging. The establishment of a deep-water port to service the site is constrained by distances of over 5km from water depths of >10m to the closest developable land. The site does not have proximity to rail facilities or any proposed rail link.
Site option - Taranaki	The site has limited access. A total of 1,500Ha has been identified outside the storm tide risk area, though suitable development land is limited, incised by steeply sloping ridge terrain with gradients of 10 – 40%. The potential of the site for strategic industry development even in the long term is considered low.
Site option - Expand East Arm Port	Development of the site would disrupt existing industry and conflict with the ship lift facility and passenger rail terminus. The port facility provides excellent wharfage but is too small. The adjacent land is too small to accommodate gas-based industries and is already developed as an industrial zone.

The 'do minimum' Base Case along with seventeen options were carried forward to the MCA and Program Package identification assessment.

3.4 Regulatory initiatives not included in this assessment

Regulatory initiatives will be critical for the success of the Middle Arm Sustainable Development Precinct. There will be overarching regulatory considerations investigated in the Infrastructure Australia Stage 3 Business Case to ensure environmental controls across the proposed industry mix are considered, measured and fall within the parameters of the broader precinct. The below regulatory options will require a detailed analysis to ensure they align with the key sustainability objectives for the precinct.

3.4.1 Precinct level approvals

A precinct wide environmental approval will be required for the infrastructure developed and managed by Government. Precinct level approvals will require each proponent to apply for their own approvals for their facilities. The precinct level environmental approvals are dependant of the development of Middle Arm as primary and heavy infrastructure precinct. Environmental offsets are likely to be required.

Key risks for precinct level approvals include:

- Environmental approvals are not granted, or require limiting conditions preventing economically efficient use
- Duplication of effort by multiple proponents to provide base line information
- Delay of investment due to lack of certainty around approvals and first come first serve basis
- Policies which identify support for a primary / heavy infrastructure precinct:
 - Our Economic Future: Northern Territory Economic Development Framework 2017, DTBI9
 - Northern Territory 10 Year Infrastructure Plan 2019-2028, DIPL11

- Territory Economic Reconstruction Commission: Final Report: Nov 2020
- Gas Service and Supply Plan (DTBI, March 2020)
- Resourcing the Territory.

3.4.2 Proponent led approvals

Under the proponent led approvals, the strategic environmental approval is obtained by Government, providing a structure where proponents may undertake a shortened process to attain specific approvals.

Under a precinct level environmental approval, DIPL would submit and apply for a strategic environmental approval, obtaining coverage for the Precinct within agreed and defined envelope parameters. Each proponent will then apply for and obtain specific environmental approval for its development. However, this scenario would be a more straightforward and concise process, therefore delivering value to the proponent in greater certainty of outcomes, shorter approval (and development) timeframes, and reduced costs.

Similar to the precinct level environmental approvals, Proponent led approvals are dependant of the development of Middle Arm as primary and heavy infrastructure precinct, where environmental offsets are likely required. However, sub-regional land use planning assessment and approvals would provide proponents with a level of 'pre-approval', reducing proponent risk in the planning processes.

Key risks for precinct level approvals include:

- Approval's framework is limiting and inhibits the proponent's developments.
- Proponents require approval outside the strategic framework, therefore, strategic approval provides no benefit.
- Policies which identify support for a primary / heavy infrastructure precinct and the development of proponent facilities:
 - Our Economic Future: Northern Territory Economic Development Framework 2017, DTBI9
 - Northern Territory 10 Year Infrastructure Plan 2019-2028, DIPL11
 - Territory Economic Reconstruction Commission: Final Report: Nov 2020
 - Gas Service and Supply Plan (DTBI, March 2020)
 - Resourcing the Territory.

4. Phase 2 – Stakeholder engagement

4.1 Approach

As part of the stakeholder consultation process, the Project team hosted a series of workshops to capture expert information, test and gather feedback on relevant issues pertinent to the Project. Participants of the workshops have specialist and valuable knowledge due to their long-standing involvement in prior consultations, and relationships with interested industry proponents and stakeholder groups relating to the Middle Arm industrial precinct.

Key workshops to develop the options development methodology to inform the Stage 2 submission comprised of:

1. Problems and opportunities definition workshop (15 July 2022 via MS Teams across Darwin and Perth):

Purpose: to develop and test the projects problems, opportunities and objectives through an investment logic mapping exercise

- The workshop drew deep discussions across experienced participant groups representing both the NTG and the Commonwealth Government
- The outcomes resulted in a draft Project problems, opportunities and objectives summary being circulated to the PWG for review and comment.

2. Confirm and test evaluation criteria workshop (26 July 2022 via MS Teams across Darwin and Perth)

Purpose: to develop critical project success factors (validate, develop and finalise the key criteria elements) to be applied in MCA

- MCA instructions, methodologies, criteria weightings, and scoring were explained, to provide the PWG context prior to discussing the potential criteria categories
- A number of key Project themes were developed. Themes specifically aligned with the Territory policies and Infrastructure Australia's guidelines to provide a thought-provoking baseline to stimulate discussion
- Key inputs for the categories and sub-categories was discussed and tested with the broader group to ensure all Project criteria met and aligned with the Territory and Commonwealth Government objectives
- Weightings were allocated against each major category and subcategory. The results were circulated post the workshop, to validate and collect feedback.

3. MCA workshop (8 August 2022 in the Darwin office and MS Teams across Darwin and Perth)

Purpose: to conduct an MCA analysis on each of the longlisted options

- The workshop opened with finalising the weighting criteria to ensure they accurately reflect the outcomes from the previous workshop, and feedback received
- The PWG was separated into two groups to ensure diverse responses were captured
- Each item on the long list of options was individually discussed against each sub criteria and an informed score was allocated based on the knowledge the PWG had obtained from stakeholder consultations (detailed in Phase 2 section 4.2)
- The process uncovered some additional long list items which were raised and added to the long list
- A follow up consultation was conducted to the two sets of results tested with the DIPL project director and final score averaged
- The MCA results were shared with the PWG and finalised over the following week.

4. MCA 2 workshop (23 August 2022 in the Darwin office and MS Teams across Darwin and Perth)

Purpose: to assign weightings to the packages to inform package ranking.

- The workshop included key members of the Middle Arm Project engineering team and external consultants
- Identified packages were discussed and agreed
- The criteria rationale and weighting were agreed and the PWG were asked to weight the packages and return via email
- The responses were aggregated, and the MCA 2 ranking of packages was based on those results

Copies of the workshop materials can be located in **Appendix A**.

Figure 22: Option Evaluation Process: The attendees of the workshops

Category	Sub-category	Value
Category 1	Sub-category 1.1	Value 1.1.1
	Sub-category 1.2	Value 1.2.1
	Sub-category 1.3	Value 1.3.1
	Sub-category 1.4	Value 1.4.1
	Sub-category 1.5	Value 1.5.1
	Sub-category 1.6	Value 1.6.1
	Sub-category 1.7	Value 1.7.1
	Sub-category 1.8	Value 1.8.1
Category 2	Sub-category 2.1	Value 2.1.1
	Sub-category 2.2	Value 2.2.1
	Sub-category 2.3	Value 2.3.1
Category 3	Sub-category 3.1	Value 3.1.1
	Sub-category 3.2	Value 3.2.1
	Sub-category 3.3	Value 3.3.1
	Sub-category 3.4	Value 3.4.1
Category 4	Sub-category 4.1	Value 4.1.1
	Sub-category 4.2	Value 4.2.1
	Sub-category 4.3	Value 4.3.1
	Sub-category 4.4	Value 4.4.1

A total of four workshops were held throughout the project, to identify and validate several key components including: project objectives, project problems, project opportunities, assessment of long lists, and MCA criteria assignment. Figure 22 lists the attendees that were included in one or more of the workshops.

The Stage 2 Infrastructure Australia Submission findings, direction, and outcomes relied on the expert knowledge of a range of NTG stakeholders. The expert group who informed the indicative MCA scoring and infrastructure solutions and supported the Stage 2 development have diverse and historical industry experience across the infrastructure in the Territory and are responsible for success to date of the Middle Arm precinct.

Credentials of the PWG and Subject Matter Experts (SMEs) can be found in **Appendix D**.

4.2 External stakeholder consultation

Prior to the development of this report, extensive consultation was performed by the PWG, and as such have extensive knowledge of stakeholder expectations, across government, industry, and other key external stakeholders.

There are a significant number of stakeholders for the Middle Arm Sustainable Development Precinct. The table below provides a summary of the stakeholder groups and their interests and views.

Table 6: External stakeholder analysis

Stakeholder	Area of interest
Australian Government agencies	<p>Potential funding of infrastructure. Approval of federal regulatory conditions. Approval of business case for inclusion on National Infrastructure Priority List.</p> <p>To create awareness of the Middle Arm Sustainable Development Precinct, DCMC and DIPL have been engaging with a number of Australian Government agencies with regards to enabling infrastructure, regulations and potential proponents. The agencies include DCMC, DISER, DITRDC, Austrade and IA.</p>
Department of the Chief Minister and Cabinet (DCMC) – Gas Task Force	<p>The Gas Task Force was initiated in 2018 to oversee the Territory Gas Service and Supply Plan which includes the following key deliverables:</p> <ul style="list-style-type: none"> • Expand the world-scale Darwin LNG export hub • Grow the NT's service and supply industry • Establish gas-based processing and manufacturing • Grow local research, innovation and training capacity • Contribute to Australia's energy security
Department of the Chief Minister and Cabinet (DCMC) – Investment Territory	<p>Investment Territory was created to respond to the TERC recommendations regarding winning investment. The Investment and Major Projects Commissioners leads this unit and are focused on winning and facilitating major private sector projects, and increasing the value of the Territory's GSP through a higher order value chain.</p> <p>A number of proponents have expressed interest in being located within the Middle Arm Sustainable Development Precinct.</p>
Department of Infrastructure, Planning and Logistics (DIPL) – Infrastructure NT	<p>Infrastructure the Territory and the Infrastructure Commissioner are key stakeholders through connection with Investment Territory, supporting the project team and the Chairman of the Gas Task Force as well as linking with the Australian Government and Infrastructure Australia.</p> <p>Infrastructure the Territory has had input into this Stage 2 submission.</p>
Department of Environment, Parks and Water Security (DEPWS)	<p>DEPWS provides support to DIPL in the development of an Environmental Impact Statement (EIS) and to the Territory Environmental Protection Authority. DEPWS developed the environmental baseline and conducted a number of studies in support of the development at Middle Arm.</p>
Department of Industry, Tourism and Trade (DITT)	<p>DITT is the lead agency for the Darwin Regional Water Supply Business Case, which is integral with the Middle Arm Sustainable Development Precinct.</p> <p>DITT is responsible for the Office of Sustainable Energy who have led the Territory Government's Hydrogen Strategy and Darwin to Katherine System Plan to target 50% renewable energy by 2030.</p>
Power and Water Corporation (PWC)	<p>PWC is the licenced water provider for the Darwin region and is also responsible for the power supply needs.</p>
Department of Treasury and Finance	<p>Department of Treasury and Finance is the central agency with responsibility for whole-of-government financial and risk management.</p>
Land Development Corporation	<p>Land Development Corporation have developed the initial 32Ha and are working with Investment Territory and Infrastructure the Territory to secure the first proponents in the Middle Arm Sustainable Development Precinct.</p>
Local Government	<p>Darwin City Council, Palmerston City Council, Litchfield Shire Council.</p>

Stakeholder	Area of interest
Australian Petroleum Production and Exploration Association (APPEA)	APPEA is the peak national body representing Australia's oil and gas exploration and production industry. It will provide a voice to the oil and gas industry in relation to the oil and gas industry, including likely demand and service levels for a variety of organisations.
Existing Proponents in Middle Arm	The current gas plants within the Middle Arm Sustainable Development Precinct are key to the success of the project. The existing proponents are Inpex and Santos and have been, and will continue to be engaged throughout the project including in opportunities to collaborate on shared infrastructure, and sharing data (particularly in the environmental space).
Potential Investment Proponents (Not for publication please)	<p>DCMC and DIPL have engaged with current and future potential proponents, gas supply, mineral extraction and manufacturing/process developers who would make use of the Middle Arm Precinct. Some of the key proponents include:</p> <ul style="list-style-type: none"> ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] ■ [REDACTED] <p>This information is commercial-in-confidence.</p>
Other Gas Proponents	Increased opportunities. [REDACTED] are key interested parties
Industry associations and lobbyist groups	<p>Darwin Harbour Advisory, Environment Centre NT</p> <p>Increased employment and business opportunities directly and indirectly associated with manufacturing.</p> <p>Perceived or actual social impacts including increased activity in the harbour.</p> <ul style="list-style-type: none"> • Environment Centre NT • Arid Lands Environment Centre • Environment Institute of Australia and New Zealand (the Territory members base) • Australasian Land and Ground Water Association • Environmental Defenders Office, the Territory Branch • Protect Country Alliance • Lock the Gate Alliance
Other Industry Bodies	<p>Increased opportunities for the following:</p> <ul style="list-style-type: none"> • Mining and petroleum companies • the Territory Road Transport Association • Chamber of Commerce NT • Minerals Council of the NT • Civil Contractors Federation the Territory • Australian Pipelines and Gas Association APGA • Australian Petroleum Production and Exploration Association APPEA • the Territory Agricultural Association • the Territory Horticultural Association

Stakeholder	Area of interest
	<ul style="list-style-type: none"> • AustralAsia Rail Corporation and Aurizon • Chemistry Australia • Manufacturing Australia • Industry Capability Network ICN
Traditional Owners	Northern Land Council Central Land Council Larrakia Development Corporation Larrakia Nation
Other interest groups	Increased employment and business opportunities directly and indirectly associated with manufacturing. Increased activity in the harbour. <ul style="list-style-type: none"> • Darwin Harbour Advisory Committee (through DNER) • AFAThe Territory (Amateur Fisherman's Association NT) • SeaLink NT • Darwin Regional Harbour Master (DIPL internal stakeholder) • Australian Institute of Marine Science • Australian Marine Conservation Society • the Territory Seafood Council • Defence & the Naval Harbour Master, Royal Australian Navy • Darwin Port (Landbridge) • Weddell residential development • Various marine logistics companies (e.g. barge operators).
Community	Almost 80 contacts, engagements and presentations were delivered to stakeholders in the second half of 2021 to introduce the project, and seek initial feedback as to how stakeholders would like to be involved and informed throughout the project lifecycle. This engagement will continue throughout 2022, including more focused public consultation to seek an understanding of what values matter to the stakeholders affected by a development of this kind.

Feedback from the stakeholder consultations is included in **Appendix E**. Responses have been anonymised as requested.

4.3 Summary

A comprehensive consultation process across all stakeholder groups, found that the location of the Middle Arm Peninsula would be the best option to locate a sustainable and diverse industrial precinct. Through government consultation it was identified that the precinct's industrial strategy; to enable a diverse industrial ecology to support and attract investment directly, aligns with various policies and initiatives, detailed in Phase 1 and 9 of this report.

5. Phase 3 – MCA

Following the establishment of an Infrastructure Project long-list (Phase 1) and a comprehensive stakeholder engagement strategy (Phase 2), an MCA was conducted against the Project Infrastructure long-list. The purpose of an MCA is to act as a priory filter, a tool used to evaluate the long list of infrastructure project options. The objective of the MCA was to provide a more detailed and rigorous assessment of the infrastructure project long-list options to inform the Program package development in Phase 4. The MCA leverages the qualitative PWG knowledge, and where available, quantitative inputs.

5.1 Approach

The MCA criteria and weightings were developed through a series of workshops attended by the PWG and expert representatives from related Government agencies, as detailed in Phase 2 (Section 4). In developing the criteria for MCA, the overarching themes were taken into consideration, and where appropriate, refined by the PWG to ensure they directly met the needs of the Territory, and the Project objectives. However, given the availability of data and the complexity of the analyses completed, the MCA criteria and weightings were refined to a level of detail that could be easily communicated to the MCA workshop participants.

It was agreed that the MCA process would score the infrastructure project list against four criteria. A set of sub-criteria was considered when assessing each criterion. The criterion and sub-criterion are outlined Figure 23. A detailed description of each criterion, including suggested key considerations that were made during the assessment process, and indicators can be found in Table 7. Climate factors were considered in each of the four assessment criteria outlined in Appendix B.

Figure 23: MCA Criteria and sub-criteria used to assess the infrastructure project list

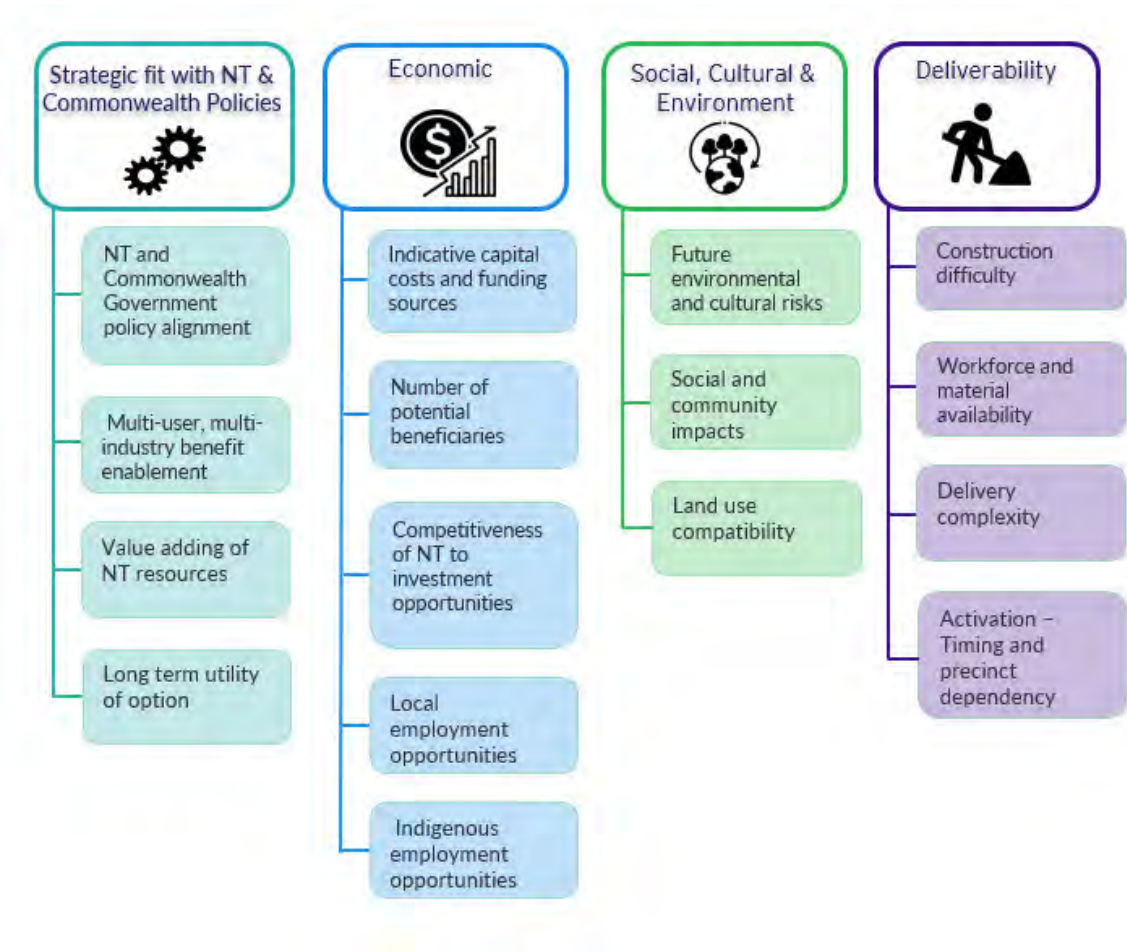


Table 7: MCA Criteria and sub-criteria descriptions and considerations communicated during the workshop

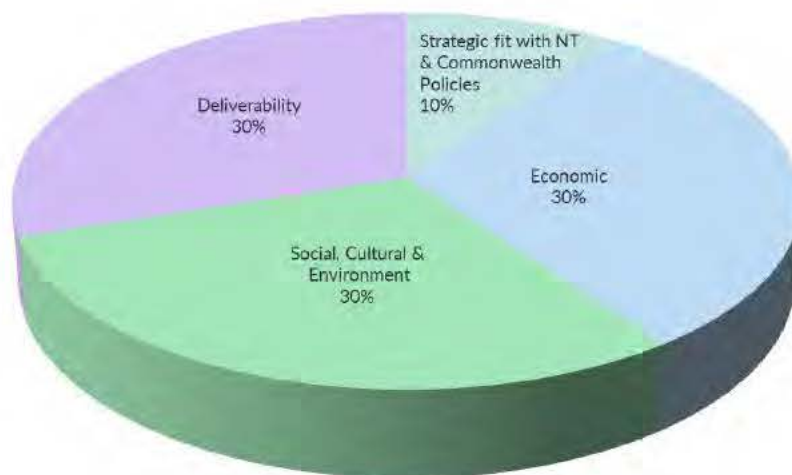
Theme	Criteria	Description	Example low score consideration	Example high score consideration
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	To what degree does the option facilitate strategic policy objectives? (Supply chain resilience, critical minerals manufacturing, energy transition, net zero)	<ul style="list-style-type: none"> The objectives and intended outcomes of the option do not closely align with a majority of policies or plans 	<ul style="list-style-type: none"> The option is closely related to energy transition policies and plans It supports and accelerates the energy transition and net zero target
	1.2 - multi-industry benefit enablement	The options ability to encourage diverse industry investment	<ul style="list-style-type: none"> The option only fits industry specific/specialist operations with low benefit potential 	<ul style="list-style-type: none"> The option is Industry agnostic with minimal limitations for industry use to maximise benefits
	1.3 - Value adding	To what degree does the option accelerate the value adding of the Territory resources?	<ul style="list-style-type: none"> The option provides limited/inefficient functional Commonly used infrastructure is not able to be accessed within reasonable period for value adding activities Infrastructure for value adding production 	<ul style="list-style-type: none"> The option provides accessible infrastructure for different type users It is flexible to fit different value adding production models The option is easy to adjust to meet future developing requirements
	1.4 - Long term utility of option	Ability to scale up and decarbonise as demand increase, taking into account commercial users and the Territory long-term objectives	<ul style="list-style-type: none"> The option is unable/difficult to upgrade to meet users' needs in the future It is not feasible to extend or increase the capacity and capability in the future 	<ul style="list-style-type: none"> The option is easy to strengthen and refurbish utility facilities to meet decarbonisation trends and industry development (e.g. from grey hydrogen to blue hydrogen)
Economic	2.1 - Indicative capital costs and funding sources	Is the options nature one that is likely to require Government capital and oversight to enable wide economic activity across multiple proponents?	<ul style="list-style-type: none"> The option is not commonly used by multiple proponents (I.e., one proponent) It is irresponsible to be underwritten by Government due environmental concerns Commercially favours one industry type 	<ul style="list-style-type: none"> Option falls in line with reasonable funding expectations
	2.2 - Number of potential beneficiaries	The number of potential users to a piece of common-user infrastructure	<ul style="list-style-type: none"> One potential proponents/user Relatively low marginal value for various beneficiaries (low benefits for individual, industry and government) 	<ul style="list-style-type: none"> 3-6 potential proponents Wide ranges of groups receive significant benefits from this development (direct users and supply chain services) Cumulative benefits to different beneficiaries

Theme	Criteria	Description	Example low score consideration	Example high score consideration
				increase exponentially in long term
	2.3 - Competitiveness of the Territory to investment opportunities	Relative impact of option that enhances the Territory competitive advantage for private sector investment	<ul style="list-style-type: none"> Inefficient infrastructure development unable to meet the private sector needs to make investments Additional benefits/ impacts added from the option are less attractive comparing with other locations 	<ul style="list-style-type: none"> The option significantly reduces the risks and costs of private investment Large benefits from the options to spur the Territory to be the favourite investment location both short and long terms
	2.4 - Local employment	Potential impact on local jobs and employment	<ul style="list-style-type: none"> The option does not sustainably increase employment rate and ongoing employment opportunities in the long term Limited job opportunities in current local workplace as local workers unable to meet the skills requirements in certain period 	<ul style="list-style-type: none"> Significantly increases number of local jobs Significantly increase the participate rate of local workforce Attract high skilled worker from another region Provide ongoing jobs not previously available in the Territory
	2.5 - Indigenous employment	Potential impact on Indigenous jobs and employment opportunities	<ul style="list-style-type: none"> The option is unlikely to provide Indigenous workforce opportunities 	<ul style="list-style-type: none"> Increasing the share of Aboriginal workers employed in the Territory, associated with positive social impacts and breaking the cycle of disadvantage in Indigenous communities
Social, cultural and environment	3.2 - Future environmental and cultural risks	Cumulative impact of option on future environment and cultural scenarios	<ul style="list-style-type: none"> The option primarily encourages high emitting industries The option brings negative impact to quality of water and surrounding benefiteres construction, dredging programs and operations impact the marine ecosystems 	<ul style="list-style-type: none"> Enables industry proponents to decarbonise products or services in the short or long term
	3.3 - Social and community impacts	To what degree does the option make a positive impact and align with the community's expectations?	<ul style="list-style-type: none"> The option possesses significant risk to meeting the Territory net zero objectives Likely to conflict with future cultural and heritage sensitivities 	<ul style="list-style-type: none"> Enables and aligns with environmental and cultural the Territory policies and objectives

Theme	Criteria	Description	Example low score consideration	Example high score consideration
	3.4 - Land use compatibility	Impact on surrounding and existing precinct planning framework	<ul style="list-style-type: none"> Hinders diverse workforce opportunities Negatively impacts social licence to operate 	<ul style="list-style-type: none"> Aligns with communities' expectations
Deliverability	4.1 - Construction difficulty	Does the option require mature/future technical knowledge or execution technology?	<ul style="list-style-type: none"> The option requires execution technology which is costly to imply or take time to develop 	<ul style="list-style-type: none"> There are accessible existing technologies are ready to use to support each stage of the development
	4.2 - Workforce and material availability	To what degree does the option require the availability of a specialist workforce or construction materials?	<ul style="list-style-type: none"> Significant shortage of skilled workers or construction material to support the development of the option in a short or median term Current supply chain or logistic issues could cause significantly delay of option development. 	<ul style="list-style-type: none"> There is an established workforce to support the development It is easier to obtain construction materials and the existing facilities able to support the construction
	4.3 - Delivery complexity	Execution reliant on funding, governance or approval requirements across multiple stakeholder groups	<ul style="list-style-type: none"> There are no/ insufficient funds available for this option Complex processes with long waiting period to receive approvals 	<ul style="list-style-type: none"> There are sufficient expertise and effective approval processes to support the development of the option
	4.4 - Activation	<p>To what degree does the option activate the precinct in relation to:</p> <p>Timing: Does the option fall in line with industry current and future investment timelines and demand</p> <p>Dependence: Does the option directly enable various industries and proponents To ensure the successful industry uptake of the precinct</p>	<ul style="list-style-type: none"> Timing: Option does not align with the current time horizon to meet industry demand and investment Immature industries linked to the option Dependence: The options does not sufficiently enable other common-user infrastructure or proponents/industries 	<ul style="list-style-type: none"> Timing: The industry the option supports is mature and sufficient demand is known Dependence: The option directly supports the development of diverse industries over the precinct life

The MCA criteria were agreed upon and finalised. The next the stage was to designate weightings for each category theme, criteria and sub-criteria. Noting all the criteria is expected to achieve objectives and outcomes. However, some criteria are of greater importance than others when it comes to enabling a multi-industry Precinct, led by Government. Each criterion was assigned a weighting to characterise the importance of achieving the desired project outcome. The weightings for the infrastructure project long list are shown below in Figure 24.

Figure 24: MCA criteria themes weightings



The weightings were determined through workshoping the key themes and sub-criteria by mapping these back to the project's problems, opportunities and objectives. The PWG and workshop stakeholder group included highly knowledgeable experts who have spent years working alongside government departments, external consultants, and potential industry proponents. During the consultation process and workshops, outcomes were circulated, and feedback requested, captured and documented and, where appropriate, incorporated.

Table 8: Workshoped MCA weighting outcomes

Theme	Criteria	Theme weighting	Justification for decision	Individual weighting	Justification for decision	Alignment with Project objectives					
						Obj. 1	Obj. 2	Obj. 3	Obj. 4	Obj. 5	Obj. 6
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	10%	Strategic alignment is crucially important and underpins the entire project. However, it also is a broad topic which is discussed in detail in Phase 9 of this report. With this in mind, the group agreed the theme was to be weighted lower than the other three, however, it remained essential to the MCA process to highlight the subcategories importance in the broader project context.	4%	Similarly, alignment to policy was identified as the most significant subcategory given Commonwealth and State policies focus on renewable energy, modern manufacturing etc. These policies directly relate to all 6 project objectives and Opp. 1, 2 & 3.						
	1.2 - Multi-user, multi-industry benefit enablement			2%	The remaining 3 subcategories weightings were distributed evenly to capture the key desired outcomes of a modern industrial precinct.						
	1.3 - Value adding			2%							
	1.4 - Long term utility of option			2%							
Economic	2.1 - Indicative capital costs and funding sources	30%	Economic outcomes enabled by the infrastructure project long list items are considered essential to ensuring the jobs	7%	The indicative cost and whether it is reasonable for Government funds to underwrite the capital costs was considered a high priority category						

5.2 Infrastructure project details, strengths, weaknesses, and outcomes

In order to score the long-list infrastructure project options appropriately in the MCA workshop. Details on each suggested infrastructure project option are described below.

5.2.1 Infrastructure project 1 - Modular Offloading Facility

Option 1	Description
Type	Modular Offloading Facility (MOF)
Details	<p>A MOF consisting of:</p> <ul style="list-style-type: none"> • Loading platform consists of a 15,000 square metre reinforced concrete deck supported on steel piles • Construction of two berthing pockets adjacent to the loading deck, to cater for carrier vessels up to 220m in length • Vessel berthing/mooring dolphins connected by elevated access walkways • Dredging of harbour to allow Panamax vessels with all tide depth of 14 meters • Construction of an 800-metre-long earth causeway connecting the MOF to the landside Common User Facility (CUF). • The connecting causeway will support a 40m wide roadway for the transport of modules from the MOF to the CUF and broader Precinct Road network. • Common User Facility located at the end of Spitfire Peninsula, to enable direct connection with the marine facilities (MOF and product export jetties). <p>CUF is a 34-hectare site including:</p> <ul style="list-style-type: none"> • Common user hardstand and lay down areas, • Marine security, operations and administration facilities • Internal roads, drainage and car parking • Internal utilities (water, sewer, power and telecommunications) to support operations at the CUF, MOF and product export jetties <p>Dredging the Navigation Channel consisting of:</p> <ul style="list-style-type: none"> • Construction of a dredged navigational channel and swing basin for vessel access and product shipping - estimated total dredge volume of 20 million cubic metres. • Length of navigation channel connecting to the product export jetties and MOF – approximately 6 kilometres
Key option dependencies	<ul style="list-style-type: none"> • Dredging to enable MOF to be functional • Key road access to the waterfront (MOF and hardstand) • Common-user Product export jetties • Dredge soil re-use or disposal
Strengths	<ul style="list-style-type: none"> • Provides a guaranteed common-user option for all precinct proponents • Scored highly across all industry participants in the demand survey • Provides non-precinct proponents additional options and ability to utilise • Demand for modularisation across the top end is expected to increase as renewable projects • Low risk profile construction – Design and technical details are mature
Weaknesses	<ul style="list-style-type: none"> • Environmental risks associated with dredging and the marine ecosystem disruption • Limited precinct location options available • High upfront capital costs
Unknowns	<ul style="list-style-type: none"> • Available information on the MOF is comprehensive and meets the expected industry demand

5.2.2 Infrastructure project 2 - Product export jetties

Option 2	Description
Type	Product export jetties
Details	<ul style="list-style-type: none"> Constructing two common-use product export jetties. Each Jetty's estimated length is 300 meters. Jetty structure consists of centralised reinforced concrete deck supported on steel piles. Construction of a berthing pockets adjacent to each product export jetty catering for various product loading vessels up to 300m in length. Vessel berthing/mooring dolphins connected by elevated access walkways. Product export jetties are connected to the marine CUF via trestle structures that support a vehicle access deck, utilities to the jetty (water and power) and product pipe racks. Trestle structure estimated length –350 metres.
Key option dependencies	<ul style="list-style-type: none"> Dredging to enable to Product Jetties to be functional. Key road access to the waterfront (MOF and hardstand). Dredge soil re-use or disposal.
Strengths	<ul style="list-style-type: none"> High precinct proponent utility. Strategic proximity to Asia ensuring competitiveness of goods and exports. Large revenue earning potential for the Territory Government. Workforce opportunity – construction and operations. Strong policy and strategic alignment by achieve a diverse and balanced industry mix.
Weaknesses	<ul style="list-style-type: none"> Environmental risks associated with dredging and the marine ecosystem disruption. Potential precinct industry proponents indicate a high demand for the product jetties – Priority and governance structure needs to be considered.
Unknowns	<ul style="list-style-type: none"> Indigenous workforce opportunities on construction and operation of the product jetties are unknown.

5.2.3 Infrastructure project 3 – CCUS

Option 3	Description
Type	CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control.
Details	<ul style="list-style-type: none"> CO2 Manifold within the precinct to collectively transport proponents CO2 for a third party for sequestration. Manifold pipes based on 550mm outside diameter pipe to connect with the onshore/offshore route being proposed. The manifold connects the supply of carbon to third parties who will utilise Petrel sub-Basin in the Joseph Bonaparte Gulf or Bayu Undan for carbon sequestration.
Key option dependencies	<ul style="list-style-type: none"> Adequate sequestration sites.
Strengths	<ul style="list-style-type: none"> CCUS precinct supporting infrastructure will support the Territory to achieve a range of policies:

	<ul style="list-style-type: none"> Net zero by 2050 – the Territory Government has confirmed a goal of achieving net zero emissions by 2050. Large emitters policy – a policy outlining the Territory Government's expectations for the mitigation and management of emissions from new and expanding large greenhouse gas emitters is targeted for the end of 2020. Emissions Reduction Strategy – the development of an Emissions Reduction Strategy (ERS) by mid-2022. The ERS will identify stages, interim targets, timeframes, and potential approaches and mechanisms to achieve the net zero emissions target by 2050. Greenhouse Gas Emissions Offsets Policy - develop a Greenhouse Gas Emissions Offsets Policy to guide the application and administration of carbon offsets by mid-2022. Enables and encourages industry precinct proponents to capture CO2 from product manufacturing while improving environmental outcomes for the Territory and Australia.
Weaknesses	<ul style="list-style-type: none"> The initial construction of the CCUS infrastructure may temporarily create job opportunities, the infrastructure is not expected to directly contribute to local employment substantially. There is a strong reliance on potential precinct occupants capturing CO2 for operations to be fed into the CO2 manifold.
Unknowns	<ul style="list-style-type: none"> Detailed costing is unavailable at this stage and indicative costings applied based on a prior investigation of a whole-of-system solution.

5.2.4 Infrastructure project 4 – CCUS for [REDACTED]

Option 4	Description
Type	CO2 for [REDACTED] exclusive use - Carbon capture utilisation and storage (CCUS) infrastructure – for CO2 transmission and supporting infrastructure - manifold to access
Details	<ul style="list-style-type: none"> The manifold exclusively used by [REDACTED] CO2 Manifold within the precinct to collectively transport proponents CO2 for a third party for sequestration. Manifold pipes based on 550mm outside diameter pipe to connect with the onshore/offshore route being proposed. The manifold connects the supply of carbon to third parties who will utilise Petrel sub-Basin in the Joseph Bonaparte Gulf or Bayu Undan for carbon sequestration.
Key option dependencies	None known
Strengths	<ul style="list-style-type: none"> Will provide [REDACTED] ability to transmit CO2 across Middle Arm for sequestration.
Weaknesses	<ul style="list-style-type: none"> There is significant risk as the option precludes other types of industries ability to access carbon storage. If limited to the primary proponents, the CCUS Infrastructure will not be strategically aligned with the intention for it to be multi-user, multi-access investment. The infrastructure does not strongly align with the objectives of policies as it limits CCUS to primary proponents. It may preclude other types of emitting industry proponents from access to carbon storage and transition, which will limit the ability of the Territory to reduce greenhouse gas emissions through a large-scale investment that delivers economies of scale.
Unknowns	<ul style="list-style-type: none"> Detailed costing is unavailable at this stage and indicative costings applied based on a prior investigation of a whole-of-system solution.

5.2.5 Infrastructure project 5 – Digital infrastructure

Option 5	Description
Type	Digital subterranean cabling of precinct to support digital communications and automation to enable automation
Details	<ul style="list-style-type: none"> Construction of an underground fibre optic cabling network within the Precinct to provide high speed telecommunications to proponent and common user facilities. – 20km. Connection to the existing telecommunications network operated by Telstra.
Key option dependencies	None known
Strengths	<ul style="list-style-type: none"> High rates of traditional and new heavy industry technology adoption indicate network and telecommunication uptake for business operations across all sectors is likely, enhancing the collective ability for government, business and community to undertake digital advancement. This uptake may extend beyond the proponents within the MASDP. Industry 4.0 and the opportunities for mechanisation of high-quality digital connectivity will support the long-term utilisation of the MASDP. Adoption of technological and digital advancements are pivotal to long term advancement, enabling smarter communities and growing jobs and business across the NT. This infrastructure will be the critical to attract private sector and foreign investments as it is commonly needed by many potential proponents to enhance digital communications and automation processes through the high-quality speed and security of data transfer.
Weaknesses	<ul style="list-style-type: none"> There is the potential for minimal environmental and cultural risks due to the underground nature of the subterranean cable which will exist under the proposed infrastructure within the MASDP. There is the potential for either private or government investment, or a combination of both.
Unknowns	<ul style="list-style-type: none"> Investigations are currently taking place with a number of provides which will strengthen costs and provide additional technical details.

5.2.6 Infrastructure project 6 – Power network, Darwin-Katherine Interconnected System

Option 6	Description
Type	High capacity, networked power distribution to Middle Arm connected to DKIS.
Details	<ul style="list-style-type: none"> Construction of a reticulated electricity network within the Precinct to provide a standard grid-connected electricity option to Precinct proponents. Electricity network consists of a combination of above and below ground transmission lines with supply voltages ranging from 22kV to 132kV. Electricity network connects to existing high voltage Darwin-Katherine network via a centralised substation. Approximately 35-50 km of transmission lines for proponent access.
Key option dependencies	Subject to DKIS capacity to absorb and manage load, additional generation and system strengthening required.
Strengths	<ul style="list-style-type: none"> The energy generated from power station commonly needed by private sector regardless the type of industries. All industry users will require access to power this solution will reduce duplication.

	<ul style="list-style-type: none"> Government needs to facilitate as network must be open access, and proponent encouraged to use it. Mature technology established for infrastructure delivery. Demonstrated by advanced systematic integrated systems across Australia. Potential to benefit all MASDP new industries.
Weaknesses	<ul style="list-style-type: none"> A network is positive for investment however it is also a minimum expectation. Traditional energy mix (predominantly gas) does not strongly enhance the Territory competitive advantage for private sector investment. It does not strongly support the new zero and low emission policies as the nature of traditional provision of power network is a large carbon emitter. If connected to the DKIS as a network, there are possible benefits in injecting greater resilience across the whole network.
Unknowns	Further investigations whether the current DKIS network has enough capacity to supply and distribute precinct proponents' energy requirements.

5.2.7 Infrastructure project 7 – Power network, green energy distribution

Option 7	Description
Type	Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.
Details	<ul style="list-style-type: none"> Construction of a standalone green energy distribution network to provide gigawatt scale electricity to Precinct proponents. Green electricity network consists of a combination of above and below ground Extra High Voltage transmission lines with supply voltages up to 330kV. Green electricity network connects to an external green energy grid via a centralised electrical substation. Approximately 35-50 km of transmission lines for proponent access.
Key option dependencies	Securing firm renewable load at competitive pricing.
Strengths	<ul style="list-style-type: none"> Society expects large scale access to green energy for sectors and proponents to offer greener products and services. Providing access green energy transmission sources will make the Territory precinct very attractive for multiple proponents and sectors. High green energy demand will only increase over time as proponents respond to the market and trading partners demand for green products.
Weaknesses	<ul style="list-style-type: none"> The option requires large and intrusive development if renewable source is solar which possess some environmental risk, softened by the macro decarbonisation benefits. Network will have some footprint but minimal impact.
Unknowns	Partnership with a large-scale green energy provider will be required to support the expected green energy demand of the precinct.

5.2.8 Infrastructure project 8 – Channel Island upgrade

Option 8	Description
Type	Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.
Details	<ul style="list-style-type: none"> Upgrade a further two GE TM2500 Dual gas-hydrogen powered turbine on at Channel Island Power Plant. Includes installation by specialist installers.
Key option dependencies	None known
Strengths	<ul style="list-style-type: none"> The energy generated from hydrogen commonly needed by private sector regardless the type of industries. Will also enable a proof-of-concept hydrogen project in the MASDP by committing to offtake. Hydrogen is a central pillar of new energy security. This option will enable the DKIS to be blending hydrogen and support the transition to net zero. It has a wider application and is used by various industries in private sector.
Weaknesses	<ul style="list-style-type: none"> Potentially there is an impact on water resource as it requires significant amounts of water to generate hydrogen. Hydrogen production requires secure, long-term access to water, which may prove challenging in Australia as it is known for variable rainfall and frequent droughts.
Unknowns	Channel Island Power Plant has recently been upgraded to support Hydrogen. Further investigations into the performance of the new system will support future analysis.

5.2.9 Infrastructure project 9 - Water desalination solution available for industry proponents

Option 9	Description
Type	Water desalination solution available for industry proponents.
Details	<ul style="list-style-type: none"> Common-user desalination plant – estimated supply capacity of up to 10 GL Medium capacity common-user declination plant reverse osmosis building Associated marine structures Water transfer pipeline Transfer pump station and storage vessels Chemicals warehouse Potabilisation system
Key option dependencies	Demand for this option will be delayed as the Adelaide River off-stream storage solution will address the immediate but not all of the MASDP water needs.
Strengths	<ul style="list-style-type: none"> Desalination given proximity to the sea is an option that supports sustainability of water resources. To increase water security for all Territorians and as part of the development of a Strategic Water Plan, the Territory Government is considering infrastructure solutions for the Darwin Region. Territory Economic Reconstruction Commission final report (November 2020) identified that a step change in the Territory's approach to water is needed to support the Territory's plans for increased private investment and economic growth of the region.

Weaknesses	<ul style="list-style-type: none"> There are potential environmental challenges with discharging brine into the harbour. Generally, environmental impacts can be generated both in the construction and operation of desalination plants. The production and growth of marine organisms is severely affected by discharge of brine in the desalination process. Water will be a key input; the source is less concern to industry than availability and price. <p>In Australia, based on current prices charged for water, desalination is currently only competitive with traditional water sources in remote locations.</p>
Unknowns	Timing of MASDP demand over and above the AROSS water solution is not yet clear. Further information on final proponents, and their commissioning timeframes will inform this option.

5.2.10 Infrastructure project 10 - Wastewater solution

Option 10	Description
Type	Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure.
Details	<ul style="list-style-type: none"> Wastewater collection and storage tanks Treatment, mixing or reaction wastewater vessels and wastewater equalisation tanks Sludge and dewatering storage Chemical and filter treatment supplies warehouse Treated and discharge water tanks
Key option dependencies	Strategic environmental assessment and precinct approvals thresholds.
Strengths	<ul style="list-style-type: none"> Required to enable a circular economy, environmental expectations and MASDP overarching objectives. As per the Territory Circular Economy strategy, the Territory government is exploring options for growing waste management sector in which it suggests treated wastewater can be used can be reused in industrial processes or green spaces irrigation. Improves water utilisation with reuse. Wastewater reuse is a solution for the future to combat water scarcity. After treatment, wastewater can be used for a variety of applications including watering green spaces and golf courses, crop irrigation, firefighting and street-cleaning, or it can be used to recharge aquifers. Positively impacts but some may develop inhouse capabilities. Will be subject to scale. There are a small number of large Australian suppliers (employing 100 or more) but most of the players are smaller companies (employing 1-20 people). There are also some well-established local manufacturers and assemblers of water and wastewater treatment package plants.
Weaknesses	<ul style="list-style-type: none"> Potentially complex to implement. Most new water treatment systems in Australia these days incorporate some form of organics removal. The three commonly used processes for dealing with removal of organics from drinking water in Australia incorporate ion exchange, activated carbon, and advanced oxidation processes.
Unknowns	Level of demand use from precinct proponents is still unclear. Further investigations will be required to determine the allocated scale of the facility will meet and exceed industry demand.

5.2.11 Infrastructure project 11 – Gas pipeline

Option 11	Description
Type	Gas pipeline into Middle Arm for proponents to access.
Details	<ul style="list-style-type: none"> Natural gas pipeline to laterally connect to INPEX/Ichthys existing pipeline to supply the precinct 12-inch pipeline to transmit approximately 500 to 550 TJ/Day Proponents intended to latterly connect to precinct specific network for gas offtake Compression station not indented to be required
Key option dependencies	Production commencing at Beetaloo (or offshore).
Strengths	<ul style="list-style-type: none"> the Territory Gas will be offered to proponents as feedstock to enable a range of value-add products, such as: <ul style="list-style-type: none"> CO2 for sequestration Blue Hydrogen Methanol Gasoline, Kerosene, Diesel, Marine Fuel, Heavy Fuels The ability of offer proponents a gas connection for offtake for proponents to laterally connect into a gas pipeline to provide feedstock for operations. This infrastructure project will support local employment, utilising on the NT's existing pipeline established specialist knowledge existing in the community.
Weaknesses	<ul style="list-style-type: none"> The long-term local consumption for LNG over the long term could present a long-term investment risk. Short to medium term Australia's LNG consumption will remain steady, however as key trading partners look to lower CO2 emissions and green products becomes in higher demand LNG as a local feedstock will become less desired. This Infrastructure Project will face some environmental challenges. Natural gas pipelines can impact the environment in multiple ways: <ul style="list-style-type: none"> natural habitat loss and fragmentation changes in species movement sedimentation air emissions.
Unknowns	There are currently limited details to the design specification of this options. Should it progress to the short list, further investigations on demand should be considered.

5.2.12 Infrastructure project 12 – Rail infrastructure

Option 12	Description
Type	Rail infrastructure - build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities).
Details	<ul style="list-style-type: none"> Rail spur extended to MASDP approximately 2 km Siding at MASDP to enable material offloading Common user hardstand and lay down areas to support rail operations Overland conveyor and rail load-out facility Unloading pit and rolling stock maintenance yard

Key option dependencies	The freight and logistics hubs are critical to this option being viable.
Strengths	<ul style="list-style-type: none"> Rail into the precinct will provide the opportunity option for all proponents. The precinct houses Darwin's East Arm Wharf, the terminus of the Australasia Railway, the Darwin Business Park, the Marine Supply Base and the proposed Marine Industry Park with more than 100 service and supply businesses are operating inside. Long term horizon will strengthen the utilisation of rail as population and vehicle density in the precinct increase, therefore the business case for rail strengthens. Rail is required to address the increase in road freight congestion. Investment in the Territory is expected to increase over the next decade with multiple new projects being proposed. Rail has the ability to address safety concerns by providing an alternative to road freighters with routes typically running through the middle small the Territory towns.
Weaknesses	<ul style="list-style-type: none"> The current rail lines which are owned and operated by third parties. For Middle Arm to extend these lines coordination with multiple private entities could incur challenges. Restrictions on availability of specialist workforce and materials poses risk of project delivery. The rail industry is facing a workforce skills shortage crisis, risking significant cost and delivery blowouts on major train and tram projects nationwide during the next decade. 20 per cent of the sector's existing workforce is expected to retire before 2028.
Unknowns	Demand for the Middle Arm spur will be dependent on the final MASDP projects.

5.2.13 Infrastructure project 13 – Precinct roads

Option 13	Description
Type	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.
Details	<ul style="list-style-type: none"> Primary industrial road through Kittyhawk peninsula connecting the CUF and marine facilities (MOF and product export jetties) – 3km. Internal industrial road network to support Precinct operations and access to proponent facilities – 15km. Road network includes the construction of pavements, stormwater drainage, lighting, services corridors, product corridors and module haul tracks. Connecting intersections onto Channel Island Road.
Key option dependencies	None known
Strengths	<ul style="list-style-type: none"> Utility of roads to key locations within the precinct adds large amount of value of transporting people, resources and materials. The roads within the precinct to enabling proponents to get to and from marine infrastructure carrying essential imported or exported products and materials. In this case, the public common user roads industrial roads offer productivity benefits to support the movement of products and people. Appropriate Government management and maintenance of key road infrastructure and transport corridors is essential for controlling environmental impacts. Monitoring use, wear-and-tear and damage of roads can reduce the risk of environmental impacts such as increased emissions caused by poor surface conditions and noise pollution to nearby residential areas.
Weaknesses	None known
Unknowns	None known

5.2.14 Infrastructure project 14 – Transit system and parking

Option 14	Description
Type	Shared workforce transport / transit system – including parking and connections to worksites.
Details	<ul style="list-style-type: none"> • A common user carpark (series of carparks) with an expected bay capacity of 2,695 car bays • Appropriate infrastructure to support a future 'park and ride' transit systems • Land clearing and earthworks • Subsurface draining system • Stabilised pavement construction • One lane incoming and outgoing roads connecting key precinct roads and worksite connections • Traffic control such as signage
Key option dependencies	<ul style="list-style-type: none"> • Final precinct level planning for transport • Workers accommodation options better defined
Strengths	<ul style="list-style-type: none"> • Workforce attractiveness which a common user car park and supporting transit system can offer the precinct proponents and employees. Given the limited land availability this could be used to entice workers.
Weaknesses	None known
Unknowns	Granular details on the potential 'park and ride' transit system are still to be technically defined. Additional investigation and consultation with precinct proponents will determine the level of support and investment mix expected.

5.2.15 Infrastructure project 15 – Worker's accommodation

Option 15	Description
Type	Worker's accommodation to enable MA workers (residential land release and costs).
Details	<ul style="list-style-type: none"> • Precinct specific workers offsite accommodation solution • Land release and subdivision activities to release residential housing lots for development • Approximately 1,553 new residential land plots ranging between 500-600 square meters • including earth works, administration, development management and land holding activities
Key option dependencies	Urban planning, social infrastructure development
Strengths	<ul style="list-style-type: none"> • Residential land release and development will ensure the added pressure for accommodation expected from the increase in precinct workforce can be managed appropriately. • Supports the development of the Territory's economy through population and industry growth. • While the volatility of the Territory's residential market puts pressure on the land development industry to deliver product to meet spikes in demand and can adversely impact the end-consumer, at a macro-level this boom-bust cycle also negatively impacts private investment and growth in the economy, which more broadly impacts overall population growth.

Weaknesses	None known
Unknowns	None known

5.2.16 Infrastructure project 16 – Emergency services

Option 16	Description
Type	Local emergency response infrastructure – local fire station / medical clinic / emergency services.
Details	<ul style="list-style-type: none"> Construction of a new local fire station within a 20 km radius to the precinct Specialist two room onsite medical clinic Major hazards facilities office Capacity upscale of existing local emergency services within a 20 km radius
Key option dependencies	Precinct roads being developed
Strengths	<ul style="list-style-type: none"> Upgrades and construction of new emergency services would increase local employment opportunities for construction and operations. Typically, employment opportunities in the emergency services space will provide skilled and long-term job opportunities
Weaknesses	Level railway crossing inhibits access to site
Unknowns	Industry's own contribution or arrangements which may deliver on the infrastructure item objectives are not yet known. This option requires further industry feedback.

5.2.17 Infrastructure project 17 - Dredge soil re-use

Option 17	Description
Type	Beneficial re-use of dredge soil for additional economic land.
Details	<ul style="list-style-type: none"> Reuse and repurpose an expected 12 million cubic metres of dredged material on land as in fill to create additional economic land. Total estimated reclaimed land area of 200 hectares. Construction includes containment bunds to form reclamation ponds, pumping and placement of dredge material, and earthworks treatment to the finished ground surface to support industrial development.
Key option dependencies	Dredging conducted for the MOF and product jetties.
Strengths	<ul style="list-style-type: none"> Unlocks a large amount of industry agnostic economic land. Dredged material may be used to develop commercial sites (e.g. rehabilitating of brownfield sites, agriculture land and recreational sites), construct islands and other man-made land. Repurposing the dredge soil will create societal, environmental and financial benefits with its reuse. Because large volumes are involved, being able to potentially use dredged material represents a significant sustainability contribution.
Weaknesses	Planning and decision-making processes for beneficial use projects can become complicated and unwieldy given that federal and state natural resource and wildlife agencies, local agencies, private parties, and public interest groups are often involved. There is often no legislation specifically for dredging or for dredged material management, decision-makers need to deal with a patchwork of different rules, such as regulations to protect the ocean, inland water, residential areas, the environment, nature and for the handling of waste. Many different permits may be required.

Unknowns	A thorough analysis on the potential fill options needs further consideration to identify where the most environmentally responsible locations is that provides the most economic return.
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5.3 MCA results

As described in Phase 2, MCA workshops were facilitated by consultants and the PWG. Fifteen workshop participants included SMEs from three levels of Government both Territory and Commonwealth, represented a wide range and significant historical knowledge base relating to the precinct's development to date. Over 22 hours of workshops, individual consultations, feedback sessions, and presentations were designed to capture, record and challenge all infrastructure project long list options to ensure maximum confidence of MCA assessment and results.

The Infrastructure Project long-list was then independently assessed against each assessment criteria. Each option's ability to contribute to meeting the criterion was scored using a 1 to 7 range. The method for scoring is presented in Table 9 below.

Table 9: MCA scoring guide

Assessment Rating	Description	Score
Strongly Negative	Severe negative impact / outcome	1
Moderately Negative	Moderate negative impact / outcome Impacts may be manageable	2
Slightly Negative	Minimal negative impact / outcome Short term impact / outcome Impacts can be managed or mitigated	3
Neutral	No discernible impact / outcome	4
Slightly Positive	Minor positive impact / outcome Possible only short term Confined to a limited area	5
Moderately Positive	Moderate positive impact / outcome May provide new opportunities or improvements	6
Strongly Positive	Major positive impact / outcome Long-term improvements	7

The following section presents an overview of the MCA results and a range of sensitivities applied to the MCA scores.

Given the limited availability of economic data at the time the MCA work was conducted, costings and benefits were unavailable for all Infrastructure Projects included in the long list. The unique nature of required essential dependants required for the industrial precinct package development (Phase 4), meant that costs and benefits for the infrastructure projects which progressed through to the Program package options would only be investigated in the Rapid CBA analysis.

Workshop participants scored the economic, environmental, cultural, social and deliverability criteria from an internal knowledge base, supplemented by qualitative and quantitative information available at the time of the MCA assessment workshop. It was reasonable to assume that not all infrastructure projects in the long list would be

appropriate for the Commonwealth and Territory Governments to invest in, as the benefits and outcomes would disproportionately commercially benefit individual private proponents. The main objective of this MCA was to determine these Infrastructure Projects.

Weighted and unweighted scores from the MCA are outlined in the below Table 10.

Table 10: Infrastructure Projects MCA ranked results

Rank	Infrastructure Project	Unweighted score	Weighted score
1	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.	105	6.64
2	Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.	99	6.23
3	Digital subterranean cabling of precinct to support digital communications to enable automation.	100	6.18
4	Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.	97	6.11
5	Product export jetties.	97	5.97
6	Worker's accommodation to enable MA workers (residential land release and costs).	94	5.94
7	Shared workforce transport / transit system - including parking and connections to worksites.	96	5.93
8	CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure - Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control.	89	5.92
9	Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities).	90	5.84
10	Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.	91	5.76
11	Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure.	87	5.71
12	High capacity, networked power distribution to Middle Arm connected to DKIS.	88	5.30
13	Beneficial re-use of dredge soil for additional economic land.	89	5.28
14	Water desalination solution available for industry proponents.	72	4.38
15	Gas pipeline into Middle Arm for proponents to access.	74	4.17
16	Local emergency response infrastructure - local fire station / medical clinic / EMS.	77	4.03
17	CO2 for [REDACTED] - Carbon capture utilisation and storage (CCUS) infrastructure - for CO2 transmission and supporting infrastructure - manifold to access.	55	3.33

Results from MCA showed little variability in both the weighted and unweighted. 65% of Infrastructure Project options with the highest concentration between +1 scored between 6.64 and 5.64 (rank 1 to 11). CO2 CCUS

supporting infrastructure for [REDACTED]' exclusive use ranked seventeenth and scored poorly relative to its peers. Having a highly ranked long-list of Infrastructure Project's with scores skewed between +1 indicates that the Infrastructure Project long-list items 1 to 11 meets a majority of the project objectives.

As described above, the scoring for each sub-criteria were thoroughly discussed during the workshop and evidenced by the facilitators. The findings were recorded and aggregated, justifications for each score against the sub-criterions were documented in full across both workshop groups. To ensure each SMEs perspective was appropriately captured, the workbook findings were circulated to each participant to provide further comment and justification, ensuring all information was accurate and nothing was misunderstood during the workshop.

A detailed list of the results and evidence is located in **Appendix C**.

5.3.1 Sensitivity Analysis

Sensitivity analysis was conducted to test the robustness of the MCA results. The following scenarios tested whether the MCA weighted scores were sensitive to changes in the weightings of the evaluation criteria.

Table 11: MCA criteria weighting sensitivity test

Theme	Sub-criteria	Core	Sensitivity 1 (+/-)	Sensitivity 2 (+/-)	Core	Sensitivity 1	Sensitivity 2
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	10%	5%	15%	4%	2%	6%
	1.2 - Multi-user, multi-industry benefit enablement				2%	1%	3%
	1.3 - Value adding				2%	1%	3%
	1.4 - Long term utility of option				2%	1%	3%
Economic	2.1 - Indicative capital costs and funding sources	30%	35%	25%	7%	8%	6%
	2.2 - Number of potential beneficiaries				6%	7%	5%
	2.3 - Competitiveness of the Territory to investment opportunities				7%	8%	6%
	2.4 - Local employment				5%	6%	4%
	2.5 - Indigenous employment				5%	6%	4%
Social, cultural	3.2 - Future environmental and cultural risks	30%	25%	35%	10%	8%	12%

Theme	Sub-criteria	Core	Sensitivity 1 (+/-)	Sensitivity 2 (+/-)	Core	Sensitivity 1	Sensitivity 2
	3.3 – Social and community impacts				8%	6%	10%
	3.4 - Land use compatibility				12%	11%	13%
Deliverability	4.1 - Construction difficulty	30%	35%	25%	4%	5%	3%
	4.2 - Workforce and material availability				3%	4%	2%
	4.3 - Delivery complexity				3%	4%	2%
	4.4 - Activation				20%	22%	18%
Total		100%	100%	100%	100%	100%	100%

Under each of the two alternative scenarios tested, the criteria were adjusted and redistributed appropriately. The economic and deliverability themes in the weighting sensitivity scenarios followed the same (+/-) direction. The logic to maintain this directional relationship was to recognise the interdependencies between larger-scale projects concerning increased competitiveness, jobs and beneficiaries, and the linkages between construction, delivery and activation.

It is noted the sensitivity analysis provides a sample of alternative redistributed weightings and it is not intended to consider all alternative permutations. The weighted scores for each sensitivity test and Project Package are presented in Table 12.

Table 12: MCA criteria weighting sensitivity test

Infrastructure Project	Sensitivity 1	Rank	Sensitivity 2	Rank
Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.	6.60	1	6.68	1
Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.	6.25	2	6.21	2
Digital subterranean cabling of precinct to support digital communications to enable automation.	6.18	3	6.18	3
Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.	6.12	4	6.10	4
Product export jetties.	5.96	6	5.98	7

Shared workforce transport / transit system – including parking and connections to worksites.	5.97	5	5.89	9
Worker's accommodation to enable MA workers (residential land release and costs).	5.94	7	5.94	8
CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control.	5.85	9	5.99	5
Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities).	5.69	10	5.99	5
Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.	5.9	8	5.62	13
Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure.	5.53	13	5.89	10
High capacity, networked power distribution to Middle Arm connected to DKIS.	5.67	11	5.73	12
Beneficial re-use of dredge soil for additional economic land.	5.59	12	5.81	11
Water desalination solution available for industry proponents.	4.65	14	4.57	14
Gas pipeline into Middle Arm for proponents to access.	4.46	15	4.36	16
Local emergency response infrastructure – local fire station / medical clinic / EMS.	4.22	16	4.44	15
CO2 for Inpex and Santos - Carbon capture utilisation and storage (CCUS) infrastructure – for CO2 transmission and supporting infrastructure - manifold to access.	3.56	17	3.56	17

The results from the sensitivity tests show that under each of the two alternative scenarios, the variability between the Project Package scores remains low, and the top scoring Infrastructure Project's continuing to score favourably and consistently.

6. Phase 4 – Program package identification

6.1 Approach

The MASDP project is unlike a typical infrastructure project which, to address the problems and opportunities requires the building blocks to best enable industry investment. The unique nature and objectives of the Precinct required a tailored approach to determine the appropriate infrastructure project mix to inform the program options. To ensure the success of the Precinct, the Program options development included investigating which of the infrastructure projects were deemed 'essentially dependant' internally to other Middle Arm infrastructure projects and more broadly in relation to the Territory industry investment attraction.

The infrastructure projects determined essentially dependent to MASDP's success were identified as the bare minimum requirement of the Precinct. The essential dependant infrastructure projects would be included in all four program packages and progress to a Rapid CBA review.

Phase 4 options development process was split into four processes:

- Identifying the infrastructure projects that are considered 'essentially dependant' to the success of the program as a bare minimum. These are used as baseline common-user infrastructure the other three program options.
- In addition to the essential dependant infrastructure, the top five highest ranking infrastructure projects uncovered in the MCA.
- The essential dependants plus the infrastructure projects most desired by industry proponents, obtained through survey responses.
- Finally, the essential dependants in addition to the top ranked MCA infrastructure projects and the most desired by potential industry proponents.

6.2 Infrastructure projects identified as 'Essential Dependants' to ensure the success of MASDP

To establish which infrastructure projects were considered essentially dependant, analysis was performed on each Infrastructure Project long list option. The assessment made by the PWG, and three key criteria were chosen. These were: the extent to which each option addresses the problems and opportunities; the extent to which the precinct is dependent on the option and its relationship to other essential dependant options; and whether it requires government coordination, leadership and/or funding. Projects deemed essentially dependant also needed to fall in the top 10 of MCA ranked infrastructure items. The below key considerations were used when determining if infrastructure project was essentially dependant.

Table 13: Determining key essential dependant criteria

Essential dependant key consideration	1. To what extent is the project essential to addressing the problem /opportunities	2. To what extent is the precinct dependant on the project and what are the relationships with other projects in the essential dependant list.	3. Does this project require government coordination and or leadership/funding	4. Falls within the MCA top 10 ranked infrastructure projects
Description	<p>Infrastructure types that promote and accelerate a diverse uptake of value-add products while reducing the investment barrier to entry for innovative proponents. The sustainable nature of the precinct must consider both the environment and future operational industrial landscape.</p> <p>Problems and opportunities:</p> <p>Problem 1: Lack of common user industrial scale marine and land-based infrastructure.</p> <p>Problem 2: Infrastructure to access inputs is non-existent.</p> <p>Problem 3: Issues of security of supply for energy and modern minerals.</p> <p>Opportunity 1: Increase exporting products.</p> <p>Opportunity 2: Opportunity to be an early mover in developing a modern, net zero capable manufacturing hub.</p> <p>Opportunity 3: Opportunity to lead energy transition to lower emissions on the pathway net zero.</p>	<p>If this infrastructure project does not proceed, the expected negative impact on the precinct achieving its objectives is high to very high.</p> <p>Infrastructure type is related to other projects within the program in such a way that, in the absence of the other dependants, this option is less effective and efficient.</p>	<p>Infrastructure types which under public ownership could significantly enable a wide range of user types. Alternatively, under private proponent control could significantly hinder and restrict the development, investment consideration or operations of other proponents in the precinct. Infrastructure types that require government front end coordination to bring parties together to develop a strategic solution.</p> <p>Additionally, the lack of strategic direction on behalf of Government and organic industry development will result in ad hoc, duplication of infrastructure and resources. Resulting in misalignment of future demands and opportunities.</p>	<p>To ensure the essential dependant infrastructure projects met the comprehensive MCA criteria. A threshold of 1-10 was set to ensure projects considered largely aligned within results from the MCA workshop and justifications.</p>

6.3 Why the Modular Offloading Facility (MOF) and associated dredging infrastructure project is essentially dependant

The MOF and associated dredging were identified as essentially dependant infrastructure project, firmly linked to common-user, open access, essential to the beneficiation and diversity across the value chain and sustainable elements, addressing the Projects problems and opportunities. Additionally, the MOF and dredging project are highly interdependent with other connecting road and product jetty infrastructure projects outlined in Phase 3 Section 5.2.

Table 14: Essential dependant infrastructure – MOF and dredging

Criteria	Modular Offloading Facility (MOF) and associated dredging
To what extent is the project essential to addressing the problem /opportunities	<ul style="list-style-type: none"> The MOF extensively addresses the problem and opportunities. The MOF will create common user marine infrastructure and the dredging will enable further marine development. Infrastructure Australia's the Territory Regional Strengths and Infrastructure Gaps report details the downstream minerals processing and strengthening the gas production supply chain as key growth industries⁸⁵ The MOF and association with industry proponent's beneficiation of resources across the value chain directly aligns with this study's findings. A surge of industrial construction and project development across all major industries, driven by private investment is expected in the medium to short term. 13 major private industry major projects are expected to be developed over the coming years totalling approximately AU\$38.5bn. The significant investment pipeline is due to the NT's strategic location, access to natural resources and available land. The distinct situation in the Territory, particularly across the top end, is population is low and the investment pipeline is high. Figure 25 evidences Darwin as having high turnover recruitment rates and high recruitment difficulty rate. Currently, construction is exacerbated by labour shortages and lack of construction materials availability. A modularisation solution is estimated to save costs of around 10% in the non-real estate construction industry and speed up construction by 50%⁸⁶. These factors are applying pressure to the construction industry while increasing industries preference for modularisation as opposed to stick-built construction. Demand for imported modularised components to service the change in Australia's energy mix over the next decade and beyond is extensive to enable the \$66 billion expected to be invested in electricity generation, transmission, and storage over the next two decades⁸⁷. A majority of the infrastructure required to build and capture this electricity will come in a modularised option for connection and installation in Australia. This will provide the MOF with ongoing utility for years to come. Given this, the MOF will have significant environmental benefits associated with facilitation of importing modules to capture the Territory PV renewable energy. Wider benefits to MOF users will be found through the reduction of costs and construction time associated with modular builds⁸⁸.
To what extent is the precinct dependant on the project and what are the relationships with other projects in the essential dependant list.	<ul style="list-style-type: none"> The precinct is highly dependent on a MOF and dredging. Without it, the precinct will not be activated as the peninsular marine access will not be developed. The ability to import modules will be constrained and this is expected to add significantly to project capex costs and project viability. Slowing large scale capital costs and providing MOF or product jetties for mid, or downstream proponents on an operational/per usage basis will lower the cost of doing business and ultimately make it more attractive to invest in the Territory on a global scale. The MOF is co-dependant on transport infrastructure to complete the access to proponent sites with modularised infrastructure.
Does this project require government	<ul style="list-style-type: none"> The MOF and dredging indicative costs of \$737 million is a significant capital outlay. Should the MOF be privately funded and not available for common use there is significant and likely risk to the accessibility for proponents in the precinct. Offering a MOF and product jetty

⁸⁵ Infrastructure Australia - Regional Strengths and Infrastructure, 2022

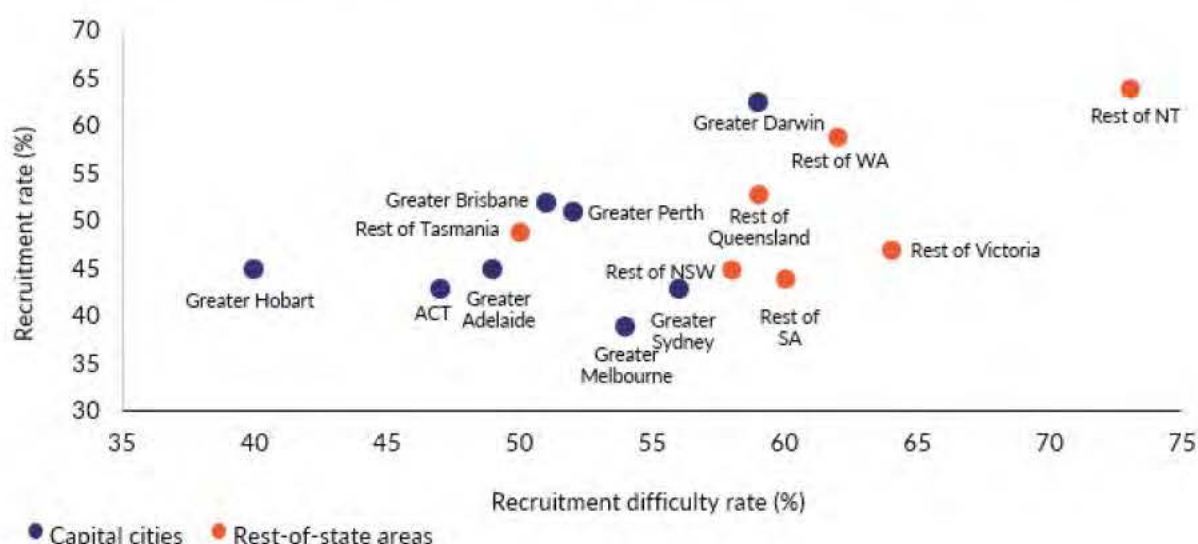
⁸⁶ McKinsey and Company - Modular construction: From projects to products, 2019

⁸⁷ Infrastructure Australia - Market Capacity for Electricity Generation and Transmission Projects, 2021

⁸⁸ McKinsey and Company - Modular construction: From projects to products, 2019

Criteria	Modular Offloading Facility (MOF) and associated dredging
coordination and or leadership/funding	<p>access for mid-tier users of the Territory resources and inputs will reduce investment capital costs.</p> <ul style="list-style-type: none"> The Inpex owned Ichthys MOF is located in Darwin. There have been logistical and accessibility challenges for private industries to secure commitment and permission to utilise Inpex's MOF. This highlights the utilisation risks and uncertainty of a privately owned MOF with large private ownership dependant on their operational demand use. A Government funded and common-user MOF will have the authority to equitably distribute industries demand and provide an open access operating platform, particularly for Middle Arm occupants. The precinct site of Middle Arm has limited marine location options available. Only one marine development to accommodate Panamax vessels is possible in Middle Arm planning configuration, providing additional justification and support for a government led MOF development.
MCA ranking	<ul style="list-style-type: none"> Modular Offloading Facility (MOF) including appropriate dredging and common user hardstand/laydown facility has aa MCA ranking of 2 with a weighted score of 6.23.

Figure 25: Rates of recruitment and recruitment difficulty by region (12 months to March 2022)⁸⁹



6.4 Why the product jetty is an essential dependant infrastructure project

The Product Jetties were identified as essentially dependant infrastructure project, firmly linked to common-user, open access, essential to the beneficiation and diversity across the value chain and sustainability elements, addressing the Program's problems and opportunities. The product jetties are highly interdependent with connecting road, MOF and dredging infrastructure projects outlined in Phase 3 section 5.2

Table 15: Essential dependant infrastructure – Product jetties

⁸⁹ NSC, Recruitment Experience and Outlook Survey, 2021 and 2022

Criteria	Product export jetties
To what extent is the project essential to addressing the problem /opportunities	<ul style="list-style-type: none"> Product jetties address the problems and opportunities by providing common user export focused marine infrastructure at the location of product development. These jetties will multiply the options available for proponents to benefit the Territory resources, creating jobs and value in the economy and improving our supply chain resilience. The product jetties will underpin capacity for export and shorter distribution pathways from MASDP to the export markets targeted by MASDP proponents. The product's produced by occupants in the MASDP are expected to be LNG, Hydrogen, Ammonia, Methanol, Urea, Lithium and Rare Earth Minerals. Producing this product mix each will require inputs from a range of the Territory resources. Inputs from across the entire value chain such as gas and renewable energy to make products blue or green will be required to meet national and international demand. The industrialised nature of the precinct will be focused on producing products that will be traded on the international markets now, and decades to come. Australia conducts 98% of its trade through marine infrastructure⁹⁰ with one in five jobs in Australia being trade-related⁹¹, maintaining and expanding opportunities for Australian exporters is vital to Australia's continued development into the future and economic prosperity.
To what extent is the precinct dependant on the project and what are the relationships with other projects in the essential dependant list.	<ul style="list-style-type: none"> The jetties are required as an essential dependant because certainty on export routes is a key consideration for industry and there are limited marine infrastructure options at Middle Arm. Common use infrastructure will enable mid-sized projects to proceed due to lower initial capex requirements which is expected to accelerate positive investment decisions and deepen the industrial complexity of the precinct. The jetties rely on the dredging undertaken to develop the MOF and also increase the benefits of doing the dredging program.
Does this project require government coordination and or leadership/funding	<ul style="list-style-type: none"> With the investment pipeline in the Territory being extremely high with, 13 private industry, major projects being planned and delivered over the coming years, the port capacity will be unable to meet demand and export infrastructure requirements. The products produced for export in the precinct are vast and significant including Titanium, Vanadium, Ammonia, Hydrogen and fertiliser to name a few. 90% of industry respondents surveyed⁹² for the precinct indicated common-user export product jetties are critically essential for exporting products to the market. Some noted that using existing port facilities could limit export quantities. A Government funded and common-user product jetty will enable equitable capacity to meet industry demand and provide an open access operating platform, particularly for Middle Arm occupants. Additionally, it should be noted precinct site of Middle Arm has limited marine location options available in its current planning configuration. Allowing only privately built jetties on remaining limited available land could restrict industry growth and jeopardize the success the diverse nature of the precinct.
MCA ranking	<ul style="list-style-type: none"> Product export jetties ranked fifth in the long list infrastructure project MCA with a weighted score of 5.96.

⁹⁰ Ports Australia, 2022

⁹¹ DFAT - Trade and Investment at a glance 2021

⁹² DIPL Industry surveys, 2022

6.5 Why the Power Network is an essential dependant infrastructure project

The power network to distribute and transmit green energy was identified as essentially dependant infrastructure project, firmly linked beneficiation and diversity across the value chain and sustainability elements to address the Program's problems and opportunities.

Table 16: Essential dependant infrastructure – Power network

Criteria	Middle Arm specific industrial electrical distribution network to transmit industrial green energy
To what extent is the project essential to addressing the problem /opportunities	<ul style="list-style-type: none"> This infrastructure option significantly addresses the access to inputs problem and all the opportunities relating to the MASDP. Beneficiation of the Territory captured and produced resources will be both feedstock and outputs of the proponents expected to reside in MASDP. Goldman Sachs reported green hydrogen could supply up to 25% of global energy requirements by 2050 to become a US\$10 trillion market by 2050⁹³. With the significant green hydrogen demand and associated products such as Methanol and Ammonia, access to green energy from renewables will be essential. A common-user power network will reduce the need for proponents to purchase individual power plants or infrastructure to support operating activities. Without a common-use and open access power option, each proponent would likely investigate individual energy generation options. Under this scenario, if five of the expected proponents sourced medium capacity gas fired power generators such as Siemens SGT5-2000E. As a conservative estimate, operating at maximum capacity for 20% of the year emits an estimated 228,000 tonnes/annum⁹⁴. 228,000 tonnes of CO2-emissions multiplied by five totals 1,140,000 tonnes/annum, equivalent to over 220,000 residential homes' electricity use per year⁹⁵. The individual uptake of energy solutions has the potential to jeopardise the Territory's emissions targets and as such, the sustainability element of the precinct. As mentioned above, with demand for green products peaking in 2050 the precinct remains future proof for years to come.
To what extent is the precinct dependant on the project and what are the relationships with other projects in the essential dependant list.	<ul style="list-style-type: none"> This precinct is considered dependant on a renewable electricity network to deliver its sustainable objectives and to value-add at every stage from the capture of solar power to hydrogen, chemical and sustainably processed resources. Without this infrastructure, projects are highly likely to attempt to develop their own solutions which will be either be gas-based or solar attempted onsite which is a sub optimal outcome use of the strategic land at middle arm. If projects proceed with gas-based options, the opportunity to realise a future focused sustainable precinct will not be realised. This infrastructure is related to the transport infrastructure option in that there are shared development pathways and there is the potential for efficiencies to be realised if developed in unison.

⁹³ Goldman Sachs - Green Hydrogen The next transformational driver of the Utilities industry, 2020

⁹⁴ GHD -Power station and associated costs, 2021

⁹⁵ EPA, Greenhouse Gas Equivalencies Calculator, 2022

Criteria	Middle Arm specific industrial electrical distribution network to transmit industrial green energy
Does this project require government coordination and or leadership/funding	<ul style="list-style-type: none"> Open access and reduced capital outlay for medium sized enterprises reduces the investment barrier for proponents looking for low-emissions production. Expectations that Government coordination, execution and operation of the precinct's power network is necessary to ensure common-user and access remains available to all proponents: <ul style="list-style-type: none"> Primary land holder - Network configuration infrastructure will be built across Government owned land. Commercial ambiguity - Government has the ability centrally coordinate various precinct proponents being a trusted body to retain and keep commercial and confident information anonymous. Collective bargaining - Ability to negotiate offtake agreements for renewable energy supply on behalf of all precinct proponents.
MCA ranking	<ul style="list-style-type: none"> Middle Arm-specific industrial electrical distribution network, to transmit industrial green energy was ranked tenth in the long list of infrastructure projects MCA, with a weighted score of 5.76.

6.6 Why the Precinct Roads is an essential dependant infrastructure project

The precinct roads and supporting transport infrastructure was identified as essentially dependant infrastructure project, firmly linked to common-user and open access, beneficiation and diversity across the value chain elements to address the Program's problems and opportunities.

Table 17: Essential dependant infrastructure – Precinct Roads

Criteria	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor
To what extent is the project essential to addressing the problem /opportunities	<ul style="list-style-type: none"> The roads address the problem of serviced, accessible industrial land connecting to marine infrastructure and are fundamental to a successful precinct. The roads within the precinct to enable proponents to get to and from marine infrastructure carrying essential imported or exported products and materials. In this case, the public common user roads industrial roads offer productivity benefits to support the movement of products and people⁹⁶. Appropriate Government management and maintenance of key road infrastructure and transport corridors is essential for controlling environmental impacts. Monitoring use, wear-and-tear and damage of roads can reduce the risk of environmental impacts such as increased emissions caused by poor surface conditions and noise pollution to nearby residential areas⁹⁷. Government funded and operated roads provides future ability to adapt to changing industry landscapes and make informed decisions based on historical evidence and road/transport corridor performance.

⁹⁶ Infrastructure Magazine- Australian roads create \$236 billion, support 1.4 million workers, 2021

⁹⁷ Infrastructure Australia- Corridor Protection: Planning and investing for the long term, 2017

Criteria	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor
To what extent is the precinct dependant on the project and what are the relationships with other projects in the essential dependant list.	<ul style="list-style-type: none"> Access to the MOF, product export jetties and rest of the precinct are all dependant on the supporting transport infrastructure connecting all other infrastructure projects. This project is essential and the MOF, Product jetties and power distribution network are both dependant on this infrastructure project.
Does this project require government coordination and or leadership/funding	<ul style="list-style-type: none"> Australia has a long history of protecting corridors to utilise linear infrastructure in the short and long term⁹⁸. Land and corridors within land boundaries of Middle Arm is currently Government owned. With strategic land at Middle Arm already owned by Government there would be substantial costs and risks to allowing third parties to develop private roads to key areas of the precinct. Roads are typically the role of Government to build, maintain, and govern and unlikely to be delivered by the market. Risks of private roads include: <ul style="list-style-type: none"> Privatisation - Jeopardise common-use and open access nature of key roads within the precinct. Governance - Decision making power over types of transport construction, resulting in a more indirect route. Transparency and confidence - Hinder precinct and industry participants long term view of how the infrastructure could be managed. Activation – the precinct could become less desirable due to industry uncertainty and increased level of security required and investment risks.
MCA ranking	<ul style="list-style-type: none"> Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor is ranked first in the long list of infrastructure projects MCA, with a weighted score of 6.64.

6.7 MCA infrastructure projects driven program

In addition to the infrastructure projects considered essential dependants, it was decided that the top-ranking projects from the MCA would progress to the Rapid CBA. With the essential dependant projects scoring high, the remaining top five Infrastructure Projects include:

- Digital subterranean cabling of precinct to support digital communications to enable automation.
- Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.
- Shared workforce transport / transit system – including parking and connections to worksites.
- Worker's accommodation to enable MA workers (residential land release and costs).
- CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control.

⁹⁸ Infrastructure Australia- Corridor Protection: Planning and investing for the long term, 2017

Table 18: MCA top ranking Infrastructure Projects

Rank	Infrastructure Project	Unweighted score	Weighted score
1 ★	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.	105	6.64
2 ★	Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.	99	6.23
3	Digital subterranean cabling of precinct to support digital communications to enable automation.	100	6.18
4	Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.	97	6.11
5 ★	Product export jetties.	97	5.96
6	Shared workforce transport / transit system – including parking and connections to worksites.	96	5.93
7	Worker's accommodation to enable MA workers (residential land release and costs).	94	5.94
8	CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure – capacity/open access control.	89	5.92

It was agreed with the PWG that only the top-ranking infrastructure projects would progress through to the options development, in this case the top 50%. The thorough nature of the MCA weighting and scoring process ensured progressed infrastructure projects are directly linked back to the Project's overall problems, opportunities and objectives.

6.8 Industry led program

Program package option 3 would combine the essential dependant, top ranked MCA infrastructure projects and include an outlier deemed critical by potential industry proponents⁹⁹. A survey was developed and distributed amongst a range of potential precinct occupants across a diverse set of industries and product manufacturing types. A copy of the distributed survey along with detailed response results can be located in **Appendix F**.

Potential biases could exist depending on the proponent's industry type and operations when applying this method. Interestingly results obtained by the survey found many industries preferred critical infrastructure items that aligned with the essential dependants or top ranked MCA options, with the exception of the water utility options. Further validating the robustness of the prior option methods. A summary of the results is shown below in Table 19.

Table 19: Summary of critical infrastructure projects required by industry

Infrastructure project	Industry proponents' response
Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility	3/6 Industry proponents deemed the common-user MOF as critical for their project business case to achieve FID
Product export jetties	6/6 Industry proponents identified the product jetties as critical for their project business case to achieve FID
CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure - Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control	1/6 Industry proponents identified Common User CCUS as critical for their project business case to achieve FID
Digital subterranean cabling of precinct to support digital communications and automation	1/6 Industry proponents identified subterranean digital cabling as critical for their project business case to achieve FID
Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy	2/6 Industry proponents identified the firm renewable distribution network as critical for their project business case to achieve FID
High capacity, networked power distribution to Middle Arm connected to DKIS	0 Industry proponents identified DKIS power network as critical for their project business case to achieve FID
Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen	1/6 Industry proponents identified the upgrades to Channel Island as critical for their project business case to achieve FID
Water desalination solution available for industry proponents	3/6 Industry proponents identified the water desalination as critical for their project business case to achieve FID
Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure	3/6 Industry proponents identified the wastewater treatment plant as critical for their project business case to achieve FID
Gas pipeline into Middle Arm for proponents to access	Not included in survey
Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities)	2/6 Industry proponents identified rail Infrastructure as critical for their project business case to achieve FID
Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor	6/6 Industry proponents identified the transport infrastructure as critical for their project business case to achieve FID
Shared workforce transport / transit system - including parking and connections to worksites	1/6 Industry proponents identified the share workforce transmit system as critical for their project business case to achieve FID
Worker's accommodation to enable MA workers (residential land release and costs)	1/6 Industry proponents identified workers accommodation as critical for their project business case to achieve FID
Local emergency response infrastructure - local fire station / medical clinic / EMS	2/6 Industry proponents identified emergency response infrastructure as critical for their project business case to achieve FID
Beneficial re-use of dredge soil for additional economic land	0 Industry proponents identified beneficial re-use of dredge soil as critical for their project business case to achieve FID

The two notable infrastructure projects identified by industry not included in the prior two methods are the water desalination and wastewater handling projects. With the separate AROWS water project providing a solution to Middle Arm (discussed in Phase 3 section 5.2), a decision was made to progress the wastewater handling solution through to Program Package 3 until water demand above the AROWS can be quantifiably confirmed.

6.8.1 Program Package 1 – Essential dependants

Program package 1 of essential dependants includes the following infrastructure projects:

- Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.
- Product export jetties.
- Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.
- Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.

6.8.2 Program Package 2 – Essential dependants plus top MCA

Program Package 2 includes the following infrastructure projects:

- Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.
- Product export jetties.
- Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.
- Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.
- Digital subterranean cabling of precinct to support digital communications to enable automation.
- Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.
- Shared workforce transport / transit system – including parking and connections to worksites.
- Worker's accommodation to enable MA workers (residential land release and costs).
- CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control.

6.8.3 Program Package 3 – Essential dependants plus industry demand

Program Package 3 includes the following infrastructure projects:

- Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.
- Product export jetties.
- Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.
- Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.
- Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure.

6.8.4 Program Package 4 – Essential dependants, top MCA ranked Infrastructure Projects and industry demand

Program Package 4 includes the following Infrastructure Projects:

- Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.
- Product export jetties.
- Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.
- Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.
- Digital subterranean cabling of precinct to support digital communications to enable automation.
- Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.
- Shared workforce transport / transit system – including parking and connections to worksites.
- Worker's accommodation to enable MA workers (residential land release and costs).
- CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control.
- Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure.

7. Phase 5 – MCA-2

Following the establishment of a Project Package long-list (Phase 1) and a comprehensive stakeholder engagement strategy (Phase 2), a second MCA (MCA-2) was conducted against the Program Packages Identified. While the purpose of the first MCA was to act as a coarse filter on the long-list of infrastructure project options, the objective of MCA-2 was to provide a more thorough assessment of packages. This included taking into consideration some of the qualitative analysis undertaken in prior Phases of work.

7.1 Approach

The MCA-2 criteria and weightings were developed through a series of workshops attended by the PWG and expert representatives. In developing the criteria for MCA-2, the overarching categories from MCA-1 were taken into consideration, and where appropriate, refined to suit program objectives. However, given that the availability of data and complexity of analysis completed since the first MCA, MCA-2’s criteria and weightings were refined to a level of detail that reflected the analysis completed to date.

It was agreed that the MCA-2 process would score Project Packages against four criteria. A set of sub-criteria was considered when assessing each criterion. The criterion and sub-criterion are outlined in Figure 26. A detailed description of each criterion, including suggested key considerations that were made during the assessment process, and likely outcomes and indicators can be found in Table 20.

Figure 26: MCA-2 criteria hierarchy

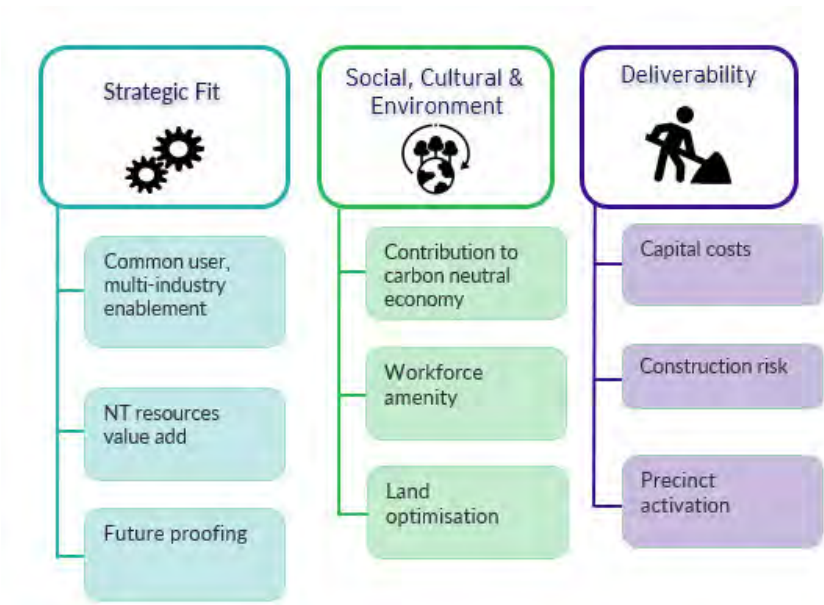


Table 20: MCA-2 Criteria, descriptions and weightings

Criteria	Sub-criteria and description	Sub-criteria weighting	Criteria weighting
Strategic Fit	1.1 – Common user, multi-industry enablement Make the precinct more attractive to a wide demographic of industries and products Critically required common user infrastructure which addresses industry demand, in a cohesive and strategic manner	15%	35%
	1.2 – the Territory resources value add Increase the output of value-add products originating from the Territory resources	10%	
	1.3 – Future proofing Make the precinct modern for future utility to address global demands Ensure new industries can integrate into the precinct as sectors and industries evolve	10%	

Criteria	Sub-criteria and description	Sub-criteria weighting	Criteria weighting
Social & Environmental Impacts	2.1 - Contribution to carbon neutral economy Decrease carbon emissions through common-user infrastructure	15%	30%
	2.2 – Workforce amenity Address the lack of workforce services and accommodation Reduce pressure on existing social services and minimise social impact	10%	
	2.3 – Land optimisation Reduce duplicate infrastructure developments Reduce energy intensive operations optimising productivity aligning with precinct existing expectations	5%	
Deliverability	3.1 –Capital costs Indicative capital costs for the program options aligns within the expected range	15%	35%
	3.2 – Construction risk Confidence in program delivery Existing program development Achieve industry timelines expectations	10%	
	3.3 – Precinct activation Increase the utility of each proponent using common-use infrastructure both long and short term Attract interest in the precinct	10%	

The Project Package long-list was then independently assessed against each assessment criteria. Each option's ability to contribute to meeting the criterion was scored using a 1 to 5 range. The method for scoring is presented in Table 21 below.

Table 21: MCA-2 scoring guide

Type	Descriptions	Score
Strong negative	Severe negative impact / outcome	1
Slightly negative	Minimal negative impact / outcome Short term impact / outcome Impacts can be managed or mitigated	2
No significant Impact	No discernible impact / outcome	3
Moderate positive	Moderate positive impact / outcome May provide new opportunities or improvements	4
Strong positive	Major positive impact / outcome Long-term improvements	5

7.2 Results

The following section presents an overview of the MCA-2 results.

In addition to the analysis undertaken during Phase 2 and the stakeholder consultation findings from Phase 4, the economic appraisal results were available for all Project Packages included in the long-list. Having the Rapid CBA results and the associated outputs available for Phase 4 allowed the PWG to adequately score the economic, environmental and safety criteria from both a quantitative and qualitative perspective. Given that Rapid CBA's aren't as comprehensive as a detailed CBA, consideration for wider economic benefits was accounted for during the scoring process.

Weighted and unweighted scores from MCA-2 are outlined in Table 22.

Table 22: MCA results

Rank	Program Package	Unweighted score	Weighted score
1	Program 2: Material offloading facility, dredging and laydown area Export product jetties Power network distributing green energy	39	4.25

	Precinct roads and supporting transport infrastructure CCUS manifold and supporting infrastructure Transit system and parking Digital subterranean cabling to support digital communications Channel Island upgrade Residential land release and costs to support additional workers accommodation		
2	Program 1: Material offloading facility, dredging and laydown area Export product jetties Power network distributing green energy Precinct roads and supporting transport infrastructure	37	4.15
3	Program 4: Material offloading facility, dredging and laydown area Export product jetties Power network distributing green energy Precinct roads and supporting transport infrastructure CCUS manifold and supporting infrastructure Transit system and parking Digital subterranean cabling to support digital communications Channel Island upgrade Residential land release and costs to support additional workers accommodation Wastewater handling and treatment facility	37	4.00
4	Program 3: Material offloading facility, dredging and laydown area Export product jetties Power network distributing green energy Precinct roads and supporting transport infrastructure Wastewater handling and treatment facility	36	3.95

Results from MCA-2 showed slight variability between the weighted and unweighted scores. Having a long-list of Project Packages with scores skewed towards +3 indicates that the Project Package long-list is likely to meet most of the project objectives relative to the Base Case. Descriptions, reasoning and evidence (where possible) for the results are documented with additional information provided in **Appendix C**.

8. Phase 6 – Rapid CBA

■ undertook a conventional Rapid CBA of a range of options relating to the MASDP Project, consistent with guidelines set forth in the IA Assessment Framework July 2021 and in accordance with discussions conducted with IA and the Department of Infrastructure, Planning and Logistics (DIPL) in preliminary briefings. The Rapid CBA was prepared on all Project Packages, which progressed through the package identification Phase and MCA phase of work.

The Rapid CBA is consistent with national economic appraisal guidelines and aligns with the economic, social and environmental objectives of the MASDP Project. The purpose of the Rapid CBA is to systematically analyse the financial, economic and environmental costs and benefits attributable to the Program Packages by monetising (where possible) both costs and benefits to enable relative comparisons against the Base Case scenario. The findings of the Rapid CBA contribute to decision making by comparing the present value of the economic benefits against the costs of the Program Packages which provides a Benefit Cost Ratio (BCR) for the Project. The result of Rapid CBA does not provide a complete analysis of the economic and financial benefits associated with the Project, however, it should serve as a source of comparative analysis.

The BCR for each Program Package is documented, assessed and ranked in this report and is ultimately used to support the Program Packages that will progress for further analysis in a full Infrastructure Australia Stage 3 Business Case.

8.1 Rapid CBA Development

The Rapid CBA applies a 7% per annum discount rate to the economic costs and benefits over a 50-year appraisal period of the Project. A list of the Program Packages and its respective key infrastructure items identified and assessed as part of Phases 1-5 of this submission is set out in the table below.

The four Program Packages are defined as four separate Project Case scenarios and can be assessed by comparing the respective net economic benefit of each Program Package against the 'Do Minimum' Base Case scenario.

Table 23: Base Case and short list Program Packages in the Project Case

Case	Program package	Description
Base Case	Do minimum	Under the "Do Minimum" Base Case scenario, the government provides only the essential land development required for the precinct to develop organically. No other common infrastructure will be supported to industry by government
Project Case	Program Package 1	Essential dependant infrastructure
	Program Package 2	Essential dependant infrastructure in addition to top scoring infrastructure projects identified in the shortlist.
	Program Package 3	Essential dependant infrastructure in addition to infrastructure projects industry demand
	Program Package 4	Essential dependant infrastructure in addition to top scoring infrastructure projects identified in the shortlist and industry demand.

8.1.1 Inputs

Key CBA inputs used in the economic appraisal were derived from the following methodology, online research, and key stakeholder consultations:

A variety of sources were used to underpin the key CBA inputs that drove the economic appraisal. The sources and its respective application to the Rapid CBA is set out in the table below.

Table 24: CBA Input Sources

Source	Source application
DIPL Infrastructure Cashflow Data Model	Enabling Infrastructure Cashflow data was provided by DIPL. The data forecasted key infrastructure capital and operational costs (MOF, Jetty, land development and roads), as well as the estimated revenue generated from the utilisation of the respective infrastructure assets. The revenue was calculated on the expected supply of potential proponent products in the precinct and associated charge fee per unit which is typically charged on a per tonne basis. The annual revenue timeline was considered for each individual potential project within the precinct. These costs and revenue forecasts have been used in developing the Rapid CBA and underpin cost and benefit quantification.
DIPL Subject Matter Expert Consultation	A range of Subject Matter Experts (SME) within DIPL's engineering department were consulted to support the assumptions that underpinned the economic benefit and cost appraisal.
IA framework	Assessment Framework 2021 Stage 2 was used in developing the Rapid CBA model. Rapid CBA principals were adopted when developing the model.

A list of key assumptions and parameters used to develop the Rapid CBA is set out in **Appendix H**.

8.1.2 Rapid CBA Approach

The Rapid CBA approach includes five key steps which are outlined in the figure 27 and table 25 below:

Figure 27: Rapid CBA approach



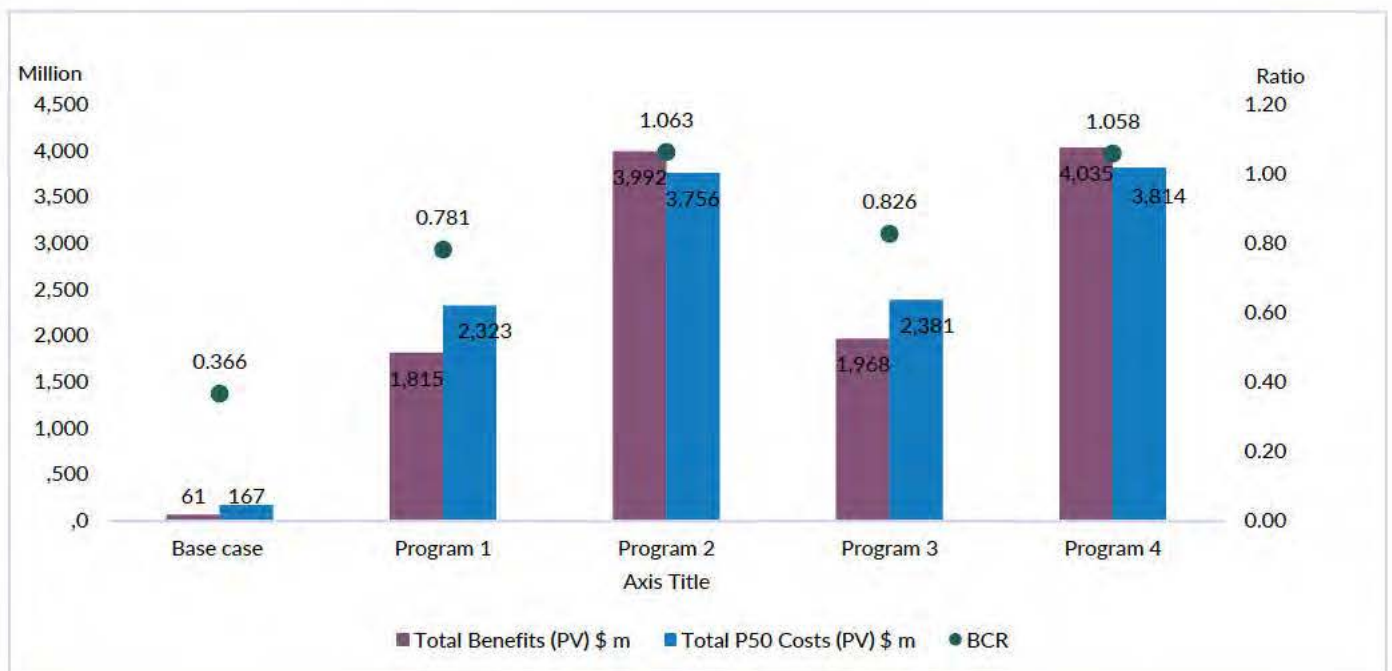
Table 25: Rapid CBA Approach

Step Title		Description
1	Key components of Program Packages	Identify and analyse key components of each infrastructure in each Program Package.
2	Demands of Program Packages	Identify the demands of common users' infrastructure under each Program Package based on the supply on projects expected to be enabled by common use infrastructure.
3	Costs of Program Packages	Estimate both capital and operational costs for each Program Package across a 50-year appraisal period.
4	Economic Benefits	<p>Quantify the economic benefits generated from each common user infrastructure across the appraisal period, including benefits resulted from the combination of common user infrastructure in each Program Package, specifically:</p> <ul style="list-style-type: none"> • Infrastructure Benefits: benefits generated from each common user infrastructure in each Program Package; and • Program Benefits: environmental and land parcel earnings benefits resulted from the combination of common user infrastructure in each Program Package.
5	Benefit Cost Ratio	Calculate the BCR by comparing the Present Value (PV) of benefits to the PV of costs.

8.2 Overview of CBA Results

As illustrated in Figure 28, the BCR of each Program Package vary between 0.78 and 1.06. under each Program Package, the BCR is consistently higher than Base Case scenario which achieved a BCR of 0.37. This not only indicates that the Base Case does not only provide a net positive economic return, but it also indicates that any Program Package selected will provide a higher economic return to the national economy than the Base Case. The BCR of Program 1 and Program 3 are below 1 and lower than other two Programs which indicated that the costs of these two Programs outweigh the benefits, and they are less favourable than their peers.

Figure 28: Rapid CBA Results (AUD\$m, PV)



8.2.1 Overview of Benefits

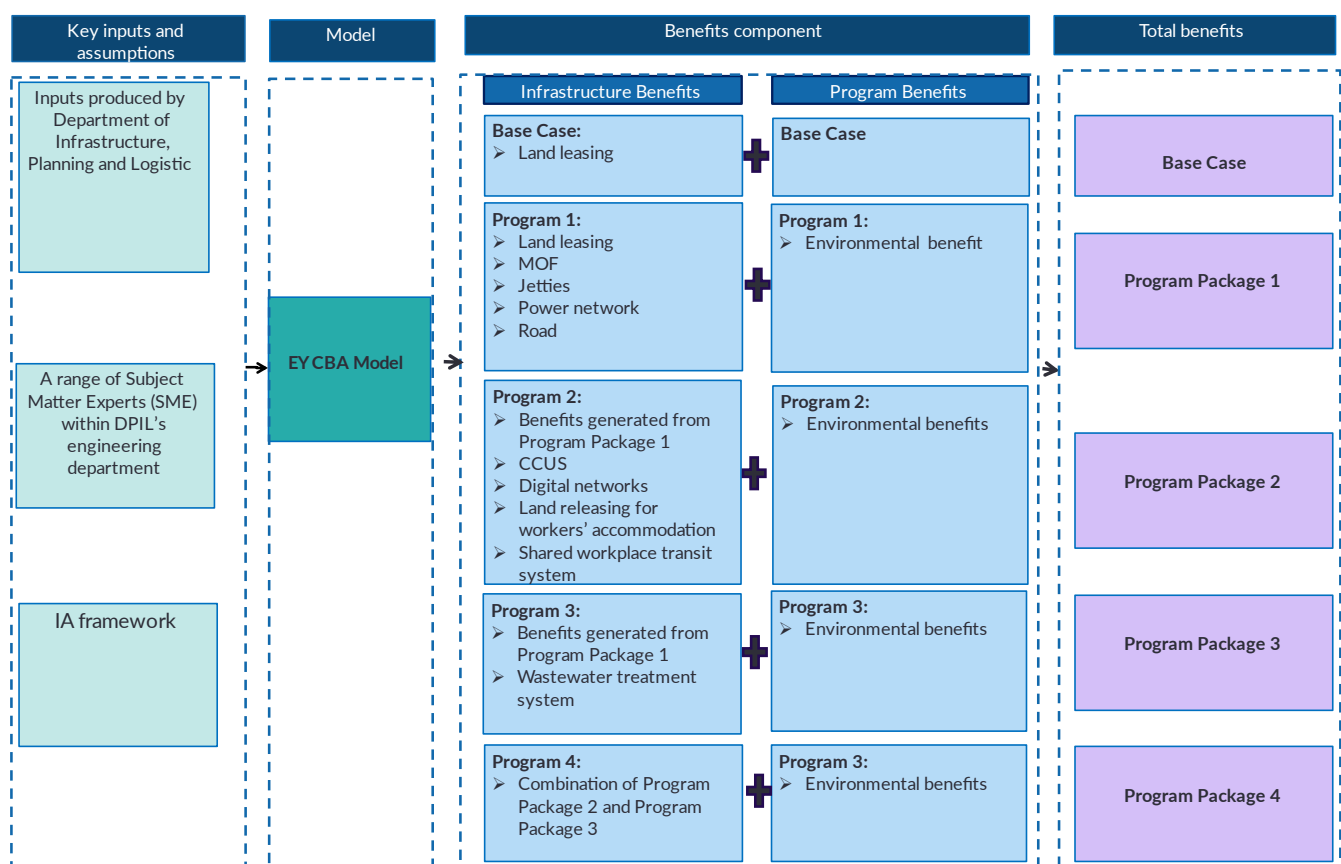
The economic costs and benefits are discounted back to end of Financial Year (FY) 2023 based on a 7% discount rate and an appraisal period of 50-years.

The approach to benefits quantification for Base Case and each Program Package can be broken down into two main parts, Infrastructure Benefits and Program Benefits.

- Infrastructure Benefits: these benefits represent the revenue generated from each infrastructure within a Program Package such as revenue generated from MOF.
- Program Benefits: these benefits are generated from the combination of the infrastructure in each Program Package.

Figure 29 illustrates the approach and methodology used to quantify the benefits of each Program Package.

Figure 29: Benefits methodology workflow



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By comparing the Net Present Value of each Program Package against the NPV of the Base Case, the NPV of Program 1 and Program 3 increased by around 21% and 26%, respectively. And NPV of Program 2 and Program 4 increased by approximately 45% and 48% separately. The NPV results are consistent with BCR and suggested all Programs outperformed the Base Case. Program Package 1 and 3 stated that the net values of the economic costs and revenue are negative and significantly lower than Program Package 2 and Program Package 4. Program 2 and Program 4 return significant higher and positive NPV which suggested that inclusion of additional common user infrastructure on top of essential dependent infrastructure would provide much larger economic benefits relative to the costs.

Table 26 below illustrates that Program Package 4 provides the highest revenue across the appraisal period, achieving approximately \$4 billion on an NPV basis. However, the economic NPV and BCR of Program Package 2 is greater than Program Package 4, mainly owing to the additional costs associated with the wastewater treatment system infrastructure asset included under Program Package 4. It can therefore be said that Program Package 2 should be the preferred Program Package under the Rapid CBA.

Table 26: Present value of benefits, costs and BCR results summary¹⁰⁰

Description	Base Case	Program 1	Program 2	Program 3	Program 4
Total present value of benefits (AUD\$m, PV)	61	1,815	3,992	1,968	4,035
Total present value of costs (AUD\$m, PV) – P50 ¹⁰¹	167	2,323	3,756	2,381	3,814
Net present value (AUD\$m, PV)	(106)	(508)	235	(413)	221
Net present value relative to Base Case (AUD\$m, PV)		(402)	341	(308)	327
BCR	0.366	0.781	1.063	0.826	1.058

For a further breakdown on benefits, please refer to **Appendix I**. A list of key assumptions and methodology used to develop each of the benefit is set out in **Appendix G**.

8.2.2 Overview of Costs

The Program Package's capital costs (capex), maintenance and operating costs (opex) estimates were issued by DIPL. DIPL drew on its historical public and engineering reports related to the potential industries and Middle Arm's infrastructure design, as well as internal research and ongoing studies. Insights were further supported by consultation with DIPL's engineering department with a focus on relevant operational and cost metrics such as the costs of releasing land, costs of Channel Island upgrading, MOF, Jetties etc. The data will be used as inputs to generate an operating model to calculate the overall costs of each Program Package.

The core economic appraisal results are presented using P50 costs, discounted at 7% per year over a 50- year appraisal period back to end of FY2023⁹⁹.

Table 27 below sets out the real value of total costs on a P50 basis. The costs vary between \$4.3 billion to \$6.8 billion across four different Program Packages in real terms, or approximately \$2.3 billion to \$3.8 billion in present values terms¹⁰⁰.

The cost estimates between Program Package 1 and Program Package 3 are relatively similar in quantum as documented in Table 27. The difference between Program Package 1 and Program Package 3 is around \$117 million in real terms or approximately \$58 million on PV basis. The difference in cost between Program Package 1 and 3 is mainly driven by the inclusion of a wastewater treatment system in Program Package 3.

The cost estimates for Program Package 2 and Program Package 4 are also similar in size. However, they are significantly larger than its peers, each of which are at least approximately \$2 billion higher than Program Package 1

¹⁰⁰ The benefits and costs are discounted at 7% to present value in FY2023 for a 50-year forecasting period

¹⁰¹ The present value includes both Opex and Capex

and 3 in real terms, or approximately \$1 billion on PV basis. This large difference is mainly driven by additional costs associated with extra infrastructure included in Program Package 2 and Program Package 4.

Overall, the costs estimated for each Program Package are significantly higher than the Base Case in both real and discounted terms. This is due to the significant costs realised as a result of developing infrastructure for each Program Package relative to the Base Case.

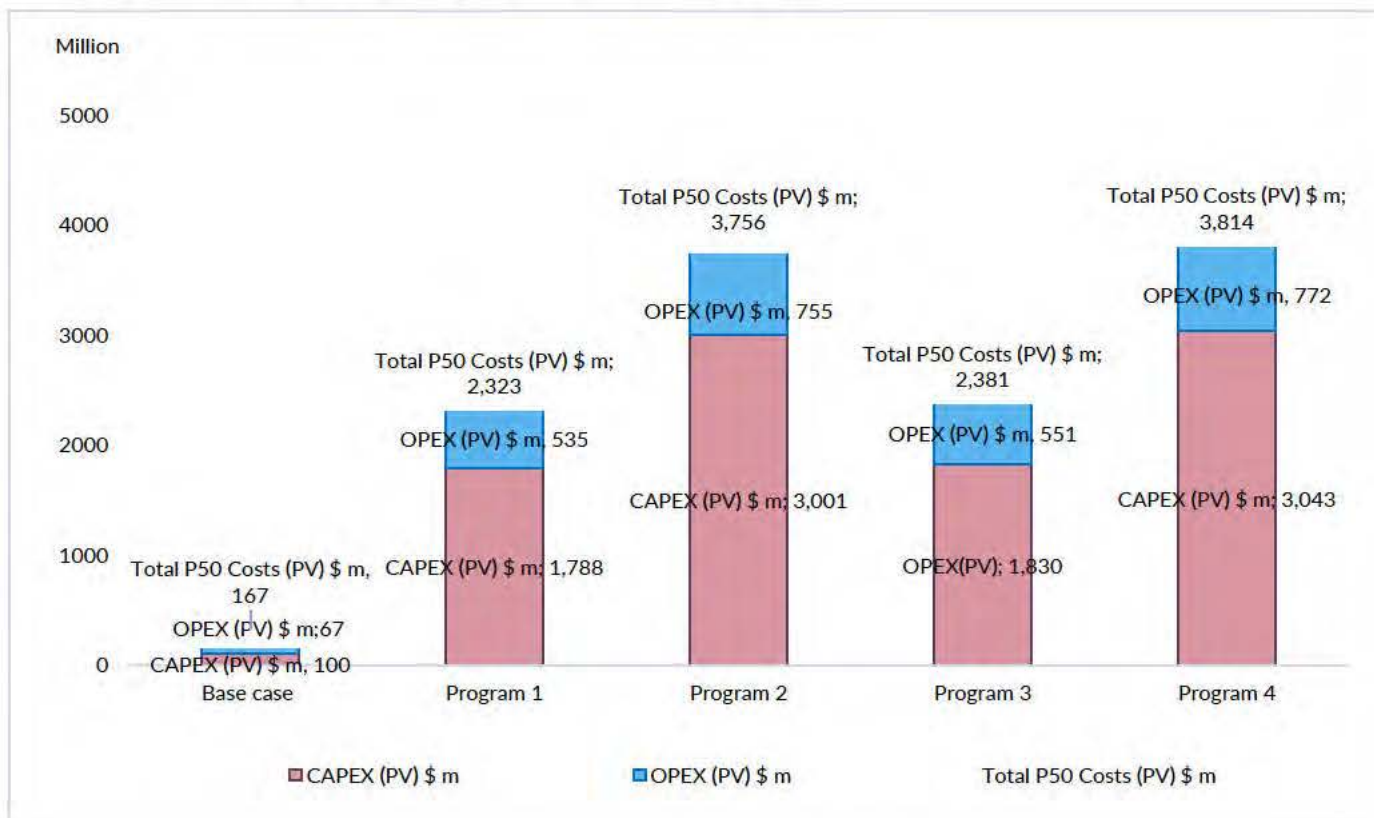
Figure 30: Total P50 costs summary

Description	Base Case	Program 1	Program 2	Program 3	Program 4
Total P50 costs (AUD\$m, real)	392	4,325	6,678	4,442	6,795
Total present value of P50 costs (AUD\$m, PV) ¹⁰²	167	2,323	3,756	2,381	3,814
Net P50 costs relative to Base Case (AUD\$m, real)		3,933	6,286	4,050	6,403
Net P50 costs relative to Base Case (AUD\$m, PV)		2,156	3,590	2,214	3,648

The Rapid CBA model assumes that construction commences in FY2025, and the capital costs are evenly distributed over a two-year construction period. The capex value is the real costs during construction periods. The core economic appraisal results are forecasted and presented using P50 costs, discounted at 7% p.a. back to the end of FY2023 over a 50-year appraisal period. As illustrated in Figure 31, the capital cost is consistently the main component that drives the costs for each Program Package.

¹⁰² Discounted at 7% per annum over a 50-year appraisal period

Figure 31: Present value of P50 capex and opex costs (AUD\$m, PV) ¹⁰³



For a further breakdown on capital and operational costs, please refer to **Appendix J**.

8.2.3 Overview of real benefits and costs

Program 2 and Program 4 provides the highest net real values of approximately \$18.8 billion and \$19 billion. Even though the net real value of Program 4 is slightly greater than Program 2. Program 2 remains the optimal program option. Benefits of Program 4 only increased by 0.89% when P50 costs increased by 1.75% by adding the wastewater treatment system infrastructure. A summary table of real value of benefits and costs is set out in **Appendix K**.

8.3 Sensitivity analysis of Rapid CBA Results

Sensitivity analysis was conducted on the core results to test the robustness of the results to changes in the following assumptions:

- MOF demands ($\pm 20\%$)
- CO2 emissions demands ($\pm 20\%$)
- Present value of costs ($\pm 20\%$)
- Present value of benefits ($\pm 20\%$)
- Discount rates (4%, 10%)

¹⁰³ Discounted at 7% per annum over a 50-year appraisal period

8.3.1 Sensitivity analysis - MOF demands ($\pm 20\%$)

The revenue from the MOF is one of the key revenue drivers for each Program Package. It contributes approximately 40% and 39% of total present value of revenue in Program Package 1 and Program Package 3 and accounts for approximately 30% for Program Package 2 and Program Package 4 on a discounted basis. Therefore, it is important to acknowledge the risks associated with changes in MOF demands and the impacts on the BCR results for each Program Package. As shown in Figure 32 and Figure 33 below, the Impact of changes of MOF demands on BCR results is negligible, a 20% increase in MOF demand will increase the BCR for Program Package 2 and Program Package 4 by approximately 0.05 whilst BCR of Program 1 and Program 3 would rise by 0.06, and vice versa.

8.3.2 Sensitivity analysis – CO2 emissions ($\pm 20\%$)

The volume of CO2 emissions affects Infrastructure Benefits and Program Benefits as both CCUS benefits and environmental benefits are calculated based on the volume of CO2 emissions avoided. That is, the benefit calculated is equal to the reduced environment cost. CO2 benefits are those relating to the use of renewable energy through the large-scale network (present in all Programs) and those related to CCUS (present in Program 2&4). The combination of both infrastructure benefits and (CCUS infrastructure access revenue) and environmental benefits account for approximately 37% of total benefits for both Program 2 and Program 4 on a PV basis. The benefits associated with CO2 emissions are weighted heavily across these Program Packages. Therefore, a change in CO2 emissions is crucial when evaluating BCR results.

As shown in Figure 32 and Figure 33 below, a 20% increase in CO2 emissions reduction benefits will increase BCR by approximately 0.004 (Program 1&3) or 0.08 (Program 2&4) across Program Packages, and vice versa. Program 2 has a higher BCR across all Program Packages in both CO2 emissions scenarios. All four Program Packages provided higher BCR than the base case.

A CO2 emission sensitivity of a 50% increase and decrease will impact the BCR results of each option greater than what is illustrated in Figure 32. In this report we have performed a Rapid CBA, meaning only key associated economic costs and benefits were explored. A 50% sensitivity on CO2 emissions more broadly across each option will be more impactful and will be investigated in a Stage 3 business case where emissions will be more broadly considered across each Infrastructure Project and Program option.

8.3.3 Sensitivity analysis – total P50 costs (PV) and total benefits (PV) ($\pm 20\%$)

The present value of total costs and total benefits directly affect the BCR results. Therefore, it is useful to evaluate the level of impacts on BCR results by changing total costs and benefits. A 20% increase in present value of costs will increase BCR of each Program Package by approximately 0.13 or 0.18, when a 20% decrease in present value of costs will increase BCR of each Program Package by approximately 0.2 or 0.27. A 20% increase in present value of total benefits will also increase BCR of each Program Package by approximately 0.17 or 0.21 and vice versa. In all scenarios, the BCR of each Program Package is higher than the Base Case scenario. This indicates the success of each Program Package is resilient to changes in total costs and total benefits.

8.3.4 Sensitivity analysis – discount rate (4%, 10%)

As shown in Figure 32 and Figure 33 below, changes of the discount rate have the largest impact on the BCR results. This is consistent with the vast majority of infrastructure projects when costs and benefits are discounted over large periods of time. A reduction in the discount rate will increase the PV of costs and the PV of long-term benefits leading to an increase in the BCR and vice versa.

Figure 32: BCR sensitivity results – upper end

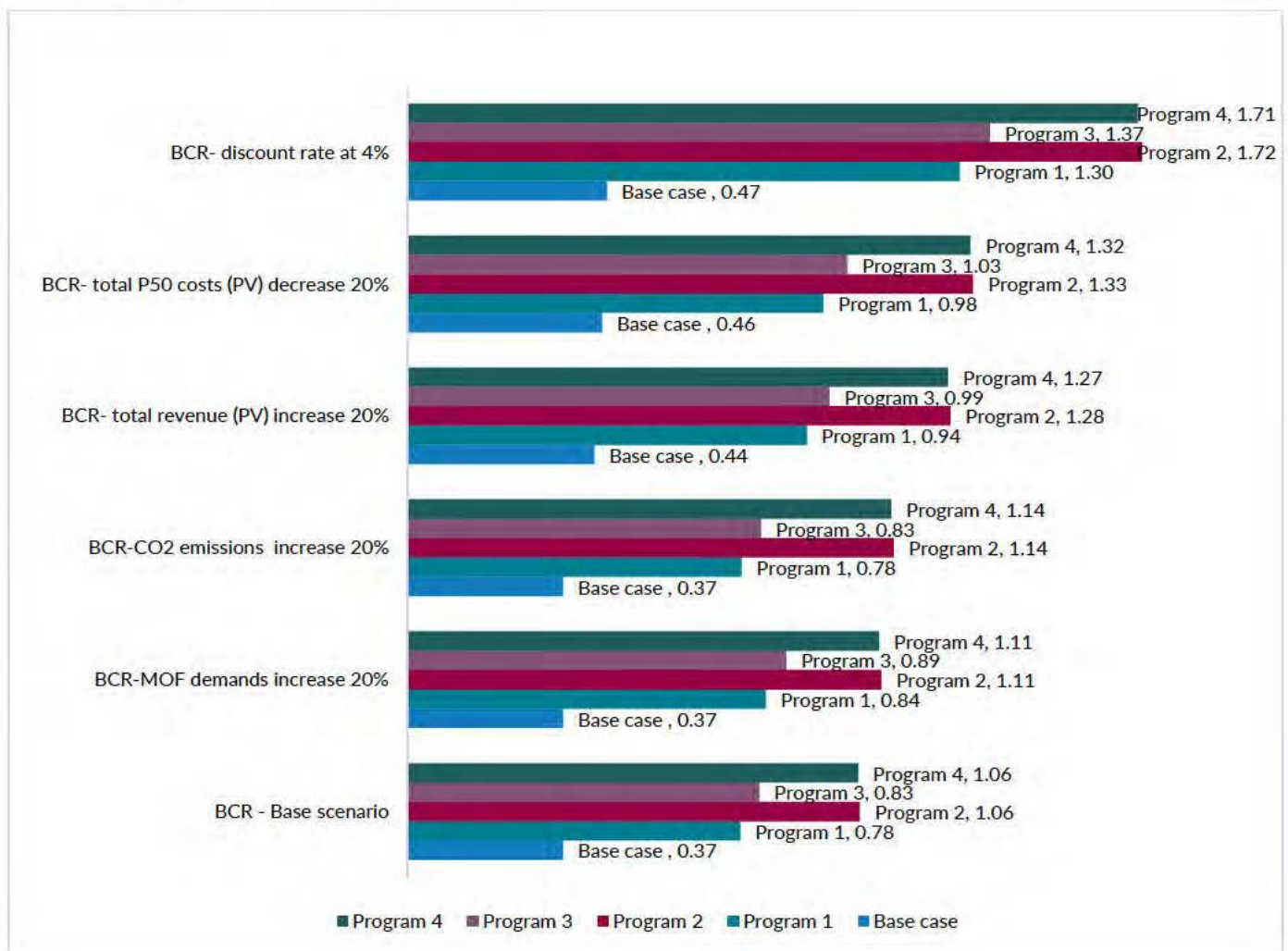
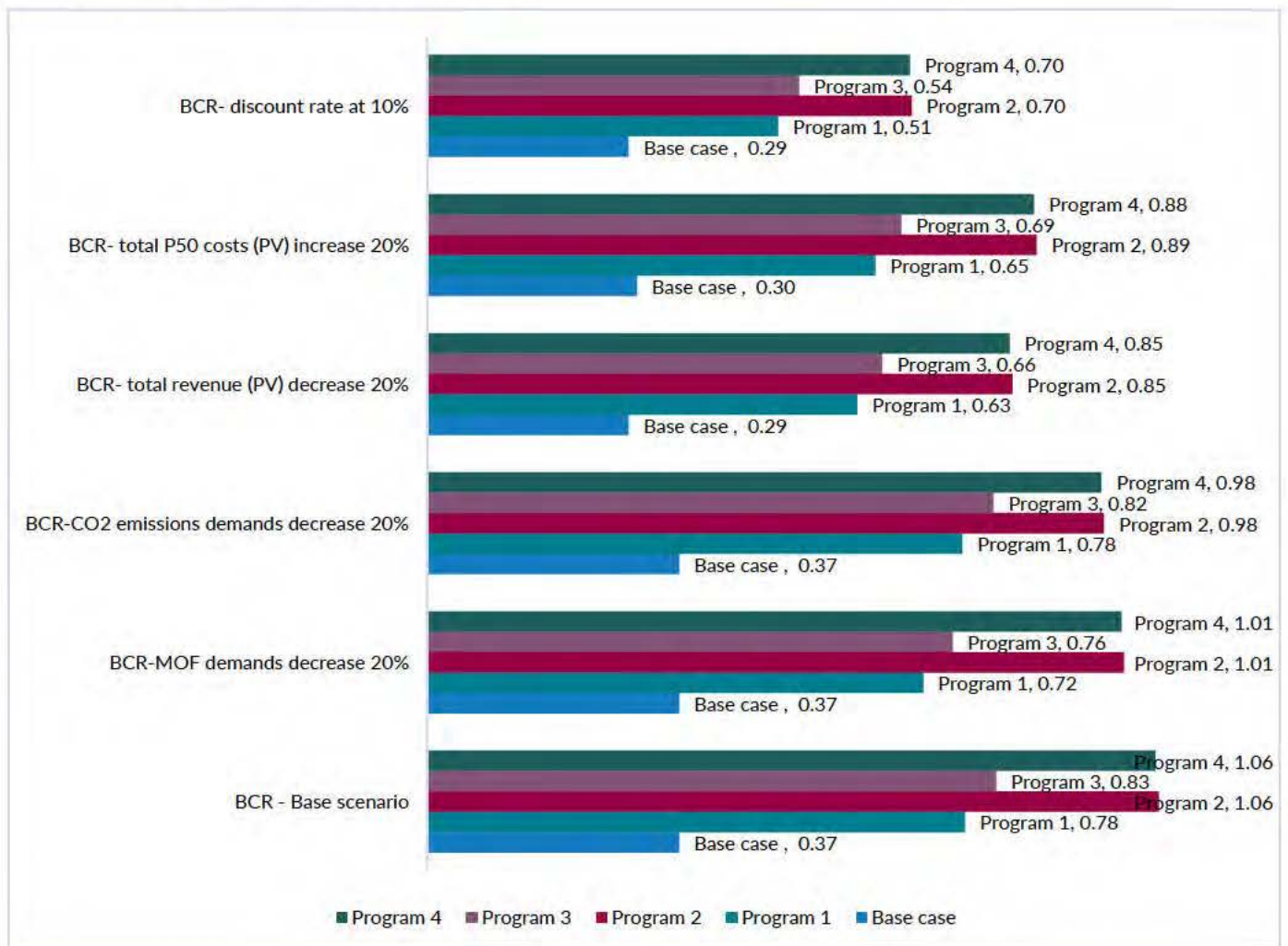


Figure 33: BCR sensitivity results – lower end



9. Strategic Alignment

This chapter assesses the alignment between project objectives, the short-listed options, and State, local, and national planning policies, strategies, and priorities.



As previously stated in Section 1.7 of this report, the intended objectives and outcomes of the Project is to provide the necessary future proofed, common user infrastructure to accelerate and increase the value adding of the Territory resources and emerging industries, increasing supply chain resilience and economic sustainability.



These objectives, which respond to the problem and opportunities identified in the study area, are closely aligned to planning policies and strategies at all levels of Government.



An activated Middle Arm Sustainable Development Precinct has the potential to be a catalyst for long term, sustained economic growth for the State and national economy. The local Darwin community will further benefit from gains attributable to the Precinct, including increased diversity of jobs available, greater population, and investment in amenities.


A more detailed analysis to demonstrate alignment between the Project's intended outcomes and State, local, and national policies is provided in **Table 28**.

Table 28: Alignment between objectives, outcomes and states policies, strategies, and plans

Key Documents	Alignment with Project Objectives and Outcomes
<p>Northern Territory Climate Change Response: Towards 2050</p> 	<p>The Northern Territory Government's is committed to taking action on climate change to maximise the economic, social and environmental wellbeing of Territorians.</p> <p>The Climate response is centred around four objectives;</p> <ul style="list-style-type: none"> • Net zero emissions by 2050 • A resilient territory that plans for the impacts of climate change • Opportunities for a low carbon future; and • Informing Territorians. <p>The MASDP is consistent with all of these objectives as it provides pathways to net zero, including for current significant emitters; planning is being done to manage the effects of climate related vulnerabilities, the Precinct is expected to enable the exporting of the Territory's abundant irradiance and land; and finally the project is being progressed through a comprehensive environmental engagement process through a Strategic Environmental Assessment</p>
<p>Territory Economic Reconstruction Commission</p> 	<p>The Territory Economic Reconstruction Commission (TERC) has been established to inform the development of a Rebound strategy following the COVID-19 pandemic. TERC has provided its final reports with several recommendations which have been accepted by the Northern Territory Government.</p> <ul style="list-style-type: none"> • The objectives of Middle Arm Industrial Development Precinct (MAIDP) effectively respond to the TERC recommendations regarding delivery of significant infrastructure to enable industry growth to support green economy development. The investment in critical infrastructure via MAIDP will provides the opportunity for the significant growth of private sector led manufacturing in the Territory in a range of industries and downstream sectors, increase the value of the Territory's GSP through a higher order value chain. The outcome of this project will support development of Aboriginal community and increase the share of Aboriginal workers employed in the Territory which directly aligns with the recommendations in the report. • The MASDP will strengthen the Territory to be at the forefront of the developing renewable hydrogen industry, grow on and off-site mineral processing and value

Key Documents	Alignment with Project Objectives and Outcomes
	adding opportunities including manufacturing. grow this industry and associated downstream sectors
<p>Northern Territory Gas Strategy - Five Point Plan</p> 	<p>The Northern Territory Gas Strategy has as its vision “By 2030, the Territory is a world class gas production, manufacturing and services hub”. Under this initiative, a Gas Taskforce (GTF) has been established to provide a whole of government approach to the delivery of a Gas Strategy and the Five Point Plan (FPP).</p> <p>The outcomes and objectives of this project are closely aligned with the Territory’s vision to take full advantage of our gas reserves and maximise our export opportunities, and support the Territory Government to delivery of Gas strategy and five-point plan to:</p> <ul style="list-style-type: none"> • Expand the world-scale Darwin LNG export hub • Grow the Northern Territory’s service and supply industry • Establish gas-based processing and manufacturing • Grow local research, innovation and training capacity • Contribute to Australia’s energy security
<p>the Territory Infrastructure Strategy</p> 	<p>The Territory Infrastructure Strategy 2022-2030 sets out the Northern Territory’s vision and objectives for governments infrastructure investment. The vision is for infrastructure investment that enables growth of the Territory economy and population and supports wellbeing and quality of life for all Territorians, underpinned by sustainability and resilience.</p> <p>The MASDP is a key initiative of the strategy describing it as ‘A unique master planned industrial sustainable development precinct to accommodate large strategic industries for downstream gas processing, mineral processing, renewable energy and related developments. Project Outcome The infrastructure investment is in common user facilities to attract investors’.</p>
<p>Federal Government’s fuel security package</p>	<p>The Government’s fuel security package aims to increase the domestic storage and to hold a sovereign refining capability that meets national needs during an emergency, as well as into the future.</p> <p>The outcome of MASDP effectively to support the Federal Government’s fuel security package. This includes developing more local storage as quickly as possible and ensuring a sustainable refining sector. One of the potential proponents Darwin Clean Fuels proposed 100,000 barrels per day condensate and LPG processing plant at Middle Arm would contribute up to 10% of Australia’s liquid fuel requirements from Australian sourced condensate.</p>
<p>Australia in the Asian Century white paper</p>	<p>This White Paper is a plan to build on national strengths and future. It highlighted that the key role of Darwin in shaping Australia’s future engagement with Asia and the importance of NT’s infrastructure development to support business investment and population growth. There are five key determinants outlined in the white paper for long term regional economic growth:</p> <ul style="list-style-type: none"> • Education and skills • Sustainable communities • Access to international • National and regional markets • Comparative advantages and business competitiveness; and intergovernmental partnerships and integrated regional planning. <p>MASDP has strong alignment with the recommendation in the white paper. The Project would bring together natural resources, alongside access to existing rail and road</p>

Key Documents	Alignment with Project Objectives and Outcomes
	<p>infrastructure, port facilities and carbon capture and storage capability. Offering Australia's closest deep seaport to target export markets, the Precinct has been identified on the 2021 Infrastructure Australia Priority List. It will support the diversification and development of manufacturing industries, utilise NT's competitive advantages and support private sectors to catch up the growing demand in Asian market. The outcome of this Project will also support all five of the key determinants by indirectly creating opportunities for Indigenous Australians, maintaining affordable housing and attracting a highly educated permanent workforce.</p>
<p>Australian Government's 2021 Infrastructure Plan</p>	<p>The Australian Government's 2021 Infrastructure Plan considers that the nation benefits from a dedicated focus on supporting Northern Australia's prosperity. It nominates energy, gas, advanced manufacturing, carbon capture and storage and minerals processing as central drivers to the growth and sustainability of Northern Australia.</p> <p>The MASDP enables realisation of IA's articulated objectives, furthermore, the project is also aligned with the remit of the Northern Australia Infrastructure Facility (NAIF). The Precinct will deliver transformational growth for Northern Australia, driving economic and population growth, Indigenous opportunities and partnerships and public benefit.</p>
<p>the Territory Renewable Hydrogen Master Plan</p> 	<p>The Territory Renewable Hydrogen Master Plan, which sets the pathway to export by focusing on foundational activities to enable private sector investment in the domestic renewable hydrogen industry, including early local off-take to generate a level of product demand to support early mover investment.</p> <p>The Project has strong linkages with Northern Territory Government objectives to support the Territory to be the leader transitioning towards net zero emissions. This precinct will provide proponents a hub to collectively drive and accelerate an emergent Northern Territory hydrogen sector, and encourage private sector to harness emergent technologies that deliver a cleaner and greener future.</p>
<p>Australia's National Hydrogen Strategy</p>	<p>Australia's National Hydrogen Strategy prioritises action that scales up activities and support to create, test and prove Australia's clean hydrogen supply chains, encourage global markets to develop cost-competitive production capability.</p> <p>Completion and activation of the Middle Arm Sustainable Development Precinct is central to the development of a hydrogen industry in the Northern Territory, and therefore to activities that will enable the transition to net zero. The precinct brings together a collective of proponents – also supporting an industrial ecology that maximises the value chain, converts waste into product and achieve cost efficiency.</p>
<p>Territory Benefit Policy</p> 	<p>The primary objective of the Territory Benefit Policy is to maximise the contribution to the Territory economy by private sector projects in the Territory. The Territory Benefit Policy aims to support project proponents to maximise the local benefit of these projects during all project phases, including outcomes in:</p> <ul style="list-style-type: none"> • Local workforce development and employment • Regional and Aboriginal economic and community development • Local business participation and small to medium enterprise capability development • Economic, industry and social infrastructure investment • The outcome and objective of this project <p>The Project objectives is to maximise the long-term local benefits to Territorians: the creation of local business opportunities and jobs, an education pathway for a skilled workforce, and benefits flowing into Aboriginal communities. These objectives clearly align with those of this policy, which provides an immediate and direct path to attracting Government support to the precinct.</p>

Key Documents	Alignment with Project Objectives and Outcomes
Aboriginal Contracting Framework 	<p>The Aboriginal Economic Participation Framework (the Framework) is designed to support Aboriginal employment and business opportunities which will benefit the Territory by growing the local economy, increasing business and regional development and building the local Territory workforce.</p> <p>The outcome of this Project would indirectly increase the share of Aboriginal workers employed in the Territory, associated with positive social impacts and breaking the cycle of disadvantage in Indigenous communities.</p>
Modern Manufacturing Strategy	<p>The Modern Manufacturing Strategy is a whole-of-government strategy to help Australian manufacturing scale-up, become more competitive and resilient – creating jobs for now and future generations. There are six priorities sections are identified to deliver long-term transformational outcomes for the Australian economy:</p> <ul style="list-style-type: none"> • Resources Technology & Critical Minerals Processing • Food & Beverage • Medical products • Recycling & Clean Energy • Defence • Space <p>The outcome of this Project would support the development of manufacturing industries. These industries and those aligned with the value chain will require a diverse, agile and skilled workforce into the longer term. The precinct, alongside secondary support industries, is estimated to create more than 7,200 new jobs in the Territory.</p> <p>The underlying driver of the Middle Arm precinct is to maximise the long-term local benefits to Territorians: the creation of local business opportunities and jobs, an education pathway for a skilled workforce, and benefits flowing into Aboriginal communities. These objectives clearly align with those of the IAS and Commonwealth, which provides an immediate and direct path to attracting Government support to the precinct.</p>
Our North, Our Future: White Paper on Developing Northern Australia	<p>The Our North, Our Future: White Paper on Developing Northern Australia released in 2015, sets out the priorities to drive growth in Australia's north. It is a 20-year plan for investment and support to grow the north by taking natural advantages. There are 6 key policies have been listed in the White Paper:</p> <ul style="list-style-type: none"> • Simpler land arrangements to support investment • Developing the north's water resources • Business, trade and investment • Infrastructure to support growth • The northern workforce • Good governance <p>MASDP has strong linkages to several of strategic policies in the white paper. One of MASDP's objectives is to develop sustainable green economy and more resilient supply chain. The development of common user, future-proofed infrastructure through this project will attract significant private investment to support the Developing Northern Australia agenda.</p>

10. Project Funding

This chapter outlines the indicative funding arrangements required to support delivery of the shortlisted Project Packages.

The Project is seeking a combination of both Territory and Federal Government funding. The Federal Government have already committed \$1.5 bn in the 2022-23 budget for transformative infrastructure across the Northern Territory, centred around Middle Arm. However, the projects identified as priority projects under the Federal funding commitment have not been included in the Base Case and therefore forms part of the overall Stage 2 submission.

As the precinct is industrial in nature, the Territory Government, Federal Government, and the Australian people will be major beneficiaries of a diverse and sustainable industrial precinct. An opportunity therefore exists to consider further discussions on which Program Package funding split is appropriate in excess of the already committed allocation. Scope to revisit this arrangement may be taken into consideration during the Stage 3 Business Case submission.

11. Summary and recommendation

The Department of Infrastructure, Planning and Logistics requires significant investment from the Federal and Territory Government to accommodate a diverse ecosystem of industries at the Middle Arm Precinct. Without substantial intervention to enable industry investment, the prime strategic land at Middle Arm will likely be developed organically to the highest bidder and, consequently jeopardise the beneficiation of Territory natural resources, supplying a diverse product mix to export markets. Forgoing the economic opportunity from important trade partners in Southeast Asia. Failure to enable and activate the precinct with accessible and available common-user infrastructure could continue to result in traditional resources being exported with minimal value add from the abundance and diverse the Territory resources.

To address the Project's problem and opportunities, the PWG has identified and assessed a list of Project Packages that aim to maximise the investment of a diverse set of precinct producers and manufacturers. Each shortlisted Project Package has been acknowledged by the PWG as programs of work that will support the enhancement of a diverse investment mix as well as the improvement of environmental outcomes for the Territory, and Australia while providing sustainable economic opportunities for the local community into the future.

After identifying and evaluating a longlist of Infrastructure Projects, Phase 1, 2, 3, and 5 of the optioneering process was used to develop the most suitable Project Packages which the PWG assessed and ranked the effectiveness against the MASDP objectives.

The first approach was an assessment of the Infrastructure Projects. This was performed by three methods:

- Rank the Infrastructure Projects through an MCA process drawing upon expert knowledge and experience of the PWG supplemented by additional evidence.
- Identify which Infrastructure Projects are 'essentially dependant' to activate precinct as a bare minimum across all Program Packages.
- Identify which Infrastructure Projects industry deemed critical by potential precinct proponents.

The MCA on the Infrastructure Projects took into consideration several criteria that were determined pertinent to evaluating which common use infrastructure best met the needs and objective of the precinct. The table below outlines the scoring and ranking of the assessed Infrastructure Projects.

Table 29: Infrastructure Projects MCA ranked results

Rank	Infrastructure Project	Unweighted score	Weighted score
1	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.	105	6.64
2	Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.	99	6.23
3	Digital subterranean cabling of precinct to support digital communications to enable automation.	100	6.18
4	Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen.	97	6.11
5	Product export jetties.	97	5.96
6	Shared workforce transport / transit system – including parking and connections to worksites.	96	5.93

7	Worker's accommodation to enable MA workers (residential land release and costs).	94	5.94
8	CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control.	89	5.92
9	Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities).	90	5.84
10	Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.	91	5.76
11	Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure.	87	5.71
12	High capacity, networked power distribution to Middle Arm connected to DKIS.	88	5.30
13	Beneficial re-use of dredge soil for additional economic land.	89	5.28
14	Water desalination solution available for industry proponents.	72	4.38
15	Gas pipeline into Middle Arm for proponents to access.	74	4.17
16	Local emergency response infrastructure – local fire station / medical clinic / EMS.	77	4.03
17	CO2 for Inpex and Santos - Carbon capture utilisation and storage (CCUS) infrastructure – for CO2 transmission and supporting infrastructure - manifold to access.	55	3.33

Identification of the 'essential dependant' Infrastructure Projects was based on the assessment against criteria which best aligned with the problems, opportunities and unique strategic direction for the precinct to enable a wide range of industries. The most critical criteria were identified as being:

- To what extent is the project essential to addressing the problem /opportunities?
- To what extent is the precinct dependant on the project and what are the relationships with other projects in the essential dependant list?
- Does this project require government coordination and or leadership/funding?
- Falls within the MCA top 10 ranked infrastructure projects?

The Infrastructure Projects which aligned closest to the criteria recognised as essential for the precinct to overcome the identified problems and achieve the opportunities, were identified to be:

- Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility.
- Product export jetties.
- Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.
- Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy.

To determine the most desired common use Infrastructure Projects industry considered critical, a survey was developed and distributed amongst a range of potential precinct occupants across a diverse set of industries and product manufacturing types.

Table 30: Summary of critical Infrastructure Projects demanded by industry

Infrastructure project	Industry proponents' response
Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility	3/6 Industry proponents deemed the common-user MOF as critical for their project business case to achieve FID
Product export jetties	6/6 Industry proponents identified the product jetties as critical for their project business case to achieve FID
CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure - Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control	1/6 Industry proponents identified the CO2 Common User CCUS critical for their project business case to achieve FID
Digital subterranean cabling of precinct to support digital communications and automation	1/6 Industry proponents identified the subterranean digital cabling as critical for their project business case to achieve FID
Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy	2/6 Industry proponents identified the firmed renewable distribution network as critical for their project business case to achieve FID
High capacity, networked power distribution to Middle Arm connected to DKIS	0 Industry proponents identified DKIS power network as critical for their project business case to achieve FID
Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen	1/6 Industry proponents identified the upgrades to Channel Island as critical for their project business case to achieve FID
Water desalination solution available for industry proponents	3/6 Industry proponents identified the water desalination as critical for their project business case to achieve FID
Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure	3/6 Industry proponents identified the wastewater treatment plant as critical for their project business case to achieve FID
Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities)	2/6 Industry proponents identified rail Infrastructure as critical for their project business case to achieve FID

The Program Packages were identified by the configurations shown in Table 31 below.

Table 31: Base case and short list options in the project case

Case	Program package	Description
Base case	Do minimum	Under the "Do Minimum" Base Case Scenario, the government provides only the essential land development required for the precinct to develop organically. No other common infrastructure will be supported to industry by government.

Project case	Program package 1	Essential dependant Infrastructure Projects.
	Program package 2	Essential dependant Infrastructure Projects in addition to top scoring Infrastructure Projects identified in the shortlist.
	Program package 3	Essential dependant infrastructure in addition to the top scoring Infrastructure Projects demanded by industry.
	Program package 4	Essential dependant infrastructure in addition to top score infrastructure identified through MCA-1 and the top scoring infrastructure assets demanded by industry.

The second approach included an MCA-2 and an economic appraisal via a Rapid CBA. The Rapid CBA took into consideration several economic benefits and costs, including:

- Infrastructure benefits: benefits generated from each common user infrastructure in each program package; and
- Program benefits: environmental and land parcel earnings benefits resulted from the combination of common user infrastructure in each program package.

Results of both the MCA-2 and Rapid CBA are shown in Table 32 below.

Table 32: Results

MCA-2 Rank	Program Package	Unweighted score	Weighted score	BCR
1	Program 2: <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure • CCUS manifold and supporting infrastructure • Transit system and parking • Digital subterranean cabling to support digital communications • Channel Island upgrade • Residential land release and costs to support additional workers accommodation 	37	4.05	1.063
2	Program 1: <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure 	34	3.85	0.781

3	Program 4: <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure • CCUS manifold and supporting infrastructure • Transit system and parking • Digital subterranean cabling to support digital communications • Channel Island upgrade • Residential land release and costs to support additional workers accommodation • Wastewater handling and treatment facility 	35	3.75	1.058
4	Program 3: <ul style="list-style-type: none"> • Material offloading facility, dredging and laydown area • Export product jetties • Power network distributing green energy • Precinct roads and supporting transport infrastructure • Wastewater handling and treatment facility 	33	3.60	0.826

Variability between the rankings from the MCA-2 and the Rapid CBA results was relatively low. However, there is one Project Package that did result in conflicting rankings between the two ranking methods. The PWG ranked Program Package 4 relatively poorly during the MCA-2 workshop owing to a view that wastewater handling combined with a large infrastructure suite was too expensive and expansive for Government to fund.

The PWG agreed that the variance in Program Package 4 should undergo further investigation to explore the opportunities available in more detail through investigation as part of the IA Stage 3 Submission.

Despite the variances outlined above, the PWG agreed that the relatively low variance in rankings for each Project Package highlights a strong bundling of common use infrastructure projects that will likely provide value for money to the State, encouraging a sustainable and diverse set of industries and products leading into the future.

It was also agreed by the PWG that Project Packages that scored in the top 3 of the economic appraisal and MCA-2 analysis should be included for further assessment during the Stage 3 IA Submission. This is due to the P50 capital and operational data available at the time of developing this report. It is anticipated that the future ability to assess potential benefits and costs relating to Project Packages will have a positive impact on the economic appraisal across the Middle Arm Project Package list and should therefore not be discounted from further analysis.

12. Appendices

12.1 Appendix A – Workshop materials

Figure 34: Material used for workshop

Attendees

Workshop details and attendees		
Date and Time	Friday, 15 July 2021, 2:30 – 5:00 pm	
Location	TBC - Charles Darwin Centre DCXL7 Meeting Room D	
Attendees	NT Government	Infrastructure (Commonwealth)
	<ul style="list-style-type: none">• [REDACTED]• [REDACTED]• [REDACTED]• [REDACTED]• [REDACTED]	<ul style="list-style-type: none">• [REDACTED]• [REDACTED]
	Land Development Corp	EY
	<ul style="list-style-type: none">• [REDACTED]• [REDACTED]	<ul style="list-style-type: none">• [REDACTED]• [REDACTED]

Agenda

Topic
Purpose of the workshop
Project scope and objectives
Infrastructure Stage2 process
Project scope and objectives (IA Stage2 process)
Problem identification and prioritisation
Next steps: Evaluation methods and criteria

Purpose of workshop

The purpose of today's workshop is to:

- ▶ Test, validate and develop on existing findings to date to progress the development of the Middle Arm Infrastructure Australia Stage 2 Submission

Workshop goals

- ▶ Verify the problem statements and investment objectives associated with the Middle Arm project

Output

- ▶ A finalised set of problems and opportunities associated with the Middle Arm project
- ▶ Agreed investment objectives

- ▶ A Multi-Criteria Assessment (MCA) provides a structured framework for assessing and scoring a set of options' against a set of decision criteria.
- ▶ The criteria can be weighted to reflect their relative importance or alignment with the Projects objectives.
- ▶ MCA helps to reduce a long list of projects down to a realistic or feasible project list.
- ▶ It involves subjective decision making based on evidence available
- ▶ Consensus helps build the narrative on those short listed projects taken through to a Rapid CBA in a Stag2 submission to Infrastructure Australia(IA).

MCA Methodology - Criteria themes (to be discussed)

Based on previous Middle Arm submissions and EY's previous submissions the MCA criteria for discussion has been categorised into four (4) different themes. The four themes include:

Strategic fit with NT
& Commonwealth
Policies



Economic



Social &
Environment



Deliverability



MCA Methodology - How the criteria will be applied WORKSHOP MATERIALS ONLY

Criteria Weightings:	Description - Example	Score	
<ul style="list-style-type: none"> Workshop participants may discuss the weightings for each pre-determined criteria and allocate a weighting based on its relative importance to the Project and alignment to the Project's objectives Each Project option will be scored against the MCA criteria in the 'Scoring Matrix', with the weighted sum of each criteria providing a 'Total Score' - the scoring system is a seven point system: Workshop participants should recognise that the MCA should act as a guide to support common-sense decision making, rather than being relied upon as a 'standalone' final output 	<ul style="list-style-type: none"> Does not to marginally meet any project objectives relative to the base case Meets most project objectives relative to the base case Adequately meets almost to all project objectives relative to the base case 	<div>1-2</div> <div>3</div> <div>4-5</div>	<div>—</div> <div>—/+</div> <div>+</div>

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Table 33: Criterial workshop materials

Criteria Workshop - Discussion and weighting allocation (1/2) WORKSHOP MATERIALS ONLY

Category	Element of Assessment Criteria	Description	Weightings
Strategic fit with Commonwealth and NT policies	Policy alignment	To what degree does the option facilitate strategic policy objectives? (supply chain resilience, critical minerals manufacturing, energy transition, net zero)	4%
	Multi-user, multi-industry benefit enablement	The options ability to encourage diverse industry investment	2%
	Value adding	To what degree does the option accelerate the value adding of NT resources?	2%
	Long term utility of option	Ability to scale up and decarbonise as demand increase, taking into account commercial users and NT long-term objectives	2%
Economic	Indicative capital costs and funding sources	Is the options nature one that is likely to require Government capital and oversight to enable wide economic activity across multiple proponents?	7%
	Number of potential beneficiaries	The number of potential users to a price of common - user infrastructure	6%
	Competitiveness of NT to investment opportunities	Relative impact of option that enhances NT competitive advantage for private sector investment	7%
	Local employment	Potential impact on local jobs and employment	5%
	Indigenous employment	Potential impact on indigenous jobs and employment opportunities	5%

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Criteria Workshop - Discussion and weighting allocation (2/2)

WORKSHOP
MATERIALS ONLY

Category	Element of Assessment Criteria	Description	Weighting	
Social, cultural and environment	Environmental approvals	To what degree does the option align with precinct environmental thresholds, targets and outcomes?	7%	30%
	Future environmental and cultural risks	Cumulative impact of option on future environment and cultural scenarios	7%	
	Social and community impacts	To what degree does the option make a positive impact and align with the community's expectations?	7%	
	Land use compatibility	Impact on surrounding and existing precinct planning framework	9%	
Deliverability	Construction difficulty	Does the option require mature/future technical knowledge or execution technology?	4%	30%
	Workforce and material availability	To what degree does the option require the availability of a specialist workforce or construction materials?	3%	
	Delivery complexity	Execution reliant on funding, governance or approval requirements across multiple stakeholder groups	3%	
	Activation	To what degree does the option activate the precinct in relation to: 1. Timing: Does the option fall in line with industry current and future investment timelines and demand 2. Dependence: Does the option directly enable various industries and proponents To ensure the successful industry uptake of the precinct	20%	

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Table 34: long lists development during workshop

Long list development (1/2)

WORKSHOP
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Option #	Description	Existing Investigations
Business as usual		
1	Maintain current state - Land development activities and private sector investment only	
Marine, common -user investments (assets)		
4	Appropriate dredging, common -user wharf + product jetty and/or Modular offloading facility (MOF)	Draft Stage 2
Decarbonisation, common -user investments (assets)		
6	Co2 Carbon capture utilisation and storage (CCUS) infrastructure - Underground manifold for Co 2 transmission	Middle Arm/CSIRO
7	*Further develop and enable Channel Island to generate renewable energy (dual gas - hydrogen generation)	-
8	Industrial electrical network to transmit industrial green energy supply	Middle Arm / EY
Utilities, common -user investments (assets)		
10	Water - common use or module desalination available for industry proponents	-
11	Power generation - common use dual -fuel power plant (LNG & hydrogen) offtake to proponents	-
12	Waste water treatment and disposal plant	Draft Stage 2
13	Power supply augmentation (combine and enable a variety sources of energy generation)	Draft Stage 2
14	Gas and hydrogen precinct pipeline (current APA pipelines are at limited capacity)	

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Long list development (2/2)

WORKSHOP
MATERIALS ONLY

Option #	Description	Existing investigations
Logistics		
15	Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor/unloading pit, rollingstock maintenance yard and provisioning facilities)	-
16	Supply chain warehouse, tank storage, lay down and heavy machine area	-
Transport and related services		
18	Supporting transport infrastructure required for marine development connectivity - Common user landside facility (CULF), Corridors, roads and services to CULF, Causeway to Kittyhawk (Middle Arm only)	Stage 2 draft
19	Primary industrial roads connecting major land parcels with existing and planned common-user infrastructure - Kittyhawk Road, services and corridor, Spitfire western access road, Channel Island Road upgrades, Infill between Spitfire and Kittyhawk, roadlink across infill	Stage 2 draft
20	Precinct corridor ownership and management	
21	Workers accommodation, barracks and common facilities	

Table 35: MCA methodology scoring and examples for workshop

MCA Methodology - Scoring

WORKSHOP
MATERIALS ONLY

Criteria Weightings:	
	Workshop participants are asked to assign a single score for each infrastructure solution based on how effectively that option is likely to address the identified criteria relative to the base case.
	Each Project option will be scored against the MCA criteria in the 'Scoring Matrix ', with the weighted sum of each criteria providing a 'Total Score' - the scoring system is a seven point system.
	Workshop participants should recognise that the MCA should act as a guide to support common -sense decision making, rather than being relied upon as a 'standalone ' final output.



MCA Methodology - Scoring

WORKSHOP
MATERIALS ONLY

Assessment Rating	Description	Score
Strongly Negative	<ul style="list-style-type: none"> Severe negative impact relative to the Base Case 	-3
Moderately Negative	<ul style="list-style-type: none"> Moderate negative impact / outcome Impacts may be manageable 	-2
Slightly Negative	<ul style="list-style-type: none"> Minimal negative impact / outcome Short term impact / outcome Impacts can be managed or mitigated 	-1
Neutral	<ul style="list-style-type: none"> No discernible impact / outcome 	0
Slightly Positive	<ul style="list-style-type: none"> Minor positive impact / outcome Possible only short term Confined to a limited area 	+1
Moderately Positive	<ul style="list-style-type: none"> Moderate positive impact / outcome May provide new opportunities or improvements 	+2
Strongly Positive	<ul style="list-style-type: none"> Major positive impact / outcome Long-term improvements 	+3



BASE CASE

Maintain current state: Land development activities and private sector investment only

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MCA Scoring: Strategic fit

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MATERIALS ONLY

Element of Assessment Criteria	Description	Low score examples	High score examples
1.1 - Policy alignment	To what degree does the option facilitate strategic policy objectives? (supply chain resilience, critical minerals manufacturing, energy transition, net zero)	<ul style="list-style-type: none"> The objectives and intended outcomes of the option do not closely align with a majority of policies or plans 	<ul style="list-style-type: none"> The option is closely related to energy transition policies and plans It supports and accelerates the energy transition and net zero target
1.2 - Multi-user, multi-industry benefit enablement	The options ability to encourage diverse industry investment	<ul style="list-style-type: none"> The option only fits industry specific/specialist operations with low benefit potential 	<ul style="list-style-type: none"> The option is industry agnostic with minimal limitations for industry use to maximise benefits
1.3 - Value adding	To what degree does the option accelerate the value adding of NT resources?	<ul style="list-style-type: none"> The option provides limited/inefficient functional infrastructure for value adding production These common used infrastructure are not able to be accessed within reasonable period for value adding activities 	<ul style="list-style-type: none"> The option provides accessible infrastructure for different type users It is flexible to fit different value adding production models The option is easy to adjust to meet future developing requirements
1.4 - Long term utility of option	Ability to scale up and decarbonise as demand increase, taking into account commercial users and NT long-term objectives	<ul style="list-style-type: none"> The option is unable/ difficult to upgrade to meet users needs in the future It is not feasible to extend or increase the capacity and capability in the future 	<ul style="list-style-type: none"> The option is easy to strengthen and refurbish utility facilities to meet decarbonisation trends and industry development (eg: from grey hydrogen to blue hydrogen)

-3	-2	-1	0	+1	+2	+3
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MCA Scoring: Economic

WORKSHOP
MATERIALS ONLY

Element of Assessment Criteria	Description	Low score examples	High score examples
2.1 - Indicative capital costs and funding sources	Is the options nature one that is likely to require Government capital and oversight to enable wide economic activity across multiple proponents?	<ul style="list-style-type: none"> The option is not commonly used by multiple proponents (i.e. one proponent) It is irresponsible to be underwritten by Government due the nature Commercially favours one industry type 	<ul style="list-style-type: none"> Option fall inline with reasonable funding expectations
2.2 Number of potential beneficiaries	The number of potential users to a price of common user infrastructure	<ul style="list-style-type: none"> One potential proponents/user Relative low marginal value for various beneficiaries (low benefits for individual, industry and government) 	<ul style="list-style-type: none"> 3-6 potential proponents Wide ranges of groups receive significant benefits from this development (direct users and supply chain services) Cumulative benefits to different beneficiaries increase exponentially in long term
2.3 Competitiveness of NT to investment opportunities	Relative impact of option that enhances NT competitive advantage for private sector investment	<ul style="list-style-type: none"> Inefficient infrastructure development unable to meet the private sector needs to make investments Additional benefits/ impacts added from the option are less attractive comparing with other locations 	<ul style="list-style-type: none"> The option significantly reduce the risks and costs of private investment Large benefits from the options to spurred NT to be the favourite investment location both short and long terms
2.4 Local employment	Potential impact on local jobs and employment	<ul style="list-style-type: none"> The option does not sustainably increase employment rate and on going employment opportunities in the long term Limited job opportunities in current local workplace as local workers unable to meet the skills requirements in certain period 	<ul style="list-style-type: none"> Significantly increase number of local jobs Significantly increase the participate rate of local workforce Attract high skilled worker from other region Provide ongoing jobs not previously available in the Territory
2.5 Indigenous employment	Potential impact on Indigenous jobs and employment opportunities	<ul style="list-style-type: none"> The option is unlikely to provide indigenous workforce opportunities 	<ul style="list-style-type: none"> Increasing the share of Aboriginal workers employed in the Territory, associated with positive social impacts and breaking the cycle of disadvantage in Indigenous communities

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MCA Scoring: Social, Culture and Environment

WORKSHOP
MATERIALS ONLY

Element of Assessment Criteria	Description	Low score examples	High score examples
3.1 - Environmental approvals	To what degree does the option align with precinct environmental thresholds, targets and outcomes?	<ul style="list-style-type: none"> The option primarily encourages high emitting industries The option brings negative impact to quality of water and surrounding benefiter construction, dredging programs and operations impact the marine ecosystems 	<ul style="list-style-type: none"> Enables industry proponents to decarbonise products or services in the short or long term
3.2 - Future environmental and cultural risks	Cumulative impact of option on future environment and cultural scenarios	<ul style="list-style-type: none"> The option posses significant risk to meeting NT net zero objectives Likely to conflict with future cultural and heritage sensitivities 	<ul style="list-style-type: none"> Enables and aligns with environmental and cultural NT policies and objectives
3.3 - Social and community impacts	To what degree does the option make a positive impact and align with the community's expectations?	<ul style="list-style-type: none"> Hinders diverse workforce opportunities Negatively impacts social licence to operate 	<ul style="list-style-type: none"> Aligns with communities expectations
3.4 - Land use compatibility	Impact on surrounding and existing precinct planning framework	<ul style="list-style-type: none"> Misalignment with existing and planned land-development investigations Options which could potentially jeopardise future proponents precinct interest 	<ul style="list-style-type: none"> Aligns with proponents expectations relating to precinct development Option compliments existing Government expectations

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MCA Scoring: Deliverability

WORKSHOP
MATERIALS ONLY

Element of Assessment Criteria	Description	Low score examples	High score examples
4.1 - Construction difficulty	Does the option require mature/future technical knowledge or execution technology?	<ul style="list-style-type: none"> The option requires execution technology which is costly to imply or take time to develop 	<ul style="list-style-type: none"> There is accessible existing technologies are ready to use to support each stage of the development
4.2 - Workforce and material availability	To what degree does the option require the availability of a specialist workforce or construction materials?	<ul style="list-style-type: none"> Significant shortage of skilled workers or construction material to support the development of the option in a short or median term Current supply chain or logistic issues could cause significantly delay of option development. 	<ul style="list-style-type: none"> There is an established workforce to support the development It is easier to obtain construction materials and the existing facilities able to support the construction
4.3 - Delivery complexity	Execution reliant on funding, governance or approval requirements across multiple stakeholder groups	<ul style="list-style-type: none"> There are no/insufficient funds available for this option Complex processes with long waiting period to receive approvals 	<ul style="list-style-type: none"> There are sufficient expertise and effective approval processes to support the development of the option
4.4 - Activation	<p>To what degree does the option activate the precinct in relation to:</p> <ol style="list-style-type: none"> Timing: Does the option fall in line with industry current and future investment timelines and demand? Dependence: Does the option directly enable various industries and proponents? <p>To ensure the successful industry uptake of the precinct</p>	<p>Timing:</p> <ul style="list-style-type: none"> Option does not align with the current time horizon to meet industry demand and investment Immature industries linked to the option <p>Dependence:</p> <ul style="list-style-type: none"> The options does not sufficiently enable other common user infrastructure or proponents/industries 	<p>Timing:</p> <ul style="list-style-type: none"> The industry the option supports is mature and sufficient demand is known <p>Dependence:</p> <ul style="list-style-type: none"> The option directly supports the development of diverse industries over the precinct life

-3	-2	-1	0	+1	+2	+3
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12.2 Appendix B – Climate considerations

Climate factors considered when assessing options

Climate factors are inherent to a number of the criteria used in the MCA as outlined below:

Strategic fit with Commonwealth and the Territory policies

- Policy alignment considered, amongst other policy initiatives the net zero targets of both the Commonwealth and the Territory governments.
- Long term utility of option the option went to how well the option supported the ability to scale and decarbonise over time. Options that supported decarbonisation objectives scored highest.

Economic

- Competitiveness of the Territory to investment opportunities included discussion around the attractiveness of some options which are positive for net zero pathways to investment, e.g. the renewable industrial network.

Social, cultural and environment

- Future environmental and cultural risks considered both emissions and environmental impacts such as vegetation loss.
- Social and community impacts consider community expectations including that development must support a net zero pathway.

Deliverability

- Climate change adaptability was not directly assessed in the MCA process. However, it was considered in the overall scoring of 'Activation' of the precinct. Both 'Timing' and 'Dependence' of the common-use infrastructure solutions were assessed with climate risks and increasing volatility in mind relative to the 'do nothing' scenario.
- The stage 3 business case will provide design details of the progressed options. The option designs will be assessed based their climate change resilience.

Net zero achievability

The Middle Arm Sustainable Development Precinct's highest scoring program package, Package 2, includes both the multi-GW renewable power network and Carbon Capture Storage (CCS). These two projects within the program are central to the achievability of net zero and are examples of emissions reduction technology at scale.

Concurrent to the development of this business case is the development of inputs for a Strategic Environmental Assessment of the precinct. A concurrent Green House Gas (GHG) modelling process is underway to develop a baseline and modelling of development precinct options. The modelling indicates that for certain precinct industrial options (including the balanced scenario contemplated by this submission) CCS and integrated large-scale renewables can mitigate emissions otherwise expected to be released into the environment by up to >67% and >25% respectively.

In addition to other efficiencies, modelling suggests minimal residual emissions requiring offsets – as low as 2-3%. While the industry mix at the precinct is not yet certain, there are several GHG emissions reduction planning pathways that support Net Zero by 2050 in-line with Commonwealth and Northern Territory emissions targets.

The precinct is currently home to two LNG export facilities, Darwin LNG and Ichthys LNG. Parent companies of these facilities Santos and Inpex emit between 6 and 8 million tonnes of CO₂¹⁰⁴ in Australia. While the development of the precinct is expected to enable new renewable fuels such as Hydrogen, this precinct will also create a pathway for the

¹⁰⁴ <https://www.cleanenergyregulator.gov.au/NGER>

Darwin based LNG operations to significantly reduce their emissions through access to renewable electricity for processing and carbon capture technology. This outcome, compared to the base case achieves a nationally significant reduction in emissions.

Emissions measurement and reporting

Emissions have been estimated for the construction of the shared use infrastructure that is the subject of the business case. Scope 3 estimates have been omitted at this stage but will be considered in later stages.

The construction of the shared infrastructure at the precinct is expected to trigger the Northern Territory's Large Emitters Policy¹⁰⁵. This policy requires large emitters to provide a GHG abatement plan. An abatement plan is also a possible condition within the Strategic Environmental Assessment for Middle Arm industries. The Strategic Environment Assessment will provide a full GHG abatement plan as required under the *Environment Protection Act (NT) 2019* and the *Environment Protection and Biodiversity Conservation (Cth) Act 1999*. This will include comprehensive emissions profiles of the precinct under different development scenarios.

Measurement and forecasting of emissions is compliant with *National Greenhouse and Energy Reporting (Cth) Act 2007*. In addition, an estimate of blue carbon is being developed to measure the impact of the dredging program that is required for the marine infrastructure.

The Stage 3 business case will include and analyse further detail on emissions. This Stage 2 submission includes a Rapid CBA and as such has only included the direct and significant avoided emissions from the renewable network and captured emissions from CCS. The Rapid CBA quantifies the primary benefit and cost streams directly associated with CO₂. The CO₂ benefit considerations for Infrastructure Project's 7 (Power network, green energy distribution) and 3 (Carbon Capture Utilisation and Storage) was reported on. Further Scope 3 investigations relating to impacts will be further investigated in a Stage 3 business case and when the MASDP Environmental Approvals are made public.

Problem and opportunities sustainability considerations

Opportunity 2: The precinct has an opportunity to be an early mover in developing a modern, net zero capable manufacturing hub (in a first world environmental regime) for future focused minerals and energy closest to growing market demand

Opportunity 3: The Territory has the fundamentals to deliver a diverse range of energy sources to lead energy transition to lower emissions on the pathway net zero

The above opportunity statements directly refer to developing an early mover net zero manufacturing hub. The problems and opportunities have been directly considered in the optioneering process throughout the Stage 2 report flowing into both MCA processes. Opportunity 2 was developed to ensure the Middle Arm precinct takes advantage of future low emissions industry processing including processing minerals of the future required to manufacture technologies to aid in the reduction of greenhouse gases. Additionally, the opportunity considers the existing Brownfields LNG facilities local to Middle Arm and the development by these industries of dedicated large-scale renewables and CCS (both key GHG mitigation technologies). Middle Arm Precinct is expected to capitalise on these critical heavy industrial decarbonisation technologies "at the gate" and will provide a critical pathway for future minerals and advanced manufacturing to decarbonise their operations.

Opportunity 3 recognises the ability for the precinct to develop renewable energy sources in an export ready format which will support our neighbours in their decarbonisation efforts.

¹⁰⁵ Northern Territory Large Emitters Policy - https://depws.nt.gov.au/__data/assets/pdf_file/0018/1042164/factsheet-large-emitters-policy-and-the-community.pdf

12.3 Appendix C – Infrastructure Projects MCA-1 and MCA-2 Results

Table 36: MCA

Theme	Criteria	Aggregated score	Score evidence
Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user hardstand/laydown facility			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	7	The role of this infrastructure is pivotal to help proponents (and their products and services) achieve outcomes which align with a wide range government policy. Policies include, but not limited to: Territory Economic Reconstruction Commission – A common-user MOF will strengthen the Territory to be at the forefront of importing modules for renewable energy generation. Our North, Our Future: White Paper on Developing Northern Australia, a focal point to the Territory specific paper outlines the need for infrastructure to support growth. With the existing Inpex owned MOF is not available for future proponent use combined with the Darwin Port operating at levels which currently remain optimised, any additional demand such as large-scale solar panel import to the region could pose a significant risk for reaching growth to new industries and investment opportunities.
	1.2 - Multi-industry benefit enablement	7	This infrastructure is commonly needed by different types of industries to obtain input and distribute output. 100% Industry proponents surveyed indicated that MOF and jetty access is the number one enabling infrastructure ¹⁰⁶ .

¹⁰⁶ EY/DIPL industry survey feedback

Theme	Criteria	Aggregated score	Score evidence
	1.3 - Value adding	7	<p>The MOF would support value adding and product development (primary through importing and exporting) of goods and investments in the NT.</p> <p>Infrastructure Australia's the Territory Regional Strengths and Infrastructure Gaps report details the downstream minerals processing and strengthening the gas production supply chain as key growth industries¹⁰⁷ The MOF and association with industry proponent's beneficiation of resources across the value chain directly aligns with the findings in this report.</p> <p>Lowering the barrier for entry for mid or downstream proponents will encourage proponents which can value-add the Territory resources such as LNG, green energy through photovoltaic or the power network and mineral processing and manufacturing.</p>
	1.4 - Long term utility of option	7	MOF and dredging will be required regardless of changing demands of energy and products. It supports and attracts private sector proponents who will bring more sustainable or carbon efficient products and services in/out of the Territory. Australia conducts 98% of its trade through ports ¹⁰⁸ , added with the strategic placement of the Territory to SE Asia the Long-term utility of a MOF is extremely high.
Economic	2.1 - Indicative capital costs and funding sources	7	<p>The indicative cost and whether it is reasonable for Government funds to underwrite the capital costs is considered a high priority category:</p> <ul style="list-style-type: none"> Government investment is critical to ensure equitable use of the MOF across precinct proponents and industries. <p>Indicative costs of +\$600 m is in line with budget expectations.</p>
	2.2 - Number of potential beneficiaries	7	<p>This infrastructure will be the critical to attract private sector investments as it is commonly needed by many potential proponents/users.</p> <p>100% industry proponents have indicated the use of the MOF.</p>
	2.3 - Competitiveness of the Territory to investment opportunities	7	The MOF will make the precinct more desirable to national and foreign investment. This has been communicated by potential industry participants through the industry survey.
	2.4 - Local employment	7	There are mining companies want to use this for large loads and put it onto roads, these derived projects would support ongoing local employment.
	2.5 - Indigenous employment	4	There is limited information about the impact on Indigenous employment - neutral effect

¹⁰⁷ [Infrastructure Australia - Regional Strengths and Infrastructure, 2022](#)

¹⁰⁸ [Ports Australia - Ports take Australia to the world, 2022](#)

Theme	Criteria	Aggregated score	Score evidence
Social, cultural and environment	3.2 - Future environmental and cultural risks	4	Indirectly the MOF could reduce environmental impacts through benefiting many users to import/export greener products, but it may have direct negative impacts on marine environment and ecosystem. <ul style="list-style-type: none"> • Further environmental studies will be completed to minimise the impact. • The indirect benefits associated with the import of modules to enable decarbonising infrastructure development.
	3.3 - Social and community impacts	5	There are indications some members of the Territory community are against the development due to the impact on the marine environment. As reported in the New Daily publication ¹⁰⁹ .
	3.4 - Land use compatibility	7	The MOF (and dredging) will allow more land to be used and heighten precinct efficiency. The MOF directly aligns with existing precinct development expectations. Expected in DIPL's current planning.
Deliverability	4.1 - Construction difficulty	6	The construction difficulty and knowledge base are mature, due to similar project execution in the region. However, the scale of the undertaking is significant and reflected in scoring.
	4.2 - Workforce and material availability	5	<ul style="list-style-type: none"> • The workforce requires a reasonably specialised skillset to deliver however this workforce will be in the Territory for the Shiplift. • The Shiplift project being executed will provide specialist, renewable knowledge¹¹⁰.
	4.3 - Delivery complexity	5	The delivery complexity is relatively advanced but is not unique and can be managed accordingly by the project owner ¹¹¹ .
	4.4 - Activation	7	It is critical infrastructure to ensure the successful industry uptake of the precinct and attract future private sector interments. <ul style="list-style-type: none"> • All industry proponents looking to invest in Middle Arm have indicated this project as a top priority. • Timing wise, directly aligns with what the Territory companies require in the short and medium term. • The MOF will enable other infrastructure in the precinct including the wider the Territory supply chain.

¹⁰⁹ Newdaily - Significant adverse impacts': Proposed Darwin gas hub labelled a risk to health and environment, 2022

¹¹⁰ Invest the Territory – Shiplift, 2022

¹¹¹ DIPL engineering team

Theme	Criteria	Aggregated score	Score evidence
Product export jetties			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	7	The role of this infrastructure is pivotal to help proponents (and their products and services) achieve outcomes which align with a wide range government policy. Common-user jetties will strengthen the Territory to be at the forefront of importing modules for renewable energy generation. Our North, Our Future: White Paper on Developing Northern Australia, a focal point to the Territory specific paper outlines the need for infrastructure to support growth. With the Darwin Port operating at levels which currently remain optimised, any additional demand such as large-scale solar panel import to the region could pose a significant risk for reaching growth to new industries and investment opportunities.
	1.2 - Multi-industry benefit enablement	7	This infrastructure is commonly needed by different types of industries to obtain input and distribute output. Similar to the MOF, 100% of industry proponents surveyed indicated that product jetties access is the number a top enabling piece of common-user infrastructure.
	1.3 - Value adding	7	It would support value adding and product development (primary through importing and exporting). 100% ¹¹² all of industry proponents surveyed conveyed a product jetty (along with the MOF) the most significant enabling infrastructure required for beneficiation.
	1.4 - Long term utility of option	7	Export jetties and dredging will be required regardless of changing demands of energy and products. It supports and attracts private sector proponents who will bring more sustainable or carbon efficient products and services in/out of the Territory. Australia conducts 98% of its trade through ports ¹¹³ , added with the strategic placement of the Territory to SE Asia the Long-term utility of a MOF is extremely high.
Economic	2.1 - Indicative capital costs and funding sources	7	Essential for Government capital to maximise total volume of products from the precinct and benefits received by different users, even though some private proponents will be able to self-fund.
	2.2 - Number of potential beneficiaries	6	100% of precinct occupiers wouldn't necessarily use the jetties unlike the MOF. It is expected 70% of industry proponents would be exporting products through a common-user product jetty.

¹¹² EY/DIPL industry survey feedback

¹¹³ Ports Australia - Ports take Australia to the world, 2022

Theme	Criteria	Aggregated score	Score evidence
	2.3 - Competitiveness of the Territory to investment opportunities	7	<p>This infrastructure will be critical to attracting private sector investments as it is commonly needed by many potential proponents/users.</p> <ul style="list-style-type: none"> With the investment pipeline in the Territory, extremely high with 13 private industry, major projects being planned and delivered over the coming years. There are concerns that the current port capacity will be unable to meet demand. The products produced for export in the precinct are vast and significant including Titanium, Vanadium, Ammonia, Hydrogen and fertiliser to name a few. 90% of industry respondents surveyed¹¹⁴ for the precinct indicated common-user export product jetties are critically essential for exporting products to the market. Some noted that using existing port facilities could limit export quantities.
	2.4 - Local employment	7	Some mining companies want to use this for large loads and put it onto roads, these projects would support ongoing local employment.
	2.5 - Indigenous employment	4	There is limited information about the impact on Indigenous employment - neutral effect.
Social, cultural and environment	3.2 - Future environmental and cultural risks	4	<p>Indirectly, the dredging and jetties could reduce environmental impacts through benefiting many users to import/export greener products, but it may have direct negative impacts on marine environment and ecosystem.</p> <ul style="list-style-type: none"> Further environmental studies will be completed to minimise the impact. The indirect benefits associated with the import of modules to enable decarbonising infrastructure development.
	3.3 – Social and community impacts	5	There are indications some members of the Territory community are against the development due to the impact on the marine environment. As reported in the New Daily publication ¹¹⁵ .
	3.4 - Land use compatibility	7	The Jetties (and dredging) will allow more land to be used and heighten precinct efficiency. The jetties and dredging directly aligns with existing precinct development expectations. Expected in DIPL's current planning.
Deliverability	4.1 - Construction difficulty	6	The construction difficulty and knowledge base are mature, due to similar project execution in the region. However, the scale of the undertaking is significant.

¹¹⁴ DIPL Industry surveys, 2022

¹¹⁵ NewDaily - 'Significant adverse impacts': Proposed Darwin gas hub labelled a risk to health and environment, 2017

Theme	Criteria	Aggregated score	Score evidence
	4.2 - Workforce and material availability	5	The workforce requires a reasonably specialised skillset to deliver however this workforce will be in the Territory for the Shiplift. The Shiplift project being executed will provide specialist, renewable knowledge ¹¹⁶ .
	4.3 - Delivery complexity	5	The delivery complexity is relatively advanced but is not unique and can be managed accordingly by the project owner ¹¹⁷ .
	4.4 - Activation	6	<ul style="list-style-type: none"> It would strongly support activation. This is marked as moderate as a lack of export jetties is not seen an insurmountable supply chain issue from the private sector. All industry proponents looking to invest in Middle Arm have indicated this project as a top priority. Timing wise, directly aligns with what Territory companies require in the short and medium term. The MOF will enable other infrastructure in the precinct including the wider Territory supply chain.
CO2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for CO2 transmission and supporting infrastructure - capacity/open access control			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	6	<p>CCUS enabling infrastructure aligns with multiple the Territory developed strategies:</p> <ul style="list-style-type: none"> Net zero by 2050 – the Territory Government has confirmed a goal of achieving net zero emissions by 2050. Large emitters policy – a policy outlining the Territory Government's expectations for the mitigation and management of emissions from new and expanding large greenhouse gas emitters is targeted for the end of 2020. Emissions Reduction Strategy – the development of an Emissions Reduction Strategy (ERS) by mid-2022. The ERS will identify stages, interim targets, timeframes, and potential approaches and mechanisms to achieve the net zero emissions target by 2050. Greenhouse Gas Emissions Offsets Policy - develop a Greenhouse Gas Emissions Offsets Policy to guide the application and administration of carbon offsets by mid-2022.

¹¹⁶ Invest the Territory – Shiplift, 2022

¹¹⁷ DIPL engineering team

Theme	Criteria	Aggregated score	Score evidence
	1.2 - Multi-industry benefit enablement	7	CCUS Infrastructure offers the opportunity to allow different types of industries to access carbon storage and transmission, including heavy industries, natural gas power generation, ammonia production, methanol production, ethylene production, condensate refining and titanium vanadium, as well as power generation, hydrogen production, agriculture, aquaculture and transport ^{118, 119} .
	1.3 - Value adding	5	The infrastructure is valuable for processing, although it may have limited contribution directly accelerating the value add of the Territory resources. Evidence from elsewhere suggests carbon capture and storage is not only a proven emissions reduction solution, but also brings environmental, economic and social benefits ¹²⁰ .
	1.4 - Long term utility of option	7	This infrastructure has the ability to future proof Middle Arm, enabling industries one pathway to transition to net zero. CCUS infrastructure will play an important role in meeting net zero targets, as one of the few solutions to remove carbon from the atmosphere and tackle emissions from energy-intensive industries such as power generation and industrial plants ¹²¹ . As per the Northern Territory Infrastructure Plan 221, infrastructure is a key enabler of economic development, underpinning the capacity to create jobs, increase productivity and stimulate growth ¹²² .
Economic	2.1 - Indicative capital costs and funding sources	5	Government capital and oversight, at both Territory and Federal levels, will maximise benefits of common user operations and achieve the objectives of a diverse industry precinct. Through the Carbon Capture and Storage Hub Study and Report, policy and regulatory options to incentivise private investment have been analysed, including the identification of options to address barriers to carbon capture and storage investment ¹²³ .
	2.2 - Number of potential beneficiaries	7	The infrastructure could provide approximately 2-4 proponents options to transmit CO2 once fully utilised. Through the development of the Business Case to assess the viability of a large-scale low-emission CCUS Hub, CSIRO partnered with key industry and engineering companies, including INPEX, Santos, Woodside, Eni, Origin Energy and Xodus, who could be potential local proponents, in addition to Darwin LNG, notwithstanding the options for foreign investors ¹²⁴ .

¹¹⁸ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

¹¹⁹ Territory Gas the Territory - Carbon Capture Utilisation and Storage Hub, 2022

¹²⁰ Earth Resources – Benefit of CCS, 2022

¹²¹ Territory Gas - Carbon Capture Utilisation and Storage Hub, 2022

¹²² NT Infrastructure Plan 2021 - Annual review, 2022

¹²³ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

¹²⁴ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

Theme	Criteria	Aggregated score	Score evidence
	2.3 - Competitiveness of the Territory to investment opportunities	7	Will improve attractiveness of MASDP and offer a point of differentiation in global context, as well as provide a gateway to South-East Asia. Unlocking investment in carbon capture and storage can support high-value jobs and economic growth, as well as provide opportunities for the establishment of new industrial sectors in the Territory ¹²⁵ . Location within the MASDP will open opportunities within a globally competitive location for low-emission petrochemical, renewable hydrogen and minerals processing ¹²⁶ .
	2.4 - Local employment	4	While the initial construction of the CCUS infrastructure may temporarily create job opportunities, the infrastructure is not expected to directly contribute to local employment in a substantial way.
	2.5 - Indigenous employment	4	There is limited information about the impact on Indigenous employment - neutral effect.
Social, cultural and environment	3.2 - Future environmental and cultural risks	6	<p>While environmentally positive given the carbon capture and support for the transition to a net-zero future, this infrastructure may have issues with geology until further environmental and engineering investigations are undertaken. This position can be improved through:</p> <ul style="list-style-type: none"> • Further undertaking of environmental studies to minimise the impact, including risks posed to native flora and fauna. • The identification of learnings and best practice from other similar projects on how to address environmental and cultural risks. <p>The indirect benefits associated with the import of modules to enable decarbonising infrastructure development.</p>
	3.3 – Social and community impacts	5	Despite general community support, there are pockets of minor community concern around the CO2 storage and utilisation technology. Effective public engagement will be key for the success of CCUS infrastructure development and implementation ¹²⁷ .

¹²⁵ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

¹²⁶ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

¹²⁷ International Journal of Greenhouse Gas Control - Community compensation in the context of Carbon Capture and Storage: Current debates and practices, 2020

Theme	Criteria	Aggregated score	Score evidence
	3.4 - Land use compatibility	7	Industrial components within the MASDP will have a carbon footprint. Without CCUS infrastructure and technology, these private sectors would need to explore other offset options that could impact land use compatibility. Shared infrastructure is more efficient land use, and in line with the current intentions of DIPL through strategic land use. Integrated land use and infrastructure planning provides certainty for the community, landowners and decision makers through creating a framework to manage and guide growth and development ¹²⁸ .
Deliverability	4.1 - Construction difficulty	4	The technology delivery is relatively immature for this type of infrastructure. Proposed co-location of the CCUS Infrastructure within the MASDP is enhanced due to the offshore geological storage which may reduce pipeline and transport costs ¹²⁹ .
	4.2 - Workforce and material availability	4	Available workforce will be required to have some specialised skillsets to deliver the CCUS infrastructure. The Territory construction industry is heavily supported throughout the NTG, and private sector infrastructure investment, but characterised by recurring workforce shortages, with the growing adoption of advanced technology having the potential to create training gaps and exacerbate existing workforce challenges ¹³⁰ . Currently, there is uncertainty of material availability due to supply chain challenges, due to the ongoing constraints of COVID-19 and the Russia-Ukraine conflict which may impact material availability and sector growth ¹³¹ .
	4.3 - Delivery complexity	4	The delivery complexity is high, however manageable on the basis of the current governance planning model. The proposed co-location of the CCUS hub and MASDP may enable the minimisation of capital-intensive construction and ongoing operating costs ¹³² .
	4.4 - Activation	7	The infrastructure highly aligns with current industry investment horizons and demands demonstrated across all potential industry mixes. This includes the NTG's target of net zero emissions by 2050 ¹³³ .

¹²⁸ NT Infrastructure Plan 2021 - Annual review, 2022

¹²⁹ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

¹³⁰ ISACNT - Construction, Accessed in 2022

¹³¹ The Northern Territory Budget 2022 - Construction, Accessed in 2022

¹³² Territory Gas - Carbon Capture Utilisation and Storage Hub, 2022

¹³³ Northern Territory Government - Delivering the Climate Change Response: Towards 2050 A Three-Year Action Plan for the Northern Territory Government, 2020

Theme	Criteria	Aggregated score	Score evidence
CO2 for Inpex and Santos - Carbon capture utilisation and storage (CCUS) infrastructure - for CO2 transmission and supporting infrastructure - manifold for Inpex and Santos to access precinct CO2			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	3	The infrastructure does not strongly align with the objectives of policies as it limits CCUS to primary proponents. It may preclude other types of emitting industry proponents from access to carbon storage and transition, which will limit the ability of the Territory to reduce greenhouse gas emissions through a large-scale investment that delivers economies of scale ¹³⁴ .
	1.2 - Multi-user, multi-industry benefit enablement	1	There is significant risk as the option precludes other types of industries ability to access carbon storage. If limited to the primary proponents, the CCUS Infrastructure will not be strategically aligned with the intention for it to be multi-user, multi-access investment ¹³⁵ .
	1.3 - Value adding	5	The infrastructure is valuable for processing, though it may have limited contribution to directly accelerating the value add of the Territory's resources. Evidence suggests carbon capture and storage is not only a proven emissions reduction solution, but also brings environmental, economic and social benefits ¹³⁶ . This may be limited due to the preclusion of other types of proponents.
	1.4 - Long term utility of option	3	This option contributes to decarbonisation generally but does not provide more utility options for proponent's over time. CCUS infrastructure will play an important role in meeting net zero targets, as one of the few solutions to remove carbon from the atmosphere and tackle emissions, although this potential will be somewhat constrained due to being limited to the primary proponents ¹³⁷ .
Economic	2.1 - Indicative capital costs and funding sources	4	It is highly likely the primary proponents utilising the infrastructure will self-fund it, limiting the requirement for initial and ongoing government or foreign investment.
	2.2 - Number of potential beneficiaries	3	Due to the structure of having two primary proponents as opposed to multi-user, benefits may be reduced and limited to investing parties only.

¹³⁴ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

¹³⁵ Global CCS Institute for the Government of the Northern Territory of Australia - Carbon Capture and Storage Hub Study, 2020

¹³⁶ Earth Resources – Benefit of CCS, 2022

¹³⁷ Territory Gas – Carbon Capture Utilisation and Storage Hub, 2022

Theme	Criteria	Aggregated score	Score evidence
	2.3 - Competitiveness of the Territory to investment opportunities	4	Should the primary proponents have capacity control over the infrastructure, this significantly limits the competitive advantage for the Territory. There will be limited opportunities for other local or foreign investment outside the primary proponents.
	2.4 - Local employment	4	The infrastructure is not expected to directly contribute to local employment in a substantial way, if limited to the primary proponents.
	2.5 - Indigenous employment	4	The infrastructure is not expected to directly contribute to Indigenous employment in a substantial way.
Social, cultural and environment	3.2 - Future environmental and cultural risks	5	While environmentally positive given the carbon capture and contribution for a transition towards net zero, this infrastructure could have issues with geology until further environmental and engineering investigations are undertaken. This position can be improved for the primary proponents through: <ul style="list-style-type: none"> Further undertaking of environmental studies to minimise the impact, including risks posed to native flora and fauna. The identification of learnings and best practice from other similar projects on how to address environmental and cultural risks.
	3.3 – Social and community impacts	5	Despite general community support, there are pockets of minor community concern around the CO2 storage and utilisation technology. Effective public engagement by the primary proponents and the Territory government will be key for the success of CCUS infrastructure development and implementation ¹³⁸ .
	3.4 - Land use compatibility	1	If it is not common use, Inpex and Santos would control land use capacity which risks precluding the involvement of other proponents, which will impact land use compatibility for others. This is not aligned with the current intentions of DIPL, who recommend shared infrastructure for more efficient land use.
Deliverability	4.1 - Construction difficulty	3	The technology delivery is relatively immature for this type of infrastructure, although the primary proponents bring experience to the area. Proposed co-location of the CCUS Infrastructure within the MASDP is enhanced due to the offshore geological storage which may reduce pipeline and transport costs ¹³⁹ .

¹³⁸ International Journal of Greenhouse Gas Control - Community compensation in the context of Carbon Capture and Storage: Current debates and practices, 2020

¹³⁹ Territory Gas - Carbon Capture Utilisation and Storage Hub, 2022

Theme	Criteria	Aggregated score	Score evidence
	4.2 - Workforce and material availability	3	Available workforce will be required to have some specialised skillsets to deliver the infrastructure, it is anticipated the primary proponents will have access to these specialised skillsets during their previous and current work in the sector. Currently, there is uncertainty regarding material availability due to supply chain challenges, as a result of the ongoing constraints of COVID-19 and the Russia-Ukraine conflict, which may impact sector growth ¹⁴⁰ .
	4.3 - Delivery complexity	3	The delivery complexity is high however manageable on the basis of the current governance planning model. It is anticipated the primary proponents will bring lessons learned and best practice from the delivery of other complex infrastructure projects they have been involved in.
	4.4 - Activation	4	This option would be less attractive for future private sector investment, due to having a low dependence on alternative industry utility beyond the primary proponents.
Digital subterranean cabling of precinct to support digital communications and automation			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	7	This will support the outcomes and objectives of numerous the Territory and Commonwealth polices, including digital advancements within the Digital Territory Strategy that will provide jobs for the future, enable businesses to transform and open up new economic opportunity ¹⁴¹ . At a National level, the Digital Government Strategy outlines the intention to seek opportunity for the consolidation, integration and automation of processes ¹⁴² .
	1.2 - Multi-industry benefit enablement	7	High rates of traditional and new heavy industry technology adoption indicate network and telecommunication uptake for business operations across all sectors is likely, enhancing the collective ability for government, business and community to undertake digital advancement. This uptake may extend beyond the proponents within the MASDP.
	1.3 - Value adding	7	Digital infrastructure is essential to support the development of value adding products and processes relating to the Territory resources. Digital advances also present opportunity to open up access of the Territory to global markets through a secure, connected and thriving digital economy ¹⁴³ .

¹⁴⁰ The Northern Territory Budget 2022 – Construction, Accessed in 2022

¹⁴¹ Digital Territory- Digital Territory Strategy, 2022

¹⁴² Digital Government Strategy - Accelerating the digital future of our Australian Public Service, 2021

¹⁴³ Digital Territory- Digital Territory Strategy, 2022

Theme	Criteria	Aggregated score	Score evidence
	1.4 - Long term utility of option	7	Industry 4.0 and the opportunities for mechanisation of high-quality digital connectivity will support the long-term utilisation of the MASDP. Adoption of technological and digital advancements are pivotal to long term advancement, enabling smarter communities and growing jobs and business across the Territory ¹⁴⁴ .
Economic	2.1 - Indicative capital costs and funding sources	4	There is the potential for either private or government investment, or a combination of both.
	2.2 - Number of potential beneficiaries	7	This would be commonly used by a large range of potential proponents/users regardless of industry, the benefits being reaped both within and beyond the MASDP.
	2.3 - Competitiveness of the Territory to investment opportunities	7	This infrastructure will be critical to attract private sector and foreign investments as it is commonly needed by many potential proponents to enhance digital communications and automation processes through the high-quality speed and security of data transfer ¹⁴⁵ .
	2.4 - Local employment	5	The infrastructure is not expected to directly contribute to local employment in a substantial way.
	2.5 - Indigenous employment	5	The infrastructure is not expected to directly contribute to Indigenous employment in a substantial way.
Social, cultural and environment	3.2 - Future environmental and cultural risks	4	There is the potential for minimal environmental and cultural risks due to the underground nature of the subterranean cable which will exist under the proposed infrastructure within the MASDP.
	3.3 – Social and community impacts	6	Digital infrastructure aligns with community expectations, connecting, creating, and supporting safe, sustainable and vibrant communities ¹⁴⁶ .
	3.4 - Land use compatibility	7	Digital infrastructure is a common expectation for an industrial precinct, and will build on the Northern Territory Infrastructure Plan to focus on Sustainable Development Precincts that focus on integrated land use and infrastructure planning ¹⁴⁷ .
Deliverability	4.1 - Construction difficulty	7	The construction difficulty and knowledge base are mature, due to similar project execution in the region.

¹⁴⁴ Digital Territory- Digital Territory Strategy, 2022

¹⁴⁵ What is a submarine cable? Subsea fiber explained, 2021

¹⁴⁶ Digital Territory- Digital Territory Strategy, 2022

¹⁴⁷ Northern Territory Infrastructure Plan 2021 - Annual review, 2022

Theme	Criteria	Aggregated score	Score evidence
	4.2 - Workforce and material availability	6	This is no specific common activity, however workforce and civils are the same skills required for many other projects.
	4.3 - Delivery complexity	7	The delivery complexity is relatively low, due to similar project execution in the region.
	4.4 - Activation	7	Digital subterranean cabling is critical infrastructure to ensure the successful industry uptake of the MASDP and attract future private sector and foreign investments. Inclusion in the MASDP will support the drive for industry diversification, exports, job creation and play a pivotal role in growing the Territory economy ¹⁴⁸ .
High capacity, networked power distribution to Middle Arm connected to DKIS			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	4	It does not strongly support the net zero and low emission policies as the nature of traditional provision of power network is a large carbon emitter. If connected to the DKIS as a network, there are possible benefits in injecting greater resilience across the whole network.
	1.2 - Multi-industry benefit enablement	7	The energy generated from power stations is commonly needed by private sector, regardless of the type of industries. All industry users will require access to power, this solution will reduce duplication.
	1.3 - Value adding	6	It would support value adding, but it is recognised that this is not the optimal energy solution.
	1.4 - Long term utility of option	5	There is limited impact on development of extending utility in the long term as emissions targets for products and services increases.
Economic	2.1 - Indicative capital costs and funding sources	7	Government needs to facilitate as network must be open access, and proponents are encouraged to use it. Interaction with DKIS can provide additional benefits to community.
	2.2 - Number of potential beneficiaries	7	Potential to benefit all MASDP new industries.
	2.3 - Competitiveness of the Territory to investment opportunities	6	A network is positive for investment however it is also a minimum expectation. Traditional energy mix (predominantly gas) does not strongly enhance the Territory's competitive advantage for private sector investment.

¹⁴⁸ Northern Territory Government - Middle Arm Sustainable Development Precinct, 2022

Theme	Criteria	Aggregated score	Score evidence
	2.4 - Local employment	4	Minimal contribution to additional local employment.
	2.5 - Indigenous employment	4	Minimal contribution to additional Indigenous employment.
Social, cultural and environment	3.2 - Future environmental and cultural risks	4	Installing network has minimal environmental risk. Due to being energy mix agnostic, gas or renewable has not been ranked.
	3.3 - Social and community impacts	4	Neutral impact as social licence depends on the type of energy utilised.
	3.4 - Land use compatibility	6	A network approach rather than individual power stations is more efficient use of the strategic industrial land at the precinct.
Deliverability	4.1 - Construction difficulty	7	Mature technology established for infrastructure delivery. Demonstrated by advanced systematic integrated systems across Australia ¹⁴⁹ .
	4.2 - Workforce and material availability	6	Mature workforce knowledge and material is available to support this construction.
	4.3 - Delivery complexity	7	The delivery complexity is low. This is demonstrated by the advanced systematic integrated systems across Australia ¹⁵⁰ .
	4.4 - Activation	7	It is essential to ensure the successful industry uptake of the precinct.
Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	4	No direct specification detailed across policies, however, a neutral position due to the positive enabling nature of the option. The green energy transmission and distribution will encourage and reduce barrier for proponents in the precinct to produce green hydrogen, aligning with the Northern Territory Renewable Hydrogen Strategy ¹⁵¹
	1.2 - Multi-industry benefit enablement	6	The option will enable multiple industry proponents to access green energy throughout the precinct - uptake across sectors will be high especially with the proponents looking to value add in the hydrogen related spaces.

¹⁴⁹ IBIS World, IBIS World Industry report, Electricity Distribution in Australia, 2014

¹⁵⁰ IBIS World, IBIS World Industry report, Electricity Distribution in Australia, 2014

¹⁵¹ Northern Territory Government - Northern Territory Renewable Hydrogen Strategy, 2022

Theme	Criteria	Aggregated score	Score evidence
	1.3 - Value adding	6	Will support proponents to package and re-produce low emissions products and services to the market. Beneficiation of the Territory captured and produced resources will be both feedstock and output in many proponents expected to reside in MASDP. Goldman Sachs reported green hydrogen could supply up to 25% of global energy requirements by 2050 to become a US\$10 trillion market by 2050 ¹⁵² . With the significant green hydrogen demand and associated products such as Methanol and Ammonia, access to green energy from renewables will be essential.
	1.4 - Long term utility of option	7	This option ranks very high as green energy demand will only increase over time as proponents respond to market demands. Without a common-use and open access power option, each proponent would likely investigate individual energy generation options. Under this scenario, if five of the expected proponents sourced medium capacity gas fired power generators such as Siemens SGT5-2000E. As a conservative estimate, operating at maximum capacity for 20% of the year emits an estimated 228,000 tonnes/annum ¹⁵³ . 228,000 tonnes of CO2-emissions multiplied by five totals 1,140,000 tonnes/annum, equivalent to over 220,000 residential homes' electricity use per year ¹⁵⁴ . The individual uptake of energy solutions has the potential to jeopardise the Territory emissions targets the sustainability element of the precinct.
Economic	2.1 - Indicative capital costs and funding sources	4	Neutral to whether the government should be providing the necessary capital outlay.
	2.2 - Number of potential beneficiaries	7	Based on proponents across all sectors medium to long term emissions targets, uptake potential is very high.
	2.3 - Competitiveness of the Territory to investment opportunities	7	Providing access to green energy transmission sources will make the Territory precinct very attractive for multiple proponents and sectors.
	2.4 - Local employment	6	The local workforce required to develop this large-scale capital works will provide significant local employment opportunity (in generating the renewable energy, not the network necessarily).

¹⁵² Goldman Sachs - Green Hydrogen The next transformational driver of the Utilities industry, 2020

¹⁵³ GHD - Power station and associated costs, 2021

¹⁵⁴ EPA - Greenhouse Gas Equivalencies Calculator, 2022

Theme	Criteria	Aggregated score	Score evidence
	2.5 - Indigenous employment	6	The local workforce required to develop this large-scale capital works will provide significant local employment opportunity.
Social, cultural and environment	3.2 - Future environmental and cultural risks	4	The option requires large and intrusive development if renewable source is solar; which possess some environmental risk, softened by the macro decarbonisation benefits. Network will have some footprint but minimal impact.
	3.3 - Social and community impacts	7	Society expects large scale access to green energy for sectors and proponents to offer greener products and services.
	3.4 - Land use compatibility	7	The options directly align with current planning expectations for the precinct ¹⁵⁵ .
Deliverability	4.1 - Construction difficulty	4	Option technology and specialist knowledge to execute delivery is advanced.
	4.2 - Workforce and material availability	3	There is some risk to sourcing materials and labour to deliver the option.
	4.3 - Delivery complexity	4	A number of parties involved in delivery but will be on commercial terms.
	4.4 - Activation	6	This option falls directly in line with sector and societies timeline expectations.
Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	7	Aligns with the objectives of low emissions and net zero policies. Australia along with the Territory targets to reduce emissions to net zero by 2050 ¹⁵⁶ .
	1.2 - Multi-industry benefit enablement	7	The energy generated from hydrogen is commonly needed by private sector regardless of industry. Will also enable a proof-of-concept hydrogen project in the MASDP by committing to offtake. It has a wider application and is used by various industries in private sector. ¹⁵⁷
	1.3 - Value adding	6	Establishing a hydrogen industry in the Territory will provide a way to export our renewable energy more extensively.

¹⁵⁵ DIPL engineering team

¹⁵⁶ Australia's Long-Term Emissions Reduction Plan - A whole-of-economy plan to achieve net zero emissions by 2050, 2021

¹⁵⁷ WHA - Hydrogen industry applications: past, present, and future, Accessed in 2022

Theme	Criteria	Aggregated score	Score evidence
			Australia plans to be a top-three exporter of hydrogen to Asian markets by 2030 ¹⁵⁸ .
	1.4 - Long term utility of option	7	Hydrogen is a central pillar of new energy security. This option will enable the DKIS to blend hydrogen and support the transition to net zero. Diversifying Australia's energy infrastructure is key to energy security. Supported by an economic stretch goal of A\$2 per kilogram, the Australian Government is prioritising investments to support the growth of Australian hydrogen industry. ¹⁵⁹
Economic	2.1 - Indicative capital costs and funding sources	7	Government needs to facilitate as currently owned by government; current regulations maybe not encourage private funding ¹⁶⁰ .
	2.2 - Number of potential beneficiaries	7	Potential to benefit all MASDP new industries ¹⁶¹ .
	2.3 - Competitiveness of the Territory to investment opportunities	7	This infrastructure will provide a point of difference for the MASDP. Not only to supply greener energy to precinct but offer Hydrogen producers the opportunity to supply hydrogen within 20 km of production site.
	2.4 - Local employment	4	Slightly positive, minimal contribution to additional local employment. Installation only – specialist field, not common.
	2.5 - Indigenous employment	4	Minimal contribution to additional Indigenous employment. Channel island operations could employ additional Indigenous workforce.
Social, cultural and environment	3.2 - Future environmental and cultural risks	5	There are some potential environmental risks of storing and transporting it safely to avoid leakage, as hydrogen is an indirect greenhouse gas with a potential global warming effect ¹⁶² . There is a potential impact on water resources, as it requires a significant amount of water to generate hydrogen. Hydrogen production requires secure, long-term access to water, which may prove challenging in Australia as it is known for variable rainfall and frequent droughts ¹⁶³ .

¹⁵⁸ The Conversation - Australia plans to be a big green hydrogen exporter to Asian markets – but they don't need it, 2022

¹⁵⁹ Business envoy July 2021, Diversifying Australia's energy infrastructure: hydrogen technology, 2021

¹⁶⁰ The National Law Review - Updates to Hydrogen Policy and Funding in Australia, 2021

¹⁶¹ Land development Corporation - Middle Arm Sustainable Development Precinct, Accessed in 2022

¹⁶² Science for Environmental Policy - Environmental Impacts of Hydrogen-based Energy Systems, 2006

¹⁶³ Allens - Water access for hydrogen projects: don't let your options dry up, 2021

Theme	Criteria	Aggregated score	Score evidence
	3.3 – Social and community impacts	5	Potentially there is an impact on water resources as it requires a significant amount of water to generate hydrogen which may trigger community concern ¹⁶⁴ . Overall, this is of community benefit, providing opportunity for greening the energy mix.
	3.4 – Land use compatibility	6	It aligns with the objectives of precinct planning framework; it could be an enabler for land development as the development of hydrogen industry. The precinct has an extensive product corridor network for the transmission of utilities, gas, feedstock and products. All lots will be serviced with power, water and communications infrastructure. There is also potential for high- and low-pressure gas to be reticulated throughout the estate. With gas feedstock being supplied through product corridors, high- and low-pressure gas availability throughout the estate will support co-location of various downstream manufacturing proponents. ¹⁶⁵
Deliverability	4.1 – Construction difficulty	7	Mature technology, upgrading Channel Island has already commenced indicating there is already local knowledge to install, operate and maintain. ¹⁶⁶
	4.2 – Workforce and material availability	5	The current workforce may not have specialised skillset which may require some training. Requires further analysis.
	4.3 – Delivery complexity	6	This requires a counter party to supply hydrogen, this offtake could be fulfilled by Middle Arm precinct proponents.
	4.4 – Activation	7	It will support and attract future potential industries in the long term and will be an important proof of concept for the Territory hydrogen industry.
Water desalination solution available for industry proponents			
Strategic fit with Commonwealth and the Territory policies	1.1 – Policy alignment	6	Desalination given proximity to the sea is an option that supports sustainability of water resources To increase water security for all Territorians and as part of the development of a Strategic Water Plan, the Territory Government is considering infrastructure solutions for the Darwin Region. Darwin region future water supply describes the aim of the option of desalination is to provide a short-term solution to support industrial growth where there may be a high willingness and capacity to pay for the water ¹⁶⁷ .

¹⁶⁴ Allens – Water access for hydrogen projects: don't let your options dry up, 2021

¹⁶⁵ Land development Corporation – Middle Arm Sustainable Development Precinct, Accessed in 2022

¹⁶⁶ General Electric – TM2500 and Channel Island Power Station: supporting hydrogen, 2022

¹⁶⁷ Department of Industry, Tourism and Trade – Darwin region future water supply, Accessed in 2022

Theme	Criteria	Aggregated score	Score evidence
	1.2 - Multi-industry benefit enablement	4	Water will be a key input; the source is less concern to industry than availability and price. In Australia, based on current prices charged for water, desalination is currently only competitive with traditional water sources in remote locations ¹⁶⁸ .
	1.3 - Value adding	7	Water is critical to value adding aspirations. The NTG has an ambitious target to achieve a \$40 billion economy by 2030. The Territory Economic Reconstruction Commission final report (November 2020) identified that a step change in the Territory's approach to water is needed to support the Territory's plans for increased private investment and economic growth of the region ¹⁶⁹ .
	1.4 - Long term utility of option	6	This option is scalable and future proofs the precinct by de-risking water supply. As the Territory grows, water security is critical, for people, agriculture, and industry. By 2050, it is forecast that an additional supply of 11,000 ML p.a. is required to meet future population growth and having only one major surface water source creates water security risks and exposure to climatic factors ¹⁷⁰ .
Economic	2.1 - Indicative capital costs and funding sources	4	Neutral to whether the government should be providing the necessary capital outlay. A business case was prepared; funded by the Federal Government through the National Water Grid Fund, a \$3.5 billion investment program for water infrastructure projects to help secure Australia's water future ¹⁷¹ .
	2.2 - Number of potential beneficiaries	4	As needed. Enable significant growth in the Darwin region's agricultural and horticultural industry, which is currently constrained by a lack of available groundwater and enablement of downstream processing and manufacturing ¹⁷² .
	2.3 - Competitiveness of the Territory to investment opportunities	5	Critical to attractiveness, but investors somewhat agnostic to source. ¹⁷³
	2.4 - Local employment	4	Modularised technology, minimal direct jobs. ¹⁷⁴
	2.5 - Indigenous employment	4	Modularised technology, minimal direct jobs. ¹⁷⁵

¹⁶⁸ ResearchGate - The Economics of Desalination and It's Potential Application to Australia, 2002

¹⁶⁹ Northern Territory Government - Darwin region future water supply, Accessed in 2022

¹⁷⁰ Department of Industry, Tourism and Trade - Adelaide River Off-stream Water Storage Project, Accessed in 2022

¹⁷¹ Australian Water - Northern Territory infrastructure plans explore region's water future, 2021

¹⁷² Department of Industry, Tourism and Trade - Darwin region future water supply, Accessed in 2022

¹⁷³ DIPL Project Working Group and SMEs

¹⁷⁴ DIPL Project Working Group and SMEs

¹⁷⁵ DIPL Project Working Group and SMEs

Theme	Criteria	Aggregated score	Score evidence
Social, cultural and environment	3.2 - Future environmental and cultural risks	3	There are potential environmental challenges with discharging brine into the harbour. Generally, environmental impacts can be generated both in the construction and operation of desalination plants. The production and growth of marine organisms is severely affected by discharge of brine in the desalination process. These organisms are interrelated with each other so any distraction in their population has extreme impacts on all marine life in the area. ¹⁷⁶ In addition to brine, other main issues are the high energy consumption of the desalination and brine treatment technologies as well as the air pollution due to emissions of greenhouse gasses and air pollutants. Other issues include entrainment and entrapment of marine species, and heavy use of chemicals ¹⁷⁷ .
	3.3 - Social and community impacts	2	There is community concern about the health of Darwin harbour particularly among the Territory community. The potential threats were identified in a risk assessment the NTG was required to submit under the environmental approvals process: <ul style="list-style-type: none"> • Soil and water quality could also suffer if erosion, leaks, discharge of wastewater or spills of hazardous materials occur. • Threatened species and sensitive vegetation may be adversely affected when the site; which is about the size of 750 AFL ovals, is cleared. • Potential damage to the seabed and marine ecosystems during dredging, infrastructure construction and shipping operations. • The slated development would also likely prevent the Territory from achieving its greenhouse gas emissions targets. • Indigenous sacred sites could be affected during dredging, land clearing, shipping and industrial operations¹⁷⁸.
	3.4 - Land use compatibility	4	Neutral position related to the existing precinct planning framework ¹⁷⁹ .
Deliverability	4.1 - Construction difficulty	6	Proven technology. Modern industrial-scale desalination uses reverse osmosis to remove salt and other impurities from sea water. Water is forced under high pressure through a series of membranes through which salt and other impurities cannot pass ¹⁸⁰ .
	4.2 - Workforce and material availability	3	Challenge in long lead items and current supply chain issues.

¹⁷⁶ Researchgate - An Assessment of the Environmental Impact of Brine Disposal in Marine Environment, 2021

¹⁷⁷ Researchgate - An Assessment of the Environmental Impact of Brine Disposal in Marine Environment, 2021

¹⁷⁸ Guardian - Fears second Darwin port and industrial hub could have 'significant adverse impacts' on health, 2022

¹⁷⁹ DIPL Middle Arm Engineering Department

¹⁸⁰ The Conversation - Cities turn to desalination for water security, but at what cost, 2019

Theme	Criteria	Aggregated score	Score evidence
			Design, construction and maintenance costs of these industrial plants are high. They also use large amounts of electricity, which increases greenhouse gas emissions unless renewable energy sources are used ¹⁸¹ .
	4.3 - Delivery complexity	3	A number of stakeholder groups will need to be consulted, and approvals sought. Requirement for assessment and approval processes that protect the environment, without creating unnecessary duplication and delay that may cost the economy millions of dollars ¹⁸² . Further investigations are required internally in the NTG to consult with independent Darwin water projects and participants.
	4.4 – Activation	7	This option secures water for the full activation of the precinct. If not done, the precinct will not reach full potential. The Darwin region's water supply is currently operating at, or above its sustainable supply level and cannot grow without an additional water supply ¹⁸³ .
Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	7	Circular economy policies, environmental expectations and MASDP overarching objectives. As per the Territory Circular Economy strategy, the Territory government is exploring options for a growing waste management sector in which it suggests treated wastewater can be reused in industrial processes or green space irrigation ¹⁸⁴ .
	1.2 - Multi-industry benefit enablement	7	Under hybrid mixed ecology case there will be several users required to treat wastewater. Benefits are captured when mid-tier parties are able to access this kind of facility, improving their initial capital raising requirements. Water authorities remain the main purchasers and users of goods and services in this sector ¹⁸⁵ .
	1.3 - Value adding	7	Supports a sustainable value adding supply chain ¹⁸⁶ .
	1.4 - Long term utility of option	6	Improves water utilisation with reuse. Wastewater reuse is a solution for the future to combat water scarcity. After treatment, wastewater can be used for a variety of applications including watering green spaces and golf courses, crop irrigation, fire-fighting and street-cleaning, or it can be used to recharge aquifers ¹⁸⁷ .
Economic	2.1 - Indicative capital costs and funding sources	6	Need to ensure multiuser access and associated infrastructure. High need for government intervention.

¹⁸¹ The Conversation - Cities turn to desalination for water security, but at what cost, 2019

¹⁸² Guardian - Fears second Darwin port and industrial hub could have 'significant adverse impacts' on health, 2022

¹⁸³ Northern Territory Government - Northern Territory Balanced Environment Strategy, 2016

¹⁸⁴ Northern Territory Circular Economic Strategy - Waste as a Resource - Transitioning to a Circular Economy, Accessed in 2022

¹⁸⁵ Australia - Country Commercial Guide - Water and Wastewater Treatment, 2022

¹⁸⁶ ResresearchGate - Consolidated Value Chain, 2017

¹⁸⁷ Open Edition Journals - Wastewater reuse: a solution with a future, 2020

Theme	Criteria	Aggregated score	Score evidence
			The Australian Government has established the National Water Grid Fund as a US\$2.5 billion rolling 10-year infrastructure program to fund water infrastructure investments. Australia spends an estimated US\$6 billion each year on water and wastewater treatment services. Direct capital purchases and equipment maintenance account for 20% of total spending ¹⁸⁸ .
	2.2 - Number of potential beneficiaries	6	Positively impacts but some may develop inhouse capabilities. Will be subject to scale. There are a small number of large Australian suppliers (employing 100 or more) but most of the players are smaller companies (employing 1-20 people). There are also some well-established local manufacturers and assemblers of water and wastewater treatment package plants ¹⁸⁹ .
	2.3 - Competitiveness of the Territory to investment opportunities	6	The PWG scored Positive, particularly for mid-tier players ¹⁹⁰ .
	2.4 - Local employment	4	A neutral score was provided as limited workforce data available for this specific industry. An assumption was made that there would be some opportunities for constructing, operating and maintaining the facility ¹⁹¹ .
	2.5 - Indigenous employment	4	A neutral score was provided as limited workforce data available for this specific industry. An assumption was made there would be some opportunities for constructing, operating and maintaining the facility ¹⁹² .
Social, cultural and environment	3.2 - Future environmental and cultural risks	6	Positive, as provides pathways for recycling as opposed to discharge. Some environmental risks. Due to the material and energy consumption, the wastewater treatment process has impacts on both air and solid pollution. The biochemical treatment stage of sewage and the sludge disposal stage can lead to greenhouse gas emissions ¹⁹³ .
	3.3 - Social and community impacts	6	Likely to see some community concerns around risks, particularly transporting to facility. The transport of hazardous substances with wastewater is not only critical issue for receiving water, but also for managing wastewater sludge ¹⁹⁴ .
	3.4 - Land use compatibility	7	Highly aligned. Treated wastewater can be reused in industrial processes or for green space irrigation ¹⁹⁵ .
Delivery >	4.1 - Construction difficulty	4	Neutral, technology is maturing but still relatively new ¹⁹⁶ .

¹⁸⁸ Australia - Country Commercial Guide - Water and Wastewater Treatment, 2022

¹⁸⁹ Australia - Country Commercial Guide - Water and Wastewater Treatment, 2022

¹⁹⁰ DIPL Project Working Group

¹⁹¹ DIPL Project Working Group

¹⁹² DIPL Project Working Group

¹⁹³ Journal of Cleaner Production - Environmental impacts assessment of wastewater treatment and sludge disposal systems under two sewage discharge standards, 2021

¹⁹⁴ Doctoral thesis - Hazardous Substances in Wastewater management, 2004

¹⁹⁵ Northern Territory Circular Economic Strategy, 2022

¹⁹⁶ CleanaWater - New technology in wastewater treatment, 2020

Theme	Criteria	Aggregated score	Score evidence
			Most new water treatment systems in Australia these days incorporate some form of organics removal. The three commonly used processes for dealing with removal of organics from drinking water in Australia incorporate ion exchange, activated carbon, and advanced oxidation processes ¹⁹⁷ .
	4.2 - Workforce and material availability	2	Possible long lead time and specialist skill challenges. From the past experience, we can see that a long time period is required as after 18 months of construction and 65,000 work hours, the Leanyer Sanderson Waste Stabilisation Ponds Inlet Works was opened in December 2018 ¹⁹⁸ .
	4.3 - Delivery complexity	3	Multiple parties and stakeholders. Planning for wastewater use typically requires the involvement of several government agencies covering health, water, sanitation, agriculture and irrigation, as well as researchers, community groups and the private sector ¹⁹⁹ .
	4.4 - Activation	6	This item particularly supports diverse mid-tier proponents who will deepen the industrial mix at the precinct including further value adding. The PWG have spoken to potential precinct proponents and this Infrastructure Project will help them achieve FID and considerably lower the investment hurdle rate.
Gas pipeline into Middle Arm for proponents to access			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	6	<p>A gas connection for offtake for proponents to laterally connect into a gas pipeline to provide feedstock for operations aligns with overarching the Territory policies²⁰⁰.</p> <p>Notably, the precinct gas pipeline aligns with the Northern Territory gas strategy: five-point plan to enable the Territory to be a world-class gas production, manufacturing and services hub by 2030²⁰¹.</p> <ul style="list-style-type: none"> • Grow the Northern Territory's service and supply industry • Establish gas-based processing and manufacturing • Grow research, innovation and training capacity • Contribute to Australia's energy security

¹⁹⁷ Australia - Country Commercial Guide - Water and Wastewater Treatment, 2022

¹⁹⁸ Utility - Improved outcomes from new water infrastructure, 2019

¹⁹⁹ Multi-Stakeholder Processes for Managing Wastewater Use in Agriculture, Accessed in 2022

²⁰⁰ DIPL Project Working Group

²⁰¹ The Northern Territory Government - Northern Territory gas strategy: five point plan, Accessed in 2022

Theme	Criteria	Aggregated score	Score evidence
	1.2 - Multi-user, multi-industry benefit enablement	7	<p>Strong positive result given the potential to convert gas feedstock into a number of various projects in the precinct. These include²⁰²:</p> <ul style="list-style-type: none"> • Liquefied Natural Gas (LNG) Train • Blue hydrogen project • CCUS Project • Methanol export plant • Condensate refinery
	1.3 - Value adding	5	<p>The value-added products produced by the projects above include:</p> <ul style="list-style-type: none"> • CO2 sequestration • Blue Hydrogen • Methanol • Gasoline, Kerosene, Diesel, Marine Fuel, Heavy Fuels <p>A moderate strong scoring has been allocated because as demands change there could be some limitations on the current local LNG dependence²⁰³.</p>
	1.4 - Long term utility of option	3	<p>There is a slightly negative score assigned due to the longevity of local consumption for LNG over the long term²⁰⁴.</p> <p>Short to medium term Australia's LNG consumption will remain steady, however as key trading partners look to lower CO2 emissions and green products becomes in higher demand LNG as a local feedstock will become less desired²⁰⁵.</p>
Economic	2.1 - Indicative capital costs and funding sources	3	<p>A slightly negative score is assigned. Government funding and investment in an LNG gas pipeline is commercially unwise based on reflection with the project's problems and opportunities²⁰⁶. Local LNG producers in the area could build a business case and deliver independently of Government support.</p>

²⁰² The Northern Territory Government –Potential precinct projects, 2022

²⁰³ DIPL Project Working Group

²⁰⁴ DIPL Project Working Group

²⁰⁵ IGCG - Changing pathways for Australian gas, 2022

²⁰⁶ DIPL Project Working Group

Theme	Criteria	Aggregated score	Score evidence
	2.2 - Number of potential beneficiaries	3	27% of the proposed industrial precinct projects would directly benefit from access to LNG pipeline ²⁰⁷ . Score is below average and does not align strongly with the project's problems, opportunities, and objectives.
	2.3 - Competitiveness of the Territory to investment opportunities	6	A moderate positive score was assigned by the PWG. The score was based on expert knowledge of the PWG and SMEs. The justification of the score is based on the scale of value from particular industries who use gas as a key input to their operations.
	2.4 - Local employment	5	A slightly positive score was assigned due to the scale of the proposed undertaking and the existing skills base already present in the Territory. APA Group are Australia's largest pipeline and associated infrastructure asset holders and operations. They have been operating in the Territory for over 30 years with a local team of over 50 skilled pipeline specialists ²⁰⁸ . APA's long-standing history in the Territory, combined with the scale of the workforce required to construct and operate the score is positive.
	2.5 - Indigenous employment	4	A neutral score was assigned. There is no available Indigenous pipeline specialist data available to be benchmarked. An assumption has been made there is some opportunity.
Social, cultural and environment	3.2 - Future environmental and cultural risks	3	A neutral score was assigned based against the base case. Should the common-user gas pipeline not be considered, it would be reasonable to assume the precinct would be utilised by existing LNG focused proponents already in the region ²⁰⁹ . Natural gas pipelines can impact the environment in multiple ways ²¹⁰ : <ul style="list-style-type: none"> • Natural habitat loss and fragmentation • Changes in species movement • Sedimentation • Air emissions.
	3.3 - Social and community impacts	3	A neutral score assigned for the precinct gas pipeline. This is because there are some social and community members who disagree with the Government funding additional gas infrastructure. As evidence by recent the Territory protests against Santos ²¹¹ .

²⁰⁷ The Northern Territory Government

²⁰⁸ APA Group – APA in the Northern Territory, 2014

²⁰⁹ DIPL Project Working Group

²¹⁰ The Nature Conservancy - Natural Gas Pipelines, 2011

²¹¹ Green Left - Climate activists target Santos' the Territory expansion plans, 2022

Theme	Criteria	Aggregated score	Score evidence
	3.4 - Land use compatibility	4	The PWG scored a slightly positive score on the basis of existing pipelines already surrounding the precinct. Inpex and Santos already have pipeline infrastructure adjacent to Middle Arm. This Infrastructure Project could be easily incorporated into the existing master plan ²¹² .
Deliverability	4.1 - Construction difficulty	5	A slightly positive score by the PWG aligns with the mature pipeline industry knowledge that exists in Darwin. APA have been operating pipelines for over 30 years while Inpex's Bayu-Undan pipeline flows directly into the Darwin LNG facility ²¹³ . Pipeline construction in Australia is common-practice and presents a low level of risk.
	4.2 - Workforce and material availability	6	A moderate positive score by the PWG was recognised due the mature workforce skillsets, knowledge and participation in the oil and gas and construction sectors in the NT. These sectors make up 12% of total the Territory employment ²¹⁴ . A strongly positive score was not assigned because there remains materials supply chain uncertainty in the market.
	4.3 - Delivery complexity	5	A slightly positive response was provided by the PWG based on internal government knowledge about approvals and administration relating to pipeline project development and execution.
	4.4 - Activation	5	A slightly positive score was assigned by the PWG based on their prior knowledge and dealings with a large range of interested precinct proponents ²¹⁵ . Timing wise, this Infrastructure Project aligns with current industry demand. Long term is less clear.
Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g. line and track extension, railroad conveyor, *rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities)			
Strategic fit with Commonwealth and the	1.1 - Policy alignment	7	Rail will support the delivery of modern metals incoming and outgoing of the precinct. ²¹⁶ Transport and logistics support both economic and social outcomes and aligns to the Territory Infrastructure strategy 2022-2030. ²¹⁷

²¹² Project Working Group

²¹³ Inpex - Bayu-Undan and Darwin LNG, Accessed in 2022

²¹⁴ The Northern Territory Government - Labour market economics, Accessed in 2022

²¹⁵ DIPL Project Working Group

²¹⁶ The Department of Industry, Science and Resources - Make it Happen: The Australian Government's Modern Manufacturing Strategy, Accessed in 2022

²¹⁷ The NT Infrastructure strategy 2022-2030, 2022

Theme	Criteria	Aggregated score	Score evidence
	1.2 - Multi-user, multi-industry benefit enablement	7	Rail into the precinct will provide opportunities for all proponents. The precinct houses Darwin's East Arm Wharf, the terminus of the Australasia Railway, the Darwin Business Park, the Marine Supply Base and the proposed Marine Industry Park with more than 100 service and supply businesses are operating in it ²¹⁸ .
	1.3 - Value adding	7	Rail will support the delivery of modern metals incoming and outgoing of the precinct. Australian mines contain about 2.8% of the world's total rare earth minerals. Australia has the fifth highest reserves of rare earth minerals in the world. The country could become the world's next big supplier ²¹⁹ .
	1.4 - Long term utility of option	7	Long term horizon will strengthen the utilisation of rail as population and vehicle density in the precinct increases, therefore the business case for rail is strengthened. Rail-linked cities are one of eight concepts floated to address population growth as Australia's population is tipped to increase to 53 million by 2101, mainly due to immigration, according to the ABS. Rail will be required to address the increase in road freight congestion ²²⁰ .
Economic	2.1 - Indicative capital costs and funding sources	7	Typically, rail requires Government coordination to enable multi-user benefits. The Australian Government commits billions of dollars to rail as part of its annual budget. In 2022, the Australian government committed to a \$A17.9bn (\$US 13.6bn) infrastructure package in the annual budget ²²¹ .
	2.2 - Number of potential beneficiaries	3	A neutral score was assigned. Further investigations into the potential proponents requiring rail needs to be realised ²²² .
	2.3 - Competitiveness of the Territory to investment opportunities	6	Attractive for proponents relative to the base case, however, not an option differentiator ²²³ .
	2.4 - Local employment	5	Minimal contribution to additional local employment. However, a slightly positive score was assigned due to the ongoing operational and maintenance workforce opportunities this Infrastructure Project presents.

²¹⁸ Darwin Convention Centre – Supply and support services, Accessed in 2022

²¹⁹ BizlatinHub - Australia's Promising 'Value-Added' Mining Future, 2019

²²⁰ ABC News – Planning for Australia's population growth rail linked cities, 2020

²²¹ IRJ -Australian government commits billions to rail in annual budget, 2022

²²² DIPL Project Working Group

²²³ The NT Infrastructure Plan and Pipeline, 2022

Theme	Criteria	Aggregated score	Score evidence
	2.5 - Indigenous employment	5	Minimal contribution to additional Indigenous employment opportunities. However, a slightly positive score was assigned due to the ongoing operational and maintenance workforce opportunities this Infrastructure Project presents.
Social, cultural and environment	3.2 - Future environmental and cultural risks	6	Reduced environmental risk when compared to vehicle emissions and scale of potential material movements. Additional macro benefits to enable lower emission bulk movement of rare earths and modern manufacturing products. The Australian Rail Association has documented that only 2.6% of Australia's transport greenhouse gas emissions are attributable to rail. This 2.6% includes both passenger and freight rail, so in fact passenger rail contributes even less ²²⁴ .
	3.3 – Social and community impacts	7	Reducing vehicle congestion and particularly large road freight trucks through smaller local community roads is welcomed by society. Road congestion is costing Australia more than an avoidable A\$16 billion every year. This is set to almost double to A\$30 billion by 2030. It also causes impact on drivers' health as it takes a longer time to reach the destination ²²⁵ .
	3.4 - Land use compatibility	5	In line with the planning framework for an optimal outcome within the precinct. Substantial areas of industrial land adjacent to transport infrastructure in the precinct are available to store equipment and coordinate operations across the Territory ²²⁶ .
Deliverability	4.1 - Construction difficulty	6	The option delivery knowledge is mature, scale required will be large. Successive reforms and investment have modernised and electrified these railways, and established a standard interstate rail network and a single national rail safety regime in Australia ²²⁷ .
	4.2 - Workforce and material availability	2	Restrictions on supply of specialist workforce and materials poses some risk. The rail industry is facing a workforce skills shortage crisis, risking significant cost and delivery blowouts on major train and tram projects nationwide during the next decade. 20 per cent of the sector's existing workforce is expected to retire before 2028 ²²⁸ .

²²⁴ Transport for NSW - Why is rail travel a better choice for the environment?, Accessed in 2022

²²⁵ The conversation – PM wants to bust congestion, 2018

²²⁶ Darwin Convention Centre – Supply and support services, Accessed in 2022

²²⁷ Australasian Railway Association - Finding the fast track for innovation in the Australasian rail industry, 2020

²²⁸ Financial Review - Skill shortage looming for Australian rail industry, 2018

Theme	Criteria	Aggregated score	Score evidence
	4.3 - Delivery complexity	3	Moderate response because not wholly government controlled and will require private cooperation to connect with existing lines.
	4.4 - Activation	7	The option meets the direct timing needs to support the immediate operations of proponents and is essential across all sectors ²²⁹ .
Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	7	Connecting roads to activate industry direct aligns with a wide range of the Territory and Commonwealth policies ²³⁰ .
	1.2 - Multi-user, multi-industry benefit enablement	7	<p>Roads are critical to enable multi-use, with strategic land at Middle Arm already owned by Government there would be substantial costs and risks to allowing third parties to develop private roads to key areas of the precinct.</p> <p>Roads are typically, the role of Government to build, maintain and govern and unlikely to be delivered by the market. Risks of private roads include:</p> <ul style="list-style-type: none"> • Privatisation - Jeopardise common-use and open access nature of key roads within the precinct • Governance - Decision making power over types of transport construction, resulting in a more indirect route. • Transparency and confidence - Hinder precinct and industry participants long term view of how the infrastructure could be managed. • Activation - the precinct could become less desirable due to industry uncertainty and increased level of security required and investment risks.
	1.3 - Value adding	7	<p>Utility of roads to key locations within the precinct adds large amount of value in terms of transporting people, resources and materials.</p> <p>The roads within the precinct to enable proponents to get to and from marine infrastructure carrying essential imported or exported products and materials. In this case, the public common user roads industrial roads offer productivity benefits to support the movement of products and people²³¹.</p>

²²⁹ DIPL Project Working Group

²³⁰ DIPL Project Working Group

²³¹ Infrastructure Magazine - Australian roads create \$236 billion, support 1.4 million workers, 2021

Theme	Criteria	Aggregated score	Score evidence
			Retaining ownership and control over the roads and corridors will provide the Government with security and contingency should global demand for products dramatically shift, the Government can adapt and respond by providing the necessary transport solution without approval or governance obstacles.
	1.4 - Long term utility of option	7	<p>Roads will remain essential across all time horizons.</p> <p>Appropriate Government management and maintenance of key road infrastructure and transport corridors is essential for controlling environmental impacts. Monitoring use, wear-and-tear, and damage of roads can reduce the risk of environmental impacts such as increased emissions caused by poor surface conditions and noise pollution to nearby residential areas²³².</p> <p>Government funded and operated roads provide future ability to adapt to changing industry landscapes and make informed decisions based on historical evidence and road/transport corridor performance.</p>
Economic	2.1 - Indicative capital costs and funding sources	7	A strong positive score was assigned by the PWG. Government coordination is expected especially given the relatively minor capital expense and ownership of the existing land corridors.
	2.2 - Number of potential beneficiaries	7	Roads will be accessible for all proponents to transport materials, products and workforce from origin to destination within the precinct.
	2.3 - Competitiveness of the Territory to investment opportunities	7	Roads for connecting and enabling movement is an expected minimum, foregoing multi-user road movement would significantly hinder competitiveness.
	2.4 - Local employment	5	The option will have a relatively low impact on local employment.
	2.5 - Indigenous employment	5	The option will have a relatively low impact on local Indigenous employment ²³³ .
Social, cultural and environment	3.2 - Future environmental and cultural risks	6	Roads commonly have low impact on the environment ²³⁴ .
	3.3 - Social and community impacts	7	The Infrastructure Project was scored as a strong positive. It is widely understood and accepted the need for connecting roads by the community.

²³² Infrastructure Australia - Corridor Protection: Planning and investing for the long term, 2017

²³³ DIPL Project Working Group

²³⁴ DIPL Project Working Group

Theme	Criteria	Aggregated score	Score evidence
	3.4 - Land use compatibility	7	The PWG assigned a strong positive score. Roads are considered essential in the existing masterplan precinct planning framework ²³⁵ .
Deliverability	4.1 - Construction difficulty	7	Technology available for road delivery is mature and easily coordinated.
	4.2 - Workforce and material availability	6	The score is reflective of the current labour shortages in Darwin. However, this is expected to only be in the short term. Some difficulties related to material availability and workforce may arise in the short term.
	4.3 - Delivery complexity	6	Minor hurdles relating to coordination of invested stakeholder groups are present but immaterial.
	4.4 - Activation	7	Roads must be adopted early and are critical to the precinct success. Highly critical to enable multiple infrastructure utility.
Shared workforce transport / transit system – including parking and connections to worksites			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	6	The PWG scored a moderately positive score based on specialist knowledge within Government. For example, this Infrastructure Project directly aligns with the Northern Territory workforce boost to assist in filling workforce shortages ²³⁶ , the need to attract additional workers recognises that additional transport systems and parking is required to meet the demand. Additionally, The Territory Infrastructure Strategy 2022 to 2030, supports developing infrastructure which support increased growth, productivity and innovation ²³⁷ .
	1.2 - Multi-industry benefit enablement	7	A strong positive score was assigned by the PWG, recognising parking and the supporting transit system will be required to accommodate the expected workforce influx associated with the full occupancy of a diverse precinct.
	1.3 - Value adding	5	A slightly positive score reflects the inherent value-add associated with providing members of the community with common user accessibility and amenity in the form of indirect benefits. Benefit was unable to be quantified prior to the workshop.
	1.4 - Long term utility of option	7	A strong positive score was allocated to the potential long-term utility of the precinct transport and park and ride system by the PWG.

²³⁵ DIPL engineering department

²³⁶ The Northern Territory Government - Northern Territory workforce boost, 2022

²³⁷ The Northern Territory Government - the Territory Infrastructure Strategy 2022 to 2030, 2022

Theme	Criteria	Aggregated score	Score evidence
Economic	2.1 - Indicative capital costs and funding sources	6	A moderately positive score was assigned due to the inductive low cost of a workforce carpark and supporting transit infrastructure to allow for park and ride operations and services to be considered by industries in the future ²³⁸ .
	2.2 - Number of potential beneficiaries	7	A strong positive score assigned on the basis that Middle Arm will create a significant number of jobs. With no public transport offering, it is assumed that majority of the industry proponents will utilise a common user carpark, supporting the park and ride transit system ²³⁹ .
	2.3 - Competitiveness of the Territory to investment opportunities	7	A strong positive score reflects the attractiveness which a common user car park and supporting transit system can offer the precinct proponents and employees. Given the limited land availability this could be used to entice workers. A recent survey found that 78% of workers would likely remain with their employer because of their benefits ²⁴⁰ and found that a company car park is one of the most desirable employee benefits.
	2.4 - Local employment	5	The PWG scored this a slightly positive as the construction will have a relatively low impact on local employment. Potentially there may be opportunities for inspectors and operators, especially if this would enable and park and ride service in the future.
	2.5 - Indigenous employment	5	The PWG scored this as slightly positive as the construction will have a relatively low impact on local employment.
Social, cultural and environment	3.2 - Future environmental and cultural risks	6	Carparks commonly have low impact on the environment ²⁴¹ . Further investigations will be required if this Infrastructure Project enables a 'Park and Ride' type system in the future.
	3.3 - Social and community impacts	4	A neutral score was assigned due to the lack of information relating to community expectations surrounding vehicle car parks and adverse effects related to the environment and potential park and ride service offering.
	3.4 - Land use compatibility	6	The PWG assigned a strong positive score. A common use parking area and supporting transit system is considered essential in the existing masterplan precinct planning framework ²⁴² .
Deliverability	4.1 - Construction difficulty	7	Technology available for road delivery is mature and easily coordinated ²⁴³ .
	4.2 - Workforce and material availability	6	The score is reflective of the current labour shortages in Darwin. However, this is expected to only be in the short term. Some difficulties related to material availability and workforce may arise in the short term.

²³⁸ DIPL Project Working Group

²³⁹ DIPL Project Working Group

²⁴⁰ Parkalot - Company car park – one of the most desirable employee benefits, 2020

²⁴¹ DIPL Project Working Group

²⁴² DIPL engineering department

²⁴³ DIPL Project Working Group

Theme	Criteria	Aggregated score	Score evidence
	4.3 - Delivery complexity	6	Minor hurdles relating to coordination of invested stakeholder groups, are present but immaterial.
	4.4 - Activation	6	A carpark and supporting transit system is moderately positive and aligns with proponents timeline expectations ²⁴⁴ .
Worker's accommodation to enable MA workers (residential land release and costs)			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	5	Directly aligns with policies to grow the Territory economy through population and industry growth. ²⁴⁵ The volatility of the Northern Territory residential market puts pressure on the land development industry to deliver product to meet spikes in demand, and can adversely impact the end-consumer. At a macro-level this boom-bust cycle also negatively impacts private investment and growth in the economy, and more broadly and impacts overall population growth ²⁴⁶ .
	1.2 - Multi-industry benefit enablement	6	Provide places to live for the project workforce. The Territory economy is growing fast, and Territorian employers are offering top working conditions to attract skilled workers to move up ²⁴⁷ .
	1.3 - Value adding	5	the Territory will benefit from an increase in labour force and skill uptake for new or existing residents. Employment in the Territory increased by 1.6% in year-on-year original terms, reflecting a 3.0% increase in full-time employment, partly offset by a 2.5% decrease in part-time employment ²⁴⁸ .
	1.4 - Long term utility of option	6	Accommodation is necessary regardless of industry changes and demands over time ²⁴⁹ .
Economic	2.1 - Indicative capital costs and funding sources	6	Housing, accommodation and residential land release are largely coordinated by and the responsibility of, the Government. Roles of the three levels of governments with regard to housing are ²⁵⁰ : <ul style="list-style-type: none"> The federal government is responsible for national housing and homelessness policy, financial sector regulations and taxation settings, which have some influence on housing affordability.

²⁴⁴ DIPL Project Working Group

²⁴⁵ The Northern Territory Population Growth Strategy 2018-2028, Accessed in 2022 , City of Darwin – Economic Development Strategy, Accessed in 2022

²⁴⁶ The Northern Territory Independent - the Territory Government eyes bringing more land to market following review, 2022

²⁴⁷ The Northern Territory boundless possible, Accessed in 2022

²⁴⁸ Department of Treasury and Finance – Northern Territory Economy, 2022

²⁴⁹ DIPL Project Working Group

²⁵⁰ Research Publications - Parliament of Australia

Theme	Criteria	Aggregated score	Score evidence
			<ul style="list-style-type: none"> State and territory governments are responsible for land use and supply policy, urban planning and development policy, housing-related taxes and residential tenancy legislation and regulation, each of which have impact on housing affordability. Local governments are mostly responsible for building approval, urban planning and development approval processes, and rates and charges.
	2.2 - Number of potential beneficiaries	6	<p>This option has the potential to indirectly benefit a large range of industries through the ability to source a local workforce.</p> <p>Australian governments have increased their commitments to infrastructure and construction to stimulate the national economy. Additionally, new social procurement policies aim to create social value for targeted populations like Indigenous peoples and unemployed youth²⁵¹.</p>
	2.3 - Competitiveness of the Territory to investment opportunities	5	This option will provide a slight increase in sector competitiveness should workforce availability increase.
	2.4 - Local employment	6	This option will provide employment opportunities across the construction, land development, government services etc.
	2.5 - Indigenous employment	5	Some opportunities for Indigenous employment.
Social, cultural and environment	3.2 - Future environmental and cultural risks	6	<p>Accommodation and residential land releases are common practice with extremely low environmental impacts and high cultural benefits.</p> <p>Land release acts as an indirect driver of deforestation and land degradation by allowing access to previously inaccessible land for infrastructure construction. If land release takes place in an environmentally sensitive areas, or in proximity to a protected area of biodiversity, it may encourage agricultural encroachment into these areas, and adversely affect local biodiversity. In such instances, there is the need to ensure that post-clearance land use is protective of the environment²⁵².</p>
	3.3 – Social and community impacts	7	Positively impacts the local community and commonly accepted basic right for residential housing and land. Media reports that the community is calling out for additional land release in the Territory ²⁵³ .

²⁵¹ How Construction Employment Can Create Social Value and Assist Recovery from COVID-19, 2021

²⁵² Humanitarian Law and Policy - Mitigating the environmental impacts of explosive ordnance and land release, 2021

²⁵³ NT News - To fix the housing crisis, give us more land, 2022

Theme	Criteria	Aggregated score	Score evidence
	3.4 - Land use compatibility	6	Projections for workforce and job creation increases are expected and aligned with the current precinct framework. The Territory has the potential to be a \$40 billion economy by 2030 – with 35,000 new jobs for Territorians ²⁵⁴ .
Deliverability	4.1 - Construction difficulty	7	Housing, accommodation and land release is a mature and developed process with little constraints. The NTG is providing development opportunities through land releases across the Territory, providing land to accommodate 6,500 homes and support economic development ²⁵⁵ .
	4.2 - Workforce and material availability	6	There are currently some challenges in the construction sector, relief is expected in the medium term. The construction industry is one of Australia's biggest sectors, but due to COVID-19, the sector's performance has been turbulent during the past two years. Construction demand consistently outpaces both supply for labour and raw materials, and is further worsened by global supply chain issues which have caused delays in projects, and added to construction costs ²⁵⁶ .
	4.3 - Delivery complexity	6	Housing, accommodation and land release is mature and developed process with little constraints. The NTG is providing development opportunities through land releases across the Territory, providing land to accommodate 6,500 homes and support economic development ²⁵⁷ .
	4.4 - Activation	6	Aligns with the timing horizon and is an essential dependency to house workers due to the proposed increase in jobs created from the precinct. Middle Arm precinct is expected to bring 20,000 new jobs by 2040 ²⁵⁸ .
Local emergency response infrastructure – local fire station / medical clinic / EMS			
Strategic fit with Commonwealth and the	1.1 - Policy alignment	6	A moderate positive score was assigned evidenced by general emergency alignment with the NT Infrastructure Strategy 2022-2030 which supports emergency management. ²⁵⁹ The policy specifically references:

²⁵⁴ The NT – Jobs First Plan, Accessed in 2022

²⁵⁵ Department of Infrastructure, Planning and Logistics – Land Release, Accessed in 2022

²⁵⁶ BDO Australia - Building for the future: opportunities and challenges in construction, 2022

²⁵⁷ Department of Infrastructure, Planning and Logistics – Land Release, Accessed in 2022

²⁵⁸ ABC News – Northern Territory businesses hope proposed port facilities at Darwin harbours middle-arm will mean new-jobs, 2022

²⁵⁹ The NT Infrastructure Strategy 2022 to 2030, Accessed in 2022

Theme	Criteria	Aggregated score	Score evidence
			<ul style="list-style-type: none"> Health – Providing additional infrastructure support in the healthcare space for the Middle Arm workforce, and broader community directly aligns with the social infrastructure objectives outlined in this policy. Education and Training – Education to support the availability of future healthcare professionals and provide services for Middle Arm workforce in case of emergencies. Civic Services – Any additional funding and investment in the vicinity of Middle Arm aligns with emergency response timeliness. This could include fire station upgrades and capacity increases.
	1.2 - Multi-industry benefit enablement	7	The PWG assigned a strong positive score given the need for accessible emergency response support regardless of industry types within Middle Arm.
	1.3 - Value adding	4	A neutral score was assigned due to limited evidence of value-adding the Territory resources that directly aligns with Middle Arm providing funding to improve emergency services. There is an assumption investment in the emergency services offerings in the Territory will value add on existing expertise.
	1.4 - Long term utility of option	6	A moderate positive score was assigned by the PWG. It is the responsibility of Government to ensure public emergency services can support the increase in population ²⁶⁰ . In this case the precinct will attract additional workforce to the region.
Economic	2.1 - Indicative capital costs and funding sources	5	The PWG scored this sub-criterion as slightly positive. The option is expected to be relatively affordable, relative to the capital costs of other Infrastructure Project considerations ²⁶¹ .
	2.2 - Number of potential beneficiaries	4	A neutral score was assigned by the PWG as its unknown if the potential precinct proponents will invest in emergency services and infrastructure independently.
	2.3 - Competitiveness of the Territory to investment opportunities	3	This sub-criterion is ranked slightly negative. Evidence received from potential industry surveys indicate this is not a considerable priority for investment ²⁶² .
	2.4 - Local employment	5	Upgrades and construction of new emergency services would increase local employment opportunities for construction and operations ²⁶³ . Typically, employment opportunities in the emergency services space will provide skilled and long-term job opportunities.

²⁶⁰ Commonwealth Government - Emergency management and disaster resilience, 2019

²⁶¹ DIPL Project Working Group

²⁶² EY/DIPL industry survey feedback

²⁶³ DIPL Project Working Group

Theme	Criteria	Aggregated score	Score evidence
	2.5 - Indigenous employment	5	Upgrades and construction of new emergency services would increase local Indigenous employment opportunities for construction and operations ²⁶⁴ . Typically, employment opportunities in the emergency services space will provide skilled and long-term job opportunities.
Social, cultural and environment	3.2 - Future environmental and cultural risks	5	Not many environmental risks to upgrading health and emergency services. Health care generates 1–5 percent of total global environmental impacts in the domains of greenhouse gas emissions, particulate matter, nitrogen oxide and sulphur dioxide. A 2019 estimate places health care's global carbon footprint at 4.4 percent of the world's total greenhouse gas emissions, whereas health expenditure accounts for some 10 percent of global economic output ²⁶⁵ .
	3.3 - Social and community impacts	6	Upgrading local emergency responses – health and civil services aligns with the community's expectations as population increases. Over the next 45 years the Australian population will increase and age rapidly. As the population increases and ages there will be substantial growth in the demand for hospital bed-days, placing a corresponding demand on infrastructure and staffing ²⁶⁶ .
	3.4 - Land use compatibility	3	The PWG has scored slightly negative as on-site emergency services have not been considered in the existing master plans for the precinct. This would fall on the central Territories Governments responsibility to ensure existing emergency response services have capacity.
Deliverability	4.1 - Construction difficulty	6	Construction difficulty for emergency services infrastructure was scored moderately strong by the PWG. Social infrastructure such as emergency services and civil service infrastructure is mature and common practice in all States and Territories in Australia ²⁶⁷ .
	4.2 - Workforce and material availability	4	Workforce and materials availability was scored neutral by the PWC. This is evidenced by a number of emergency services professions listed as 'hard to fill jobs' in the Territory ²⁶⁸ . The assigned score also reflects the supply chain issues and disruptions ²⁶⁹ currently being faced across the medical and emergency services sector.

²⁶⁴ DIPL Project Working Group

²⁶⁵ Health Affair - Health Care Sustainability Metrics: Building A Safer, Low-Carbon Health System, 2020

²⁶⁶ ResearchGate, Demographic change and the future demand for public hospital care in Australia, 2005 to 2050, 2006

²⁶⁷ DIPL Project Working Group

²⁶⁸ The Territory Northern Territory Government - 2022 Northern Territory skilled occupation priority list, 2022

²⁶⁹ Hall & Wilcox - Supply chain delays and materials shortages in the construction industry, 2021

Theme	Criteria	Aggregated score	Score evidence
	4.3 - Delivery complexity	5	A slightly positive score was assigned by the PWG. The PWG have history and experience in Government processes and administration working with the private sector on social infrastructure projects and civil services. General consensus is that processes are low in complexity.
	4.4 - Activation	3	Activation on timing and dependence scored slightly negative on the basis that industry do not immediately signal the importance for upgrades to the current emergency services model ²⁷⁰ . Additionally, there is currently no proposed Infrastructure Project currently dependant on the success of Emergency Services Infrastructure and upgrade ²⁷¹ .
Beneficial re-use of dredge soil for additional economic land			
Strategic fit with Commonwealth and the Territory policies	1.1 - Policy alignment	6	Positively aligned with the Territory's 40 by 30 vision, land release programs etc. ²⁷²
	1.2 - Multi-user, multi-industry benefit enablement	6	Unlocks a large amount of industry agnostic economic land. Dredged material may be used to develop commercial sites (e.g. rehabilitation of brownfield sites, agriculture land and recreational sites), construction of islands and other man-made land ²⁷³ .
	1.3 - Value adding	7	Value adding from the perspective of repurposing dredge soil associated with precinct development to enable greater utility of land ²⁷⁴ .
	1.4 - Long term utility of option	7	Significant long-term utility of unlocking additional industry agnostic land ²⁷⁵ .
Economic	2.1 - Indicative capital costs and funding sources	6	This option is unlikely to be developed without the central coordination of Government and the environmental considerations associated with repurposing dredge soil. This type of disposal is usually more expensive. Other major constraints are the difficulty in finding suitable locations for its use, and complex and inconsistent legislation ²⁷⁶ .
	2.2 - Number of potential beneficiaries	7	Significant beneficiaries are not isolated to industrial, but include social, commercial etc. Dredging projects can provide the greatest public benefit by addressing multiple economic and environmental objectives simultaneously ²⁷⁷ .

²⁷⁰ EY/DIPL Industry survey feedback

²⁷¹ DIPL Project Working Group

²⁷² The NT Infrastructure Strategy 2022 to 2030, Accessed in 2022

²⁷³ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁷⁴ Department of Infrastructure, Planning and Logistics Middle Arm Sustainable Development Precinct, 2022

²⁷⁵ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁷⁶ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁷⁷ Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material -Beneficial Use Planning Manual, 2007

Theme	Criteria	Aggregated score	Score evidence
	2.3 - Competitiveness of the Territory to investment opportunities	4	Neutral due to the nature of the option and low desirability and benefit to industry ²⁷⁸ .
	2.4 - Local employment	7	Significant employment opportunities given the scale (approx. 22 million tonnes) and nature of the operation.
	2.5 - Indigenous employment	5	Some opportunities for Indigenous employment.
Social, cultural and environment	3.2 - Future environmental and cultural risks	6	High from the perspective of the alternative scenario of placing on the seabed. It creates societal, environmental and financial benefits with its reuse. Because large volumes are involved, being able to potentially use dredged material represents a significant sustainability contribution ²⁷⁹ .
	3.3 - Social and community impacts	6	High from the perspective of the alternative scenario of placing on the seabed. It creates societal, environmental and financial benefits with its reuse. Because large volumes are involved, being able to potentially use dredged material represents a significant sustainability contribution ²⁸⁰ .
	3.4 - Land use compatibility	6	High from the perspective of the alternative scenario of placing on the seabed. It creates societal, environmental and financial benefits with its reuse. Because large volumes are involved, being able to potentially use dredged material represents a significant sustainability contribution ²⁸¹ .
Deliverability	4.1 - Construction difficulty	4	Neutral on the basis the technology is mature, challenges on scale. Logistics and economics are the biggest issues ^{282 283} .
	4.2 - Workforce and material availability	3	Specialist machinery is difficult to source in the current climate as the class and types of dredging equipment to be utilised depends upon the type of soil to be dredged ²⁸⁴ .
	4.3 - Delivery complexity	3	Multiple stakeholder and logistics required for execution of the option.

²⁷⁸ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁷⁹ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁸⁰ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁸¹ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁸² CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁸³ Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material -Beneficial Use Planning Manual, 2007

²⁸⁴ ScienceDirect – Dredging, 2003

Theme	Criteria	Aggregated score	Score evidence
			Planning and decision-making processes for beneficial use projects can become complicated and unwieldy given that federal and state natural resource and wildlife agencies, local agencies, private parties, and public interest groups are often involved ²⁸⁵ . There is often no legislation specifically for dredging or for dredged material management, decision-makers need to deal with a patchwork of different rules, such as regulations to protect the ocean, inland water, residential areas, the environment, nature and for the handling of waste. Many different permits may be required ²⁸⁶ .
	4.4 – Activation	6	Aligns with the current demand forecast for land on the precinct. Timing was ranked high; soil re-use will be available immediately after dredging occurs ²⁸⁷ . This Infrastructure Project is highly dependent on the MOF and associated dredging occurring.

Table 37: MCA-2 scoring sheet

Theme	Criteria	Aggregated score	Score evidence and justification
Program 1			
Strategic fit	1.1 – Common user, multi-industry enablement	4	Moderate positive <ul style="list-style-type: none"> 50% of respondents noted the common-user precinct roads as ‘no other option’. >90% industry proponents surveyed respondents scored the MOF (including dredging and laydown area) and the product jetties as the most beneficial common-use infrastructure options.
	1.2 – The Northern Territory resources value add	4	Neutral <ul style="list-style-type: none"> 82% of expected industry proponents will utilise common-use product jetty to export products which have undergone value add processes from the Territory feedstock. 27% of expected industry proponents producing Ammonia and green Hydrogen will directly benefit from renewable energy distributed from the power network.

²⁸⁵ Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material -Beneficial Use Planning Manual, 2007

²⁸⁶ CEDA IADC Factsheet -Beneficial Use of Dredged Material, Accessed in 2022

²⁸⁷ Department of Infrastructure, Planning and Logistics Middle Arm Sustainable Development Precinct, 2022

Theme	Criteria	Aggregated score	Score evidence and justification
	1.3 – Future proofing	4	Moderate positive <ul style="list-style-type: none"> Australia conducts 98% of its trade through marine infrastructure²⁸⁸. The product jetties will remain resilient and required regardless of macro and micro factors potential effecting industrial chemical and resources production markets. Green power distribution network: Demand for green hydrogen and associated chemicals is expected to grow to 500-680 million metric tonnes by 2050²⁸⁹, requiring an abundance of green energy for years to come. Additionally, the Territory is expecting to capture a 15% share of global hydrogen exports by 2035, equivalent to its current share of LNG export²⁹⁰.
Social & Environmental Impact	2.1 - Contribution to carbon neutral economy	4	Moderate positive <ul style="list-style-type: none"> \$42 million in environmental (forgone use of gas as a feedstock) benefits²⁹¹ have been associated to the MOF and product jetties attracting a range of interested proponents. MOF has wider macro decarbonisation benefits associated with the import of large solar panel modules for use across the Territory.
	2.2 – Workforce amenity	3	Neutral <ul style="list-style-type: none"> The score is neutral, precinct roads will provide workforce accessibility relative to the base case.
	2.3 – Land optimisation	4	Neutral <ul style="list-style-type: none"> A neutral score was decided and agreed upon by PWG and SMEs. There is only one strategic location the MOF and dredging can be located in the precinct. Roads are necessary as the corridors land are owned by the Government. The power network will provide relief where proponents can purchase energy instead of seeking to utilise potential gas fired power option.
Deliverability	3.1 – Capital costs	5	Strong positive <ul style="list-style-type: none"> \$2.3 bn in capital costs²⁹². Program 1 has the closest capital costs to the estimated funding amount.

²⁸⁸ Ports Australia, 2022

²⁸⁹ IEA (for the G20) - The Future of Hydrogen, 2019

²⁹⁰ Northern Territory Government - Northern Territory Renewable Hydrogen Master Plan, 2021

²⁹¹ EY MASDP Cost- Benefit Analysis

²⁹² EY MASDP Cost-Benefit Analysis

Theme	Criteria	Aggregated score	Score evidence and justification
	3.2 – Construction risk	4	Strong positive <ul style="list-style-type: none"> MOF, dredging and proposed laydown area within the precinct have extremely low risk. Inpex's East Arm MOF (next door to MASDP) has successfully been constructed and operated locally – the preliminary MASDP designs are similar in specifications²⁹³. Precinct roads and transport system, product jetties and power network design, delivery and expertise are mature.
	3.3 – Precinct activation	4	Moderate positive <ul style="list-style-type: none"> Program 1 includes a universal mix common user infrastructure items. MOF, product jetties, precinct roads and green energy power distribution pose no risk of being outdated or obsolete in the next 50 years. Modular construction popularity is expected to increase at CAGR of 6.1% over the next 6 years²⁹⁴ demonstrating medium term utility demand. The attractiveness response from industry for components of Program 1 indicate a high activation rate from multiple proponents²⁹⁵.
Program 2			
Strategic fit	1.1 – Common user, multi-industry enablement	5	Moderate positive <ul style="list-style-type: none"> High network capabilities provided for industry to utilise and improve productivity aligns with the Digital Territory Strategy that will enable businesses to transform and open up new economic opportunity²⁹⁶. >50%²⁹⁷ of the industry survey respondents ranked upgrading Channel Island power plant to accommodate hydrogen generation beneficial as upgrades will provide an opportunity for precinct occupants to supply Hydrogen <20 km to Channel Island. Scoring reflected is only moderately positive as there is lack of quantifiable evidence available for remaining Program 1 components.

²⁹³ The Northern Territory DIPL engineering team

²⁹⁴ Fortune business insights, 2021

²⁹⁵ EY/DIPL industry survey feedback

²⁹⁶ Digital Territory Strategy, Accessed in 2022

²⁹⁷ EY/DIPL Industry survey feedback

Theme	Criteria	Aggregated score	Score evidence and justification
	1.2 – the Territory resources value add	5	Strong positive <ul style="list-style-type: none"> Inclusive of Program 1 infrastructure value add opportunities, digital subterranean cabling to support automatable activities of proponents is expected to value-add internal productivity through streamlining activities²⁹⁸. 50% of industry respondents indicated digital network available is beneficial to their operations²⁹⁹ supported by evidence that typically 30% of activities could be automated³⁰⁰. CCUS will directly utilise the disposal of CO2 captured from numerous proponent's activities which derive from gas feedstock, evidence suggests carbon capture and storage is not only a proven emissions reduction solution, but also brings environmental, economic and social benefits³⁰¹.
	1.3 – Future proofing	4	Moderate positive <ul style="list-style-type: none"> In addition to Programs 1's evidence, digital network accessibility to enable AI, IoT, predictive analytics will shape the manufacturing industry for years to come as technology and software advances³⁰². CCUS enabling infrastructure offer significant strategic value in the transition to net-zero and collectively has the ability to defer an estimated 8 billion tonnes of CO2 by 2050³⁰³, however, as electrolysis becomes cheaper over time long term future demand (2050 onwards highlights its limitations – justifying a moderate future proof score.
Social & Environmental Impact	2.1 - Contribution to carbon neutral economy	5	Strong positive <ul style="list-style-type: none"> Inclusive of Program 1 infrastructure value add opportunities, occupants in the MASDP will have a carbon footprint. Without CCUS infrastructure and technology, these private sectors would need to do explore other offset options. The combination of CCUS and green energy distribution provided by the power network will have the ability forgo CO2 emissions relative to the base case. \$39 billion - The economic environmental benefit modelled by the inclusion of precinct CCUS enabling infrastructure over the project period³⁰⁴.

²⁹⁸ McKinsey & Company – A Future That Works: Automation, Employment, and Productivity, 2017

²⁹⁹ EY/DIPL Industry survey feedback

³⁰⁰ McKinsey & Company – A Future That Works: Automation, Employment, and Productivity, 2017

³⁰¹ Earth Resources – Benefits of CCS, Accessed in 2022

³⁰² Brain Vire – Digital Enablement, Future Proofing Manufacturing Industry, 2022

³⁰³ IEA – CCUS in clean energy transitions, 2020

³⁰⁴ EY MASDP Cost-Benefit Analysis

Theme	Criteria	Aggregated score	Score evidence and justification
	2.2 – Workforce amenity	5	Strong positive <ul style="list-style-type: none"> Program 2 addresses the influx of an estimated 11,000 strong workforce by 2030 associated with a full industry capacity MASDP enabled by the range of proposed infrastructure³⁰⁵. Addressing the lack of development-ready residential land in proximity of 20-40 km from the precinct, Program 2 includes the release, earthworks, and administration for housing³⁰⁶.
	2.3 – Land optimisation	5	Moderate positive In addition to Programs 1's evidence: <ul style="list-style-type: none"> High network capabilities provided for industry to utilise and improve productivity aligns with the Digital Territory Strategy that will enable businesses to transform and open up new economic opportunity³⁰⁷
Deliverability	3.1 – Capital costs	2	Slightly negative <ul style="list-style-type: none"> \$3.7 bn in capital costs³⁰⁸. Program 2 has the second most expensive capital costs relative to estimated funding amount in stage 1.
	3.2 – Construction risk	3	Neutral <ul style="list-style-type: none"> A neutral score was decided and agreed upon by PWG and SMEs. A majority of Program 2's infrastructure is mature and has limited construction risk. Infrastructure to enable CCUS applications is relatively immature evidenced by only one Australian project in operation³⁰⁹. Additionally, the proposed CCUS manifold is reliant on private stakeholders, which exposes some risk related to project timelines. Scoring considered this position to be neutral.

³⁰⁵ MASDP CGE economic modelling

³⁰⁶ The Northern Territory Government PWG and SMEs

³⁰⁷ Digital Territory Strategy, Accessed in 2022

³⁰⁸ EY MASDP Cost-Benefit Analysis

³⁰⁹ Chevron - Gorgon Carbon Capture and Storage, 2022

Theme	Criteria	Aggregated score	Score evidence and justification
	3.3 – Precinct activation	5	Strong positive <ul style="list-style-type: none"> The inclusion of digital enablement, workforce accommodation, precinct transit system Channel Island power plant upgrade provides precinct proponents the option to utilise common-user infrastructure on a per use-basis instead of outlaying capital costs. A combined indication from industry proponents, PWG and SMEs agree the project mix is welcomed by industry³¹⁰
Program 3			
Strategic fit	1.1 – Common user, multi-industry enablement	4	Moderate positive <ul style="list-style-type: none"> In addition to Programs 1's evidence, 50%³¹¹ of industry survey participants stated a common-user wastewater treatment facility would be critical for operations.
	1.2 – the Territory resources value add	4	Moderate positive <ul style="list-style-type: none"> \$43 million monetised benefit³¹² associated with the recycle and re-use of wastewater from industry proponents reducing pressure on existing water supplies. 82% of expected industry proponents will utilise common-use product jetty to export products which have undergone value add processes from the Territory's feedstock.

³¹⁰ Industry survey feedback and specialist knowledge from PWG and SMEs

³¹¹ EY/DIPL Industry survey feedback

³¹² EY MASDP Cost-Benefit Analysis

Theme	Criteria	Aggregated score	Score evidence and justification
	1.3 – Future proofing	4	<ul style="list-style-type: none"> Australia conducts 98% of its trade through marine infrastructure³¹³. The product jetties will remain resilient and required regardless of macro and micro factors potentially affecting industrial chemical and resources production markets. Green power distribution network: Demand for green hydrogen and associated chemicals is expected to grow to 500-680 million metric tonnes by 2050³¹⁴, requiring an abundance of green energy for years to come The Territory is expecting to capture a 15% share of global hydrogen exports by 2035, equivalent to its current share of LNG export³¹⁵. Additionally, the common-use wastewater facility could be used to relieve water scarcity pressures in the Territory³¹⁶, with over 50% of potential precinct industries expected to consume significant portions of water (Hydrogen and Methanol). High water consuming products manufactured in the precinct will increase as global demand for Hydrogen increases over the long term³¹⁷.
Social & Environmental Impact	2.1 - Contribution to carbon neutral economy	4	Moderate positive <ul style="list-style-type: none"> \$42 million in environmental (forgone use of gas as a feedstock) benefits³¹⁸ have been associated to the MOF and product jetties attracting a range of interested proponents. MOF has wider macro decarbonisation benefits associated with the import of large solar panel modules for use across the Territory.
	2.2 – Workforce amenity	3	Neutral <ul style="list-style-type: none"> The score is neutral, as agreed by PWG and SMEs. Precinct roads will provide workforce accessibility relative to the base case.
	2.3 – Land optimisation	5	Moderate positive In addition to Program 1: <ul style="list-style-type: none"> 50% of industry proponents will require significant volumes of water for operations.

³¹³ Ports Australia, 2022

³¹⁴ IEA (for the G20) The Future of Hydrogen, 2019

³¹⁵ The Northern Territory Government - Northern Territory Renewable Hydrogen Master Plan, 2021

³¹⁶ The Strategist - Water management in northern Australia is a national security issue, 2019

³¹⁷ IEA – Hydrogen, 2021

³¹⁸ EY MASDP Cost-Benefit Analysis

Theme	Criteria	Aggregated score	Score evidence and justification
			<ul style="list-style-type: none"> Assuming 4 of 8 considered developing individual facilities at an average space requirement of 9 km per facility³¹⁹, would reduce current available land in the precinct by 27 km². Wastewater facility aligns with current precinct planning development.
Deliverability	3.1 – Capital costs	4	Moderate positive <ul style="list-style-type: none"> Program 3 has the second closest capital costs to the estimated funding amount \$2.3 bn in capital costs³²⁰
	3.2 – Construction risk	3	Moderate positive <ul style="list-style-type: none"> MOF, dredging and proposed laydown area within the precinct have extremely low risk. Inpex's East Arm MOF (next door to MASDP) has successfully been constructed and operated locally – the preliminary MASDP designs are similar in specifications³²¹. Precinct roads and transport system, product jetties and power network design, delivery and expertise are mature. Wastewater solution poses some construction risk due to material and chemical supply chain disruption in the current global environment, however, it is anticipated to be short to medium term risk³²².
	3.3 – Precinct activation	5	Moderate positive <ul style="list-style-type: none"> MOF, product jetties, precinct roads and green energy power distribution pose no risk of being outdated or obsolete in the next 50 years. Modular construction popularity is expected to increase at CAGR of 6.1% over the next 6 years³²³ demonstrating medium term utility demand. The attractiveness response from industry for components of Program 1 indicate a high activation rate from multiple proponents³²⁴.
Program 4			

³¹⁹ Mininni et. al.- An innovative sludge management system based on separation of primary and secondary sludge treatment, 2004

³²⁰ EY MASDP Cost-Benefit Analysis

³²¹ The Northern Territory DIPL Engineering team

³²² The Northern Territory DIPL Engineering department

³²³ Fortune business insights, 2021

³²⁴ EY/DIPL Industry survey feedback

Theme	Criteria	Aggregated score	Score evidence and justification
Strategic fit	1.1 – Common user, multi-industry enablement	5	Moderate positive In addition to Programs 1's evidence: <ul style="list-style-type: none"> High network capabilities provided for industry to utilise and improve productivity aligns with the Digital Territory Strategy that will enable businesses to transform and open up new economic opportunity³²⁵. >50%³²⁶ of the industry survey respondents ranked upgrading Channel Island power plant to accommodate hydrogen generation beneficial as upgrades will provide an opportunity for precinct occupants to supply Hydrogen <20 km to Channel Island. Scoring reflected is only moderately positive as there is lack of quantifiable evidence available for remaining program one components.
	1.2 – the Territory resources value add	5	Strong positive <ul style="list-style-type: none"> Program 4 includes all common-use infrastructure which provide value adding across feedstock, energy, transportation, water and digital enablement. Preliminary investigations indicate no discernible impacts preventing the value add of the Territory's resources.
	1.3 – Future proofing	4	Moderate positive <ul style="list-style-type: none"> Program 4 includes all common-use infrastructure solutions investigated. Digital network accessibility to enable AI, IoT, predictive analytics will shape the manufacturing industry for years to come as technology and software advances³²⁷. CCUS enabling infrastructure offers significant strategic value in the transition to net-zero and collectively has the ability to defer an estimated 8 billion tonnes of CO2 by 2050³²⁸, however, as electrolysis becomes cheaper over time, long term future demand (2050 onwards) highlights its limitations – justifying a moderate future proof score. The inclusion of wastewater aligns expectations of increased global future demand.
Social & Environmental Impact	2.1 - Contribution to carbon neutral economy	5	Strong positive <ul style="list-style-type: none"> With the inclusion of all infrastructure projects producing value add opportunities, occupants in the MASDP will have a carbon footprint. Without CCUS infrastructure and technology, these private sectors would need to do explore other offset options.

³²⁵ Digital Territory Strategy, Accessed in 2022

³²⁶ EY/DIPL Industry survey feedback

³²⁷ Brainvire - Digital Enablement, Future Proofing Manufacturing Industry, 2022

³²⁸ IEA - CCUS in clean energy transitions, 2020

Theme	Criteria	Aggregated score	Score evidence and justification
			<ul style="list-style-type: none"> The combination of CCUS and green energy distribution provided by the power network will have the ability forgo CO2 emissions relative to the base case. \$39 billion - The economic environmental benefit modelled by the inclusion of precinct CCUS enabling infrastructure over the project period³²⁹. However, further investigations into the trade-offs between wastewater treatment and alternative sources are required.
	2.2 – Workforce amenity	5	Strong positive <ul style="list-style-type: none"> Program 2 addresses the influx of an estimated 11,000 strong workforce by 2030 associated with a full industry capacity MASDP enabled by the range of proposed infrastructure³³⁰. Addressing the lack of development-ready residential land in proximity of 20-40 km from the precinct, Program 2 includes the release, earthworks, and administration for housing³³¹.
	2.3 – Land optimisation	5	Strong positive <ul style="list-style-type: none"> Program 4's full suite of infrastructure projects offers the most beneficial use of existing land. High network capabilities provided for industry to utilise and improve productivity aligns with the Digital Territory Strategy that will enable businesses to transform and open up new economic opportunity³³². Additionally, 50% of industry proponents will require significant volumes of water for operations. Assuming 4 of 8 considered developing individual facilities at an average space requirement of 9 km per facility³³³ would reduce current available land in the precinct by 27 km². All infrastructure items within Program 4 aligns with current precinct planning expectations.
Deliverability	3.1 – Capital costs	1	Strong negative <ul style="list-style-type: none"> \$3.8 bn in capital costs³³⁴. Program 3 has the highest closest capital costs relative to the estimated funding amount.

³²⁹ EY MASDP Cost-Benefit Analysis

³³⁰ MASDP CGE economic modelling

³³¹ The Northern Territory Government PWG and SMEs

³³² Digital Territory Strategy, Accessed in 2022

³³³ Mininni et. al.- An innovative sludge management system based on separation of primary and secondary sludge treatment , 2004

³³⁴ EY MASDP Cost-Benefit Analysis

Theme	Criteria	Aggregated score	Score evidence and justification																																																																
	3.2 – Construction risk	2	<p>Strong negative</p> <ul style="list-style-type: none"> Achieving full suite of common user infrastructure projects in the same timeline for the beginning of proponent's operations and requirements will be challenging. As shown below, the Territory is going through a workforce and skills shortage particularly in the construction sector. Demonstrated by high recruitment turnover and difficulty rates. <p>Figure 35: Rates of recruitment and recruitment difficulty by region (12 months to March 2022)³³⁵</p> <table border="1"> <caption>Data points estimated from Figure 35</caption> <thead> <tr> <th>Region</th> <th>Recruitment difficulty rate (%)</th> <th>Recruitment rate (%)</th> <th>Category</th> </tr> </thead> <tbody> <tr><td>Greater Hobart</td><td>40</td><td>45</td><td>Capital cities</td></tr> <tr><td>ACT</td><td>47</td><td>42</td><td>Capital cities</td></tr> <tr><td>Greater Adelaide</td><td>48</td><td>45</td><td>Capital cities</td></tr> <tr><td>Rest of Tasmania</td><td>48</td><td>48</td><td>Rest-of-state areas</td></tr> <tr><td>Greater Brisbane</td><td>50</td><td>52</td><td>Capital cities</td></tr> <tr><td>Greater Perth</td><td>52</td><td>51</td><td>Capital cities</td></tr> <tr><td>Rest of NSW</td><td>53</td><td>43</td><td>Rest-of-state areas</td></tr> <tr><td>Greater Sydney</td><td>54</td><td>38</td><td>Capital cities</td></tr> <tr><td>Greater Melbourne</td><td>55</td><td>35</td><td>Capital cities</td></tr> <tr><td>Rest of Queensland</td><td>58</td><td>45</td><td>Rest-of-state areas</td></tr> <tr><td>Rest of SA</td><td>59</td><td>42</td><td>Rest-of-state areas</td></tr> <tr><td>Greater Darwin</td><td>58</td><td>62</td><td>Capital cities</td></tr> <tr><td>Rest of WA</td><td>62</td><td>58</td><td>Rest-of-state areas</td></tr> <tr><td>Rest of Victoria</td><td>65</td><td>48</td><td>Rest-of-state areas</td></tr> <tr><td>Rest of NT</td><td>72</td><td>65</td><td>Rest-of-state areas</td></tr> </tbody> </table> <p>Legend: ● Capital cities ● Rest-of-state areas</p>	Region	Recruitment difficulty rate (%)	Recruitment rate (%)	Category	Greater Hobart	40	45	Capital cities	ACT	47	42	Capital cities	Greater Adelaide	48	45	Capital cities	Rest of Tasmania	48	48	Rest-of-state areas	Greater Brisbane	50	52	Capital cities	Greater Perth	52	51	Capital cities	Rest of NSW	53	43	Rest-of-state areas	Greater Sydney	54	38	Capital cities	Greater Melbourne	55	35	Capital cities	Rest of Queensland	58	45	Rest-of-state areas	Rest of SA	59	42	Rest-of-state areas	Greater Darwin	58	62	Capital cities	Rest of WA	62	58	Rest-of-state areas	Rest of Victoria	65	48	Rest-of-state areas	Rest of NT	72	65	Rest-of-state areas
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	3.3 – Precinct activation	5	<p>Strong positive</p> <ul style="list-style-type: none"> The inclusion of digital enablement, workforce accommodation, precinct transit system, Channel Island power plant upgrade and wastewater provides precinct proponents the option to utilise common-user infrastructure on a per use-basis instead of outlaying capital costs A combined indication from industry proponents, PWG and SMEs agree the project mix is welcomed by industry³³⁶ 																																																																

³³⁵ NSC, Recruitment Experience and Outlook Survey, 2021 and 2022

³³⁶ Industry survey feedback and specialist knowledge from PWG and SMEs

12.4 Appendix D – Project Working Group credentials

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

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- [REDACTED]
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[REDACTED]

12.5 Appendix E – Stakeholder Initial Feed back

Feedback to date from the various stakeholder groups has covered some key themes as outlined below.

Rationale and the economy

- Why are we focusing on a gas precinct when we have a commitment to net zero? Is there a better alternative for this land and for an economy and community solution?
- How will the activity of MASDP impact on the viability of Darwin Port activities and commercial sustainability?
- How will this project help to build better overall outcomes for Darwin, Darwin Harbour, our economy and community?
- Is there actually a commercial demand for this precinct?
- Economic opportunity – what opportunities will there be for the Territory businesses and industry? Do we need to diversify industry, how do we ensure that local industry has the capacity and capability to meet the opportunity needs?
- Workforce – what assurances are there that the focus will be on local workforce opportunity – and related training and development – rather than FIFO?

Social and cultural

- Sacred sites – how are we identifying and working with First Nation's people to protect? How will this precinct impact on Indigenous land and sea – cultural values, social, heritage – as well as economic opportunity.
- Traffic noise during and beyond construction – noise emissions and buffers also fall into this. Extra harbour traffic – safety and amenity.
- Impact on recreational use of the Harbour – safety and amenity – also including fishing from both a cultural and social perspective.
- From construction to operation – short- and long-term impact on the availability and cost of housing stock – to buy and rent.

Environmental

- The impact on Darwin's water supplies – where is the water coming from. How will we ensure the quality of the Darwin Harbour water?
- Marine ecosystems – how will construction, dredging programs and operations impact the marine ecosystems.
- Are we planning offsets and investing in technology that encourages and protects local habitats?
- Terrestrial Ecosystems – how many mangroves are being removed, what about other flora and fauna. Are protected species impacted and what are we doing in response.

Other

- How do we avoid the mistakes of the past? The Northern Territory Government does not have a good reputation as a proponent. There is little trust in the NTG as developers and in relation to transparency and accountability.
- Perceived lack of visibility about the project.
- Is Carbon Capture and Storage just a pipedream – and is it a deal breaker?
- What is the role of the approval holder? Who will be managing the precinct and accountable to its operations and performance within approved parameters?

12.6 Appendix F– Industry survey and aggregated responses



Ernst & Young Strategic Financials
Level 20, 75 Yorkdale Drive, Sydney
NSW 2013

Ernst & Young Global Limited
Level 20, 75 Yorkdale Drive
Sydney

Industry Consultation for Middle Arm Sustainable Development Precinct (MASDP) Infrastructure Australia Submission (IA)

The Northern Territory Department of Infrastructure, Planning and Logistics (DIPL) has engaged Ernst and Young (EY) to assist in preparing a Stage 2 IA submission for the MASDP development. Part of this engagement requires consultation with industry and potential proponents to gain perspective on the preferred long list infrastructure options in order to identify the most valued and impactful common-user infrastructure options. The engagement with stakeholders and subsequent options development will provide IA and DPIL with visibility on what industry requires and seeks when considering MASDP infrastructure.

You have been identified as a business with a potential interest in accessing land at Middle Arm in the MASDP.

We would be grateful for your time to inform this process. We will ask a few questions relating to the long list of common-user infrastructure options to understand which would have the greatest impact to your business operations. This list can be located on the pages following this letter. Questions will be related to a range of criteria including criticality of the infrastructure to your proposed operation and timing requirements.

The scheduled period for the consultations to take place on is from August 15 to August 17, 2022. We appreciate your time and effort required to respond to this request with your nominated contact.

Please note the purpose of this consultation is to obtain a view of the most in-demand common-user infrastructure from within industry and why. Responses received or insight obtained from this engagement does not imply or obligate DIPL to action based on this engagement.

For further information, contact:

[Redacted contact information]

[Redacted contact information]

MASDP Industry questionnaire

General questions:

1. What sector is your company and operations associated with? (State multiple if suitable)

2. What year are you intending to begin construction and for how long?

Year commencing: _____

Expected duration: _____

3. Please indicate your commissioning and operational timeframe

Year commencing: _____

Expected duration: _____

4. Please review the below list of common-user infrastructure options (1-14) below and indicate any missing you would like to be considered.

Suggestion 1: _____

Suggestion 2: _____

Table 38: Industry questionnaire



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Darwin 0800

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ey.com/au

Infrastructure questions, please fill in the table below:

#	Option description	Expanded description	Q5) What are the most beneficial common-user infrastructure options to your operations? (Please rank 1, 2, 3) if not beneficial, leave blank	Q6) What options (if any) are critical for your project business case to achieve FID? (Select CRITICAL options only)	Please provide any additional detail of requirements and comments
1	Common-user MOF: Appropriate dredging, and/or Modular offloading facility (MOF) and common user hardstand/laydown facility	<ul style="list-style-type: none"> • Dredging of harbour to allow Panamax vessels with all tide depth • Modular Offloading Facility • Marine side hardstand and lay down area of [x] hectares 			
2	Appropriate dredging, common-user product export jetties	<ul style="list-style-type: none"> • Dredging of harbour to allow Panamax vessels with all tide depth, and • Common user product export jetties 			
3	Co2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure - Underground manifold (series of pipes underground) for Co2 transmission and supporting infrastructure - capacity/open access control	<ul style="list-style-type: none"> • The manifold connects the supply of carbon to Petrel sub-Basin in the Joseph Bonaparte Gulf or Bayu Undan for carbon sequestration 			
4	Co2 for Inpex and Santos - Carbon capture utilisation and storage (CCUS) infrastructure - for Co2 transmission and supporting infrastructure - manifold to access	<ul style="list-style-type: none"> • The manifold connects the supply of carbon to Inpex (Petrel sub-Basin in the Joseph Bonaparte Gulf) and Santos (for Bayu Undan) for carbon sequestration 	DO NOT USE		
5	Digital subterranean cabling of precinct to support digital communications and automation	<ul style="list-style-type: none"> • Cabling of a fibre network loop around Middle Arm 			



Page 4

6	Power generation to Middle Arm proponents via a high load power extension of DKIS	Agnostic to renewable or non-renewable, this network would provide firm industrial load power to the fence of proponents. This option will provide an alternative to each proponent developing their own power station.			
7	Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen	Upgrade channel island power station and early offtake for hydrogen domestic supply			
8	Middle Arm specific industrial electrical network to transmit industrial green energy supply and secured supply of energy	(Similar to option 6 but standalone network with renewables) Middle arm specific high load and reliability electrical network independent of DKIS delivering firm renewable energy			
9	Desalination solution available for industry proponents	Middle Arm desalination plant to service additional demand beyond AROWS			
10	Wastewater treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure	Common user waste-water recycling, treatment and disposal facility able to accommodate expected waste from 'hybrid/mixed ecology' case			
11	Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g., line and track extension, railroad conveyor, *rail spur, unloading pit, rollingstock maintenance yard and provisioning facilities)	<ul style="list-style-type: none"> • Rail spur to MASDP • Siding at middle arm to enable material offloading • Common user land side facility which includes hardstand and lay down areas and tanks. 			
12	Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor	<ul style="list-style-type: none"> • Primary industrial roads connecting the proposed MOF and CULF Killyhawk Road • Spitfire western access road • Channel Island Road upgrades • Road link across infill • Services corridor 			

13	Worker's accommodation to enable MA workers (residential land release and costs)	* Middle arm specific (but not necessarily at MA) workers accommodation solution			
14	Beneficial re-use of dredge soil for additional economic land	Potential activation of strategic developable land - dredge			

Table 39: summary of responses

	Industry proponent 1 – Green energy products	Industry proponent 1 – Green energy products	Industry proponent 3 – Hydrogen	Industry proponent 4 – Hydrogen	Industry proponent 5 – Gas production	Industry proponent 6 – Green energy products
Modular Offloading Facility (MOF): Appropriate dredging, and/or MOF and common user handstand/laydown facility	5	2	2	2	3	2
Product export jetties	3	3	3	3	2	1
Co2 Common user - Carbon capture utilisation and storage (CCUS) infrastructure – Underground manifold (series of pipes underground) for Co2 transmission and supporting infrastructure - capacity/open access control			4			
Digital subterranean cabling of precinct to support digital communications and automation		11	10	4		3
Middle Arm specific industrial electrical distribution network to transmit industrial green energy supply and secured supply of energy	4	1	9	5		
High capacity, networked power distribution to Middle Arm connected to DKIS		10	11		6	
Upgrade Channel Island power station turbines to accommodate both natural gas and hydrogen	6	9	5	10	4	
Water desalination solution available for industry proponents	2	4	13	-		
Wastewater handling: collection, treatment, recycle and disposal plant able to receive wastewater, treat (recycle) and discharge common-user infrastructure	1	5	1			
Gas pipeline into Middle Arm for proponents to access						
Rail infrastructure - Build upon existing rail lines and connection into East Arm precinct (e.g., line and track extension, railroad conveyor, "rail spur, unloading pit, rolling stock maintenance yard and provisioning facilities)			6	6	1	
Supporting transport infrastructure required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor	7	6	7	7	5	2
Shared workforce transport / transit system – including parking and connections to worksites	8			8		
Worker's accommodation to enable MA workers (residential land release and costs)		8	12	9		
Local emergency response infrastructure – local fire station / medical clinic / EMS	9	7	8		7	
Beneficial re-use of dredge soil for additional economic land			14			

12.7 Appendix G – Methodology and Assumption

Benefit – Land leasing

Description

The benefits for all program packages, including the base case, as the scale of land development remains constant. The benefit is applied as a conservative benchmark. The total land leasing value is appreciated or depreciated based on each program's cumulative common user infrastructure variation. To be conservative, assumptions of 25% and 20% decreasing in land value are applied in Program 1 and Program 3 to reflect the less land leasing benefit received as the result of less common user infrastructure in these Programs.

A \$15 per square meter calculation is used to calculate the land value in Base Case which is the current highest industrial land leasing price in Darwin based on the information from real estate agents.

The annual land leasing revenue is calculated based on a fixed 5% leased yield of total land value, where the total land value is determined by size of leasing land per year and the value of land per unit, these inputs are forecasted by DIPL.

General formula

Annual lease revenue = Total hectare of leasing land each year × the value per hectare × rental yield (5%) × percentage of land value variation based on program.

Input

- Total hectare of leasing land is calculated based on the size of land required by each project and also reflects the different starting time of each project. The size of leasing land for each project is assumed to stay the same during the 50-year forecasting period.

The MOF benefits are calculated based on conservative assumptions of a 2% annual growth rate in charge fee and a 5% annual increase in MOF requirements and the number of ships visiting. These growth rates could increase as the proponent's activities and productivity increase.

Benefit - MOF

Description

The annual wharfage revenue is calculated based on the total size of MOF import requirements and wharfage charge, the port due revenue, berthage revenue and pilotage revenue is generated based on the annual total number of visiting ships of different projects and charged for a fee, per unit. The calculations also take into account a 5% annual growth rate in fees, and 10% annual increasing rate of MOF demands, as the increase of productions and further development of different projects in Middle Arms precinct. The MOF revenues are estimated using the equation below. This approach is in line with the methodology used by DIPL.

General formula

Annual MOF revenue = Wharfage revenue + Port due revenue + Berthage revenue + Pilotage revenue.

- Wharfage revenue = Total cubic meters of MOF import requirements per year \times Wharfage fee per cubic meter $\times (1 + \text{increasing rate on fee per year})^{\text{forecast years}}$.
- Port due revenue = Total number of visiting ships per year \times Gross tonnes per ship \times Port due fee per gross tonne (large vessels > 20,000GT) $\times (1 + \text{fee increasing rate per year})^{\text{forecast years}}$.
- Berthage revenue = Total number of visiting ships per year \times Average hours at berthage per ship \times MOF berthage fee per hour $\times (1 + \text{increasing rate on fees per year})^{\text{forecast years}}$.
- Pilotage revenue = Total number of visiting ships per year \times Pilotage fee per call + Total number of visiting ships per year \times Gross tonnes per ship \times Port due fee per gross tonne (large vessels > 4,500GT) $\times (1 + \text{increasing rate on fees per year})^{\text{forecast years}}$.

Input

- Total cubic meters of MOF import requirements are calculated by summarising the size required by each project per year, the annual volume also takes account the different starting time of each project. A 10% annual increasing rate of MOF import requirement demand is applied through the 50-year forecasting period.
- Total number of visiting ships is calculated by summarising the size required by each project per year and reflects the different starting time of each project. A 10% annual increasing rate of MOF import requirement demand is applied through the 50-year forecasting period.

Benefit – Jetties

The CBA Jetties benefits include incomes from wharfage, Port due, berthage and pilotage and is estimated using input from DIPL. The annual wharfage revenue was calculated based on the total amount of annual bulk and liquid throughput and fee was charged per unit of bulk and liquid respectively. The port due revenue, berthage revenue and pilotage revenue were generated based on the annual total number of ships required based on the annual bulk and liquid throughput separately and fees were charged per ship call. The Jetties revenues are estimated using the equation below.

General formula

Annual Jetties revenue = Wharfage revenue + Port due revenue + Berthage revenue + Pilotage revenue.

- Wharfage revenue = (Total million tonnes of bulk product throughput \times Bulk fee per million tonnes) + (Total million kilolitres of imported liquid throughput \times liquid import charge per million kilolitres) + (Total million kilolitres of exported liquid throughput \times liquid export charge per million kilolitres).
- Port due revenue = Total number of visiting ships per year \times Gross tonnes per ship \times Port due fee per gross tonne (large vessels > 20,000GT).
- Berthage revenue = Total number of visiting ships per year \times Average fixed berthage charge per ship + Total number of visiting ships per year \times Gross tonnes per ship \times Berthage charge per gross tonne.
- Pilotage revenue = Total number of visiting ships per year (bulk ships and liquid ships) \times Pilotage fee per call + Total number of visiting ships per year (bulk ships and liquid ships) \times Gross tonnes per ship \times Port due fee per gross tonne ship (large vessels > 4,500GT).

Input

- Total million tonnes of bulk product throughput are calculated by summarising the million tonnes of bulk product throughput by each project per year, the total volume also takes account different starting time of each project. A 10% annual increasing rate of MOF import requirement demand is applied through the 50-year forecasting period.

- Total million kilolitres of liquid throughput for import and export are calculated by applying the same methodology as total million tonnes of bulk product throughput above.
- Total number of visiting ships for import and export are calculated by dividing the total bulk and liquid throughput by the bulk and liquid cargo capacity respectively.

Benefits – Road

Road infrastructure development includes several roads required for marine development connectivity with industrial parcels roads and services to MOF and Export Jetty and services corridor.

Benefit – Precinct Roads

This infrastructure is an integral part of supporting the development of other infrastructure. No direct income will be generated from the road infrastructure, but the infrastructure does increase the program's benefits which will be reflected as a part of land leasing benefit.

Benefit - Power networks

The power network infrastructure is essential to support the development of the precinct. The benefits from power networks included two components, the daily system access fee and the demand charges for power usages during peak demand hours. The assumptions and methodology are developed based on the Network Pricing Proposal 2022-2023 of Power and Water³³⁷.

General formula

Power networks revenue = The system access revenues + Demand charge revenue.

- The system access revenues = Daily system access fee × The number of days per year × (1+The annual growth rate) ^The forecasting year × The number of projects per year.
- The annual power usages of projects assumptions are made based on inputs from DIPL's engineering team.

Benefit – Digital networks

The digital network is a commonly used critical infrastructure for industry operations. Benefits associated from digital network accessibility will be calculated based on a 4.4% percentage of the capital costs. This indicative assumption is aligned with the percentage of access revenues contributed to line access charges stated in AARNet Annual Report 2021³³⁸.

- Digital network revenue = Total capital costs × percentage of the capital costs.

Input

- The percentage of the capital costs assumption is aligned with the percentage of access revenues contributed to line access charges stated in AARNet Annual Report 2021³³⁹.

Benefits – CCUS

The CCUS supporting infrastructure strongly aligns with the sustainability objectives and outcomes of the project, supporting the Territory's transition and precinct proponent's products towards a net zero target. The supporting CCUS infrastructure benefit is expected to be \$3,005 and \$589 million on NPV terms. To avoid double counting, the

³³⁷ Power and Water Corporation -Power Services- Extra of Network Pricing Proposal 2022-23 (powerwater.com.au)

³³⁸ ARNet Annual Report 2021

³³⁹ ARNet Annual Report 2021

CCUS benefits associated with revenues only count the income generated from accessing the pipelines of CCUS as this infrastructure only includes channels, and the industries will develop other facilities themselves. It is calculated based on the percentage of total CO2 emissions that are transported through the pipelines, and the fee charged to access the pipelines.

Additionally, CCUS technology unlocks a range of benefits difficult to quantify. The most significant non-quantifiable benefits are associated to CCUS' contribution to the macro circular economy.

General formula

CCUS benefit = Total tonnes of annual CO2 emissions from industries × Percentage of CO2 transported through the pipelines × Pipelines access fee per tonnes of CO2 emission.

Input

- Total annual CO2 emissions from industries are calculated by summarising the annual CO2 emissions by each project per year, the total volume also takes into account different starting time of each project.
- The percentage of CO2 captured by CCUS is assumed to be 90% which is indicated in IEA's CCUS In the Transition to Net-Zero Emissions report³⁴⁰.

Benefits – Shared workplace transit system

The shared workplace transit system revenue is part of worker support infrastructure to enable available transit systems to support the development of Middle Arm and associated industries. The benefits generated from the shared workplace transit system are quantified through car parking revenue, calculated based on Darwin's average fixed daily parking fee and the number of car parks required for workers. Including a contingency of an extra 20% of car spaces for other purposes such as guest car parks, company vehicles, etc. it also takes account the car parks filling rate.

General formula

Shared workforce transport/ transit system benefits = Number of car parks × Car parks filling rate × Average parking fee in Darwin.

Input

- The total car parks are calculated based on the potential jobs stated in Middle Arm Sustainable Development Precinct report 2022³⁴¹. To be conservative, it assumed the car parking spaces only around 30% of total 11,000 jobs stated in the report. Considering the small percentage applied, the car park filling rate is assumed to be 100%
- The average parking fee in Darwin assumption is based on online research of City Parking in Australian Capital Cities³⁴².

Benefit –land releasing for workers' accommodation

The precinct will attract a large amount of skilled workforce required to relocate to the Territory to support the construction of the Middle Arm Precinct and industry development. Based on the information from the Middle Arm Sustainable Development Precinct report 2022³⁴³, a total of 11,000 new jobs will be created through the development of Middle Arm by 2030, which will require residential accommodation. However, Darwin has limited

³⁴⁰ CCUS in clean energy transitions (windows.net)

³⁴¹ Power and Water Corporation -Power Services- Extra of Network Pricing Proposal 2022-23 (powerwater.com.au)

³⁴² City Parking Rates in Australian Capital Cities | Savings.com.au

³⁴³ Middle Arm Sustainable Development Precinct | Department of Infrastructure, Planning and Logistics

available housing³⁴⁴. Therefore, the land release for workers' accommodation plays a vital role as a support infrastructure to enable the development of the MASDP Project and industries.

The revenue from land release within the precinct contributes \$410 million, or \$96 million, on an NPV term to Programs 2 and 4. To be conservative, the revenues are calculated based on the assumption that only 70% of total new workers will lease the accommodations resulting from this land-releasing area. The land leasing price per lot is 3% of the current market asset value, which is aligned with NT's Lease of Crown Land Policy³⁴⁵.

General formula

Worker's accommodation land leasing benefit = Number of new accommodations × land leasing fee per lot.

Input

- This number of new accommodations is calculated based on the number of 4 bedrooms accommodations required based on the number of new potential jobs. To be conservative, it assumed that there are only 70% of these new employees will require new accommodation. It also takes into account the current available accommodation in Darwin and assumes this current accommodation will be filled first.
- The land leasing fee is based on the Darwin median house price and percentage of land leasing yield, the assumptions and approach are aligned with Lease of Crown Land Policy³⁴⁶.

Benefits – wastewater treatments

The wastewater treatment facility will provide a complete packaging wastewater service, including collection, treatment, recycling, and discharge. Therefore, the wastewater treatment revenues will include a fixed annual connecting charge and package charge, calculated based on the wastewater volume. The approach used to quantify the revenue from wastewater treatment system is derived from the Hunter Water's Pricing of Water, Wastewater and Stormwater Services Technical Paper ³⁴⁷.

General formula

Wastewater system benefits = Fixed annual connecting revenues and wastewater treatments package revenues.

- Fixed annual connecting revenues = Fixed annual connecting fee × The total number of proponents × Percentage of proponents who will use this common wastewater system.
- Wastewater treatments package revenues= Total water used in Middle Arm Precinct by industries × Percentage of water used required treatment × Wastewater treatments package fee per unit of wastewater.

Input

- These inputs and assumptions are made based on information from Pricing of Water, Wastewater and Stormwater Services published by Hunter Water³⁴⁸.

³⁴⁴ Dwelling type | City of Darwin | Community profile (id.com.au)

³⁴⁵ Leases of Crown Land Policy (nt.gov.au)

³⁴⁶ Leases of Crown Land Policy (nt.gov.au)

³⁴⁷ technical-paper-08-pricing-of-water-wastewater-and-stormwater-service.pdf (nsw.gov.au)

³⁴⁸ Leases of Crown Land Policy (nt.gov.au)

- The amount of water used in Middle Arm Precinct is based on the forecast by PWC³⁴⁹.

Benefit – Channel Island

No direct revenue will be generated from this infrastructure, but the infrastructure does increase the program's benefits which will be reflected as a part of land leasing benefits.

Benefits – Environmental benefits

The environmental benefits are calculated based on the volume of CO2 emissions reduced resulting from CCUS and green power network infrastructure development. The monetised environmental and social benefit realised is calculated on the volume of CO2 emissions reduced from operational industries, the costs based on the forgone CO2 emissions. To avoid double counting, the environmental benefits do not include the fee for transporting CO2 emissions through the pipelines under CCUS infrastructure. The benefits include two components. The benefit is generated from the program by avoiding costs of CO2 emission to the environment and society as the result of providing green power to some potential proponents, such as solar power. Another benefit is the reduction of CO2 emissions through CCUS infrastructure by collecting the emissions from gas users.

General formula

Environment benefits = Avoiding costs of CO2 emissions from green energy supply + Reduction of CO2 emissions through CCUS infrastructure.

- Avoiding costs of CO2 emissions from green energy supply = The CO2 emissions avoid through green energy supply × the costs to social and environment per tonnes of CO2 emissions.
- Reduction of CO2 emissions through CCUS infrastructure= Reduction of CO2 emissions through CCUS infrastructure× the costs to social and environment per tonnes of CO2 emissions.

Input

- The inputs of CO2 reduction through CCUS and power networks based on information obtained from DIPL.
- The costs of CO2 emissions to environment and social is made based on online research.

12.8 Appendix H – Rapid CBA assumptions

Table 40: Rapid CBA assumptions

Description	Unit	Assumption	Source
MACRO			
Project start	Year	June 2023	DIPL
Project finish	Year	June 2073	DIPL
Forecast Period	Years	50	DIPL
Discount rate	% (real)	7.0	IA
Total number of potential proponents	#	11	DIPL
MOF Benefits			
Total MOF requirement	M3	1,339,715	DIPL
Total MOF ship calls	#	55	DIPL

³⁴⁹ Adelaide River Off-stream Water Storage Project detailed business case (nt.gov.au)

Description	Unit	Assumption	Source
Gross tonnage per call	GT	26,500	DIPL
Time at berthage per call	Hours	6	DIPL
Wharfage charge	AUD\$/m3	13	DIPL
Port dues based on ship calls (Large vessels > 20,000GT)	AUD\$/GT ships	0.032	DIPL
MOF berthage charges	\$/hour	759	DIPL
Pilotage fees, fixed minimum charge	AUD\$/call	1,783	DIPL
MOF requirements annual growth rate	%	5%	Estimated in discussion with DIPL
MOF ships calls annual growth rate	%	5%	Estimated in discussion with DIPL
Growth rate of fee charged	%	2%	Estimated in discussion with DIPL
Jetties Benefits			
Bulk liquid fuels	Tonnes	30,000	DIPL
Bulk throughput	Kilolitres	72,455	DIPL
Cargo capacity - bulk	GT	26,500	DIPL
Cargo capacity - liquids	Hours	6	DIPL
Bulk products (import/export)	AUD\$/tonne	6	DIPL
Bulk liquid fuels (import)	AUD\$/kilolitre	6	DIPL
Bulk liquid fuels (export)	AUD\$/kilolitre	8	DIPL
Fixed charge- Berthage& moorings	AUD\$/call	2,134	DIPL
Berthage charge per GT	AUD\$/gross tonnage of ship	0.32	DIPL
Port dues based on ship calls (Large vessels > 4500GT)	AUD\$/GT of ship	0.32	DIPL
Land Lease Revenue			
Size of land	Ha	743	DIPL
Land value- Project Case	\$/m2	40	DIPL
Land value-Base Case	\$/m2	15	O'Donoghue's first nation
Lease yield	%	5%	DIPL
CO2 Emission Revenue- CCUS Pipelines			
CO2 emissions	Tonnes/Year	3,285,000	DIPL
Percentage of CO2 emission transported through CCUS pipelines	%	90%	CCUS in clean energy transitions (windows.net) from IEA
Pipelines access fee	USD\$/tCO2	35	Is carbon capture too expensive? – Analysis - IEA
Power Network Revenue			
Average power usage per project	MW hr/year	2,102,400	DIPL

Description	Unit	Assumption	Source
Number of hours in peak demand period	Hours	9	Number of Hours from 12pm to 9pm
Power throughput precinct charge- Daily system access charge	AUD \$/day/ NMI	85	Power and Water Corporation -Power Services- Extra of Network Pricing Proposal 2022-23 (powerwater.com.au)
Demand charge	AUD\$/KVA	8	Power and Water Corporation -Power Services- Extra of Network Pricing Proposal 2022-23 (powerwater.com.au)
Growth rate of fee charged	%	2%	Estimated in discussion with DIPL
Digital Networks Benefits			
Digital revenue % of total digital capital costs	%	4.4%	Based on the access revenue % PPE assets stated in Primex Manufacturing Inc's report
Shared Workforce Transit System Revenue			
Total number of parking required by employees	#	1,409	Estimated in discussion with DIPL On a conservative basis, 25% of 11,000 new potential new jobs are forecasted in MASDP Final Report
Percentage of additional car parks	%	20%	Estimated in discussion with DIPL On a conservative basis, 20% of additional car parking spaces are needed for other using purpose (e.g. guests parking, company vehicles etc)
Land Releasing Revenue			
Total current available accommodation	#	1,409	Based on the unoccupied dwellings in 2021 from City of Darwin
Total number of potential employees require accommodation	#	700	11,000 new potential new jobs are forecasted in MASDP Final Report, 70% employees need accommodation which is estimated in discussion with DIPL on a conservative basis
Average bedrooms per accommodation	#	4	2016 Darwin City, Census All persons QuickStats Australian Bureau of Statistics (abs.gov.au)
Median house price in Darwin	AUD\$	583,750	Housing - Northern Territory Economy
Land leasing yield % market housing price	%	3%	Leases of Crown Land Policy (nt.gov.au)
Wastewater system benefits			
Total water usage	ML	27,000	Adelaide River Off-stream Water Storage Project detailed business case (nt.gov.au)
Percentage of wastewater out of total water used	%	40%	Based on percentage of wastewater out of total raw water used stating in Water for Hydrogen – GHD
Percentage of proponents use common wastewater treatment system	%	50%	Estimated in discussion with DIPL

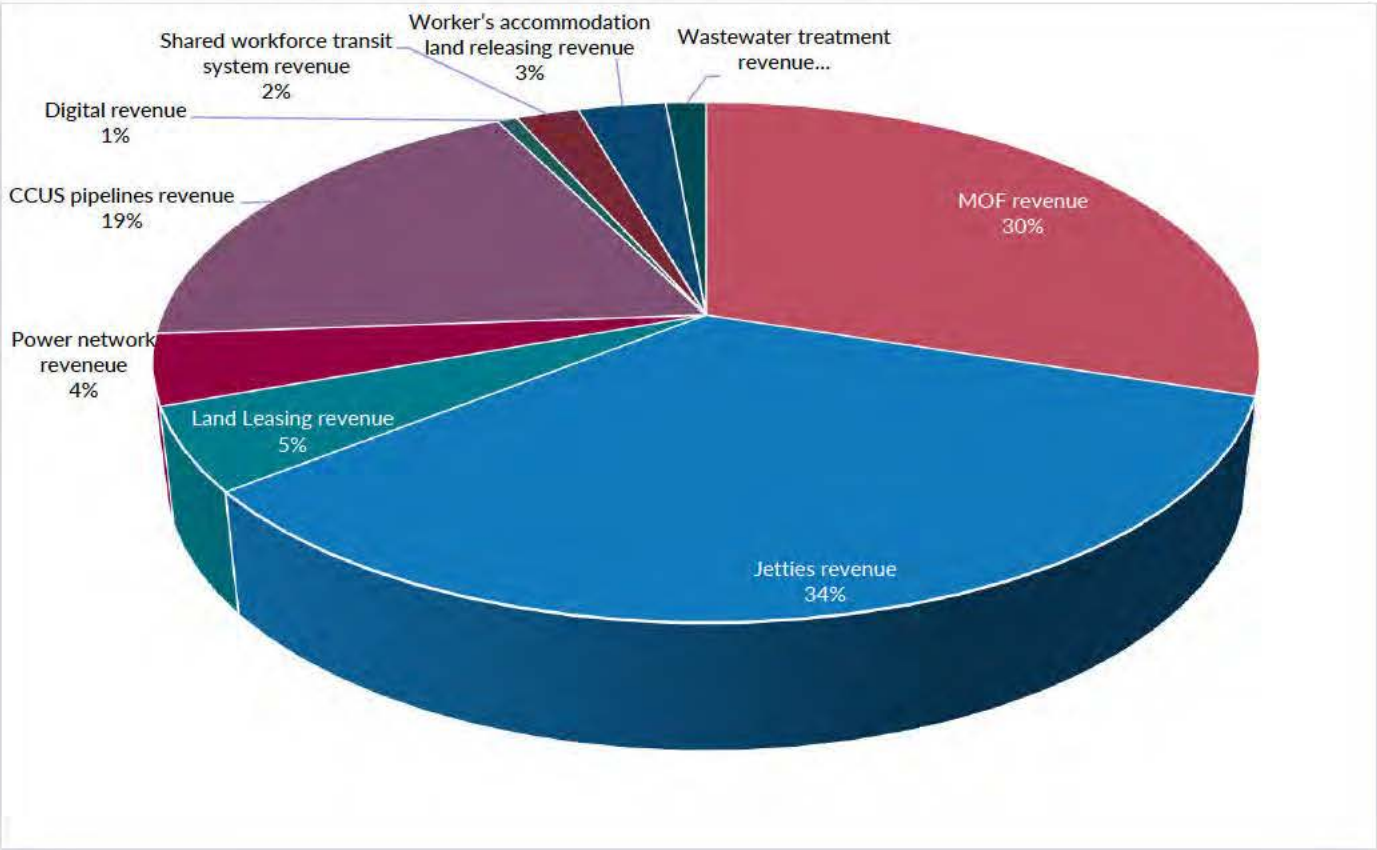
Description	Unit	Assumption	Source
Average connection charge	AUD\$	762	Hunter Water's Pricing of Water, Wastewater and Stormwater Services Technical Paper
Wastewater treatment package charge (collection, treatment, recycle and discharge)	AUD\$/KL	0.45	Hunter Water's Pricing of Water, Wastewater and Stormwater Services Technical Paper
Environment Benefits			
Avoid CO2 emissions from using solar power	Tonnes/year	132,926	prior public and engineering reports related to the potential industries. A range of Subject Matter Experts (SME) within DPIL's engineering department were consulted to support the assumptions
Reduction of CO2 emissions from using CCUS	Tonnes/year	2,956,500	DIPL
Emission costs to social and environment	AUD	50	The true cost of carbon pollution - Environmental Defence Fund (edf.org)

12.9 Appendix I – Benefit result summary

Table 41: Benefit Result Summary

Descriptions	Base case	Program 1	Program 2	Program 3	Program 4
Total benefits (AUD\$m, real)	255	11,815	23,604	12,752	23,813
Total present value of benefits (AUD\$m, PV)	61	1,815	3,992	1,968	4,035
Net benefit relative to Base Case (AUD\$m, real)		11,357	18,786	12,293	18,995
Net present value of benefits relative to Base Case (AUD\$m, PV)		1,754	3,931	1,907	3,974

Figure 36: Benefits profile by the benefits type



12.10 Appendix J – Capex Costs

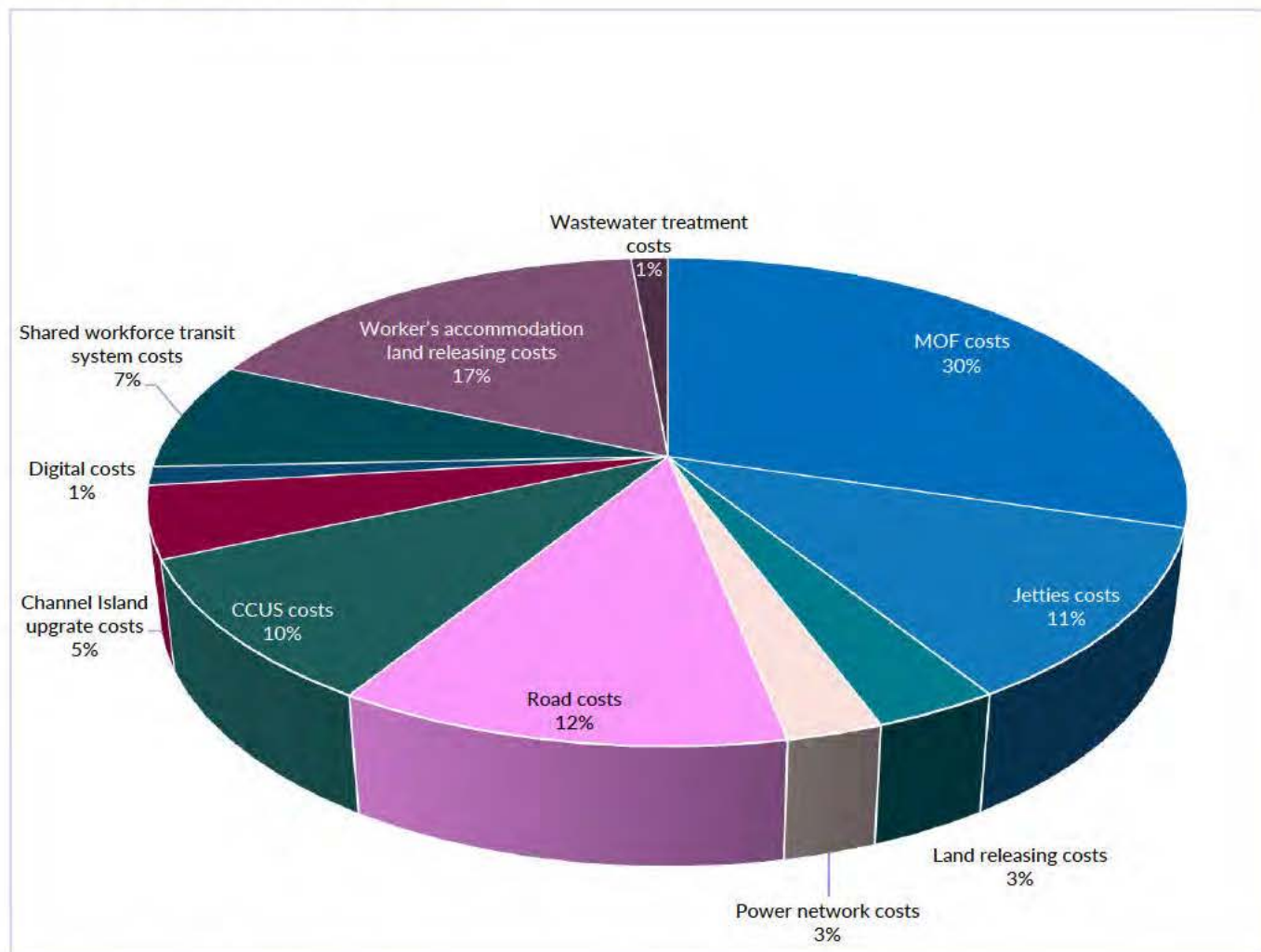
Table 42: P50 capital costs summary

Descriptions	Base case	Program 1	Program 2	Program 3	Program 4
Capex (AUD\$m, real) – P50	119	2,117	3,552	2,166	3,601
Present value of capex (AUD\$m, PV) – P50 ³⁵⁰	100	1,788	3,001	1,830	3,043
Net capex relative to base case (AUD\$m, real) – P50		1,998	3,433	2,047	3,483
Net capex relative to base case (AUD\$m, PV)- P50		1,688	2,901	1,729	2,942

Figure 37 illustrates the percentages of total capital costs contributed by each infrastructure option, where all the infrastructure options have been considered. The marine infrastructure (MOF and Jetties) are the main drivers of the total capital costs, accounting for 41% of total capex. The scale of these infrastructure options primarily drives the high costs to meet the high demands required by potential proponents.

³⁵⁰ Discounted at 7% per annum over a 50-year appraisal period

Figure 37: P50 Capex profile by infrastructure



Opex and maintenance capex

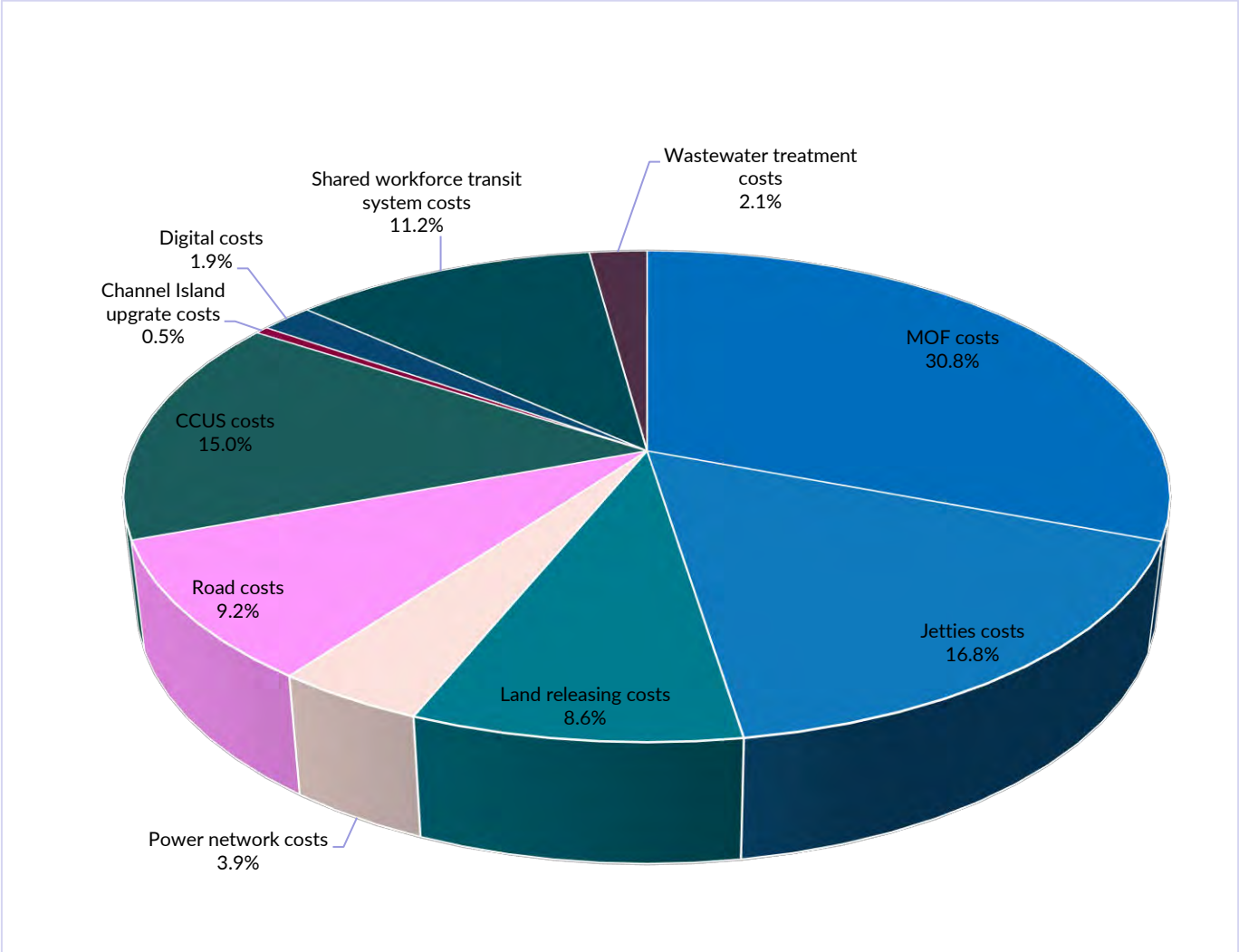
Total operational and maintenance costs commence from the operating period FY2028. The core economic appraisal results are forecasted on a year-by-year basis for each infrastructure option, through the appraisal period and presented using P50 costs, discounted at 7% per annum back to the end of FY2023 over a 50-year appraisal period. The operational costs based on the assumption that all the infrastructure will be continuously operating throughout the appraisal period.

Table 43: Opex and maintenance summary

Descriptions	Base case	Program 1	Program 2	Program 3	Program 4
Opex (AUD\$m, real) – P50	273	2,208	3,126	2,276	3,194
Present value of opex (AUD\$m, PV) – P50	66	535	755	551	772
Net opex relative to base case (AUD\$m, real) -P50		1,935	2,852	2,003	2,920
Net opex relative to base case (AUD\$m, PV) – P50		468	689	485	705

Figure 38 illustrates the percentages of total operational costs contributed by each infrastructure option where all the infrastructure options are considered. The marine infrastructure (MOF and Jetties) are the main drivers of the opex, which accounts for 47% of the total operational costs. As a result of high demands, the increased usage frequency of marine infrastructure would likely result in high operating and maintenance costs.

Figure 38: P50 Opex Profile by infrastructure



12.11 Appendix K – Real value of benefits and costs results summary

Table 44: Real value of benefits and costs results summary

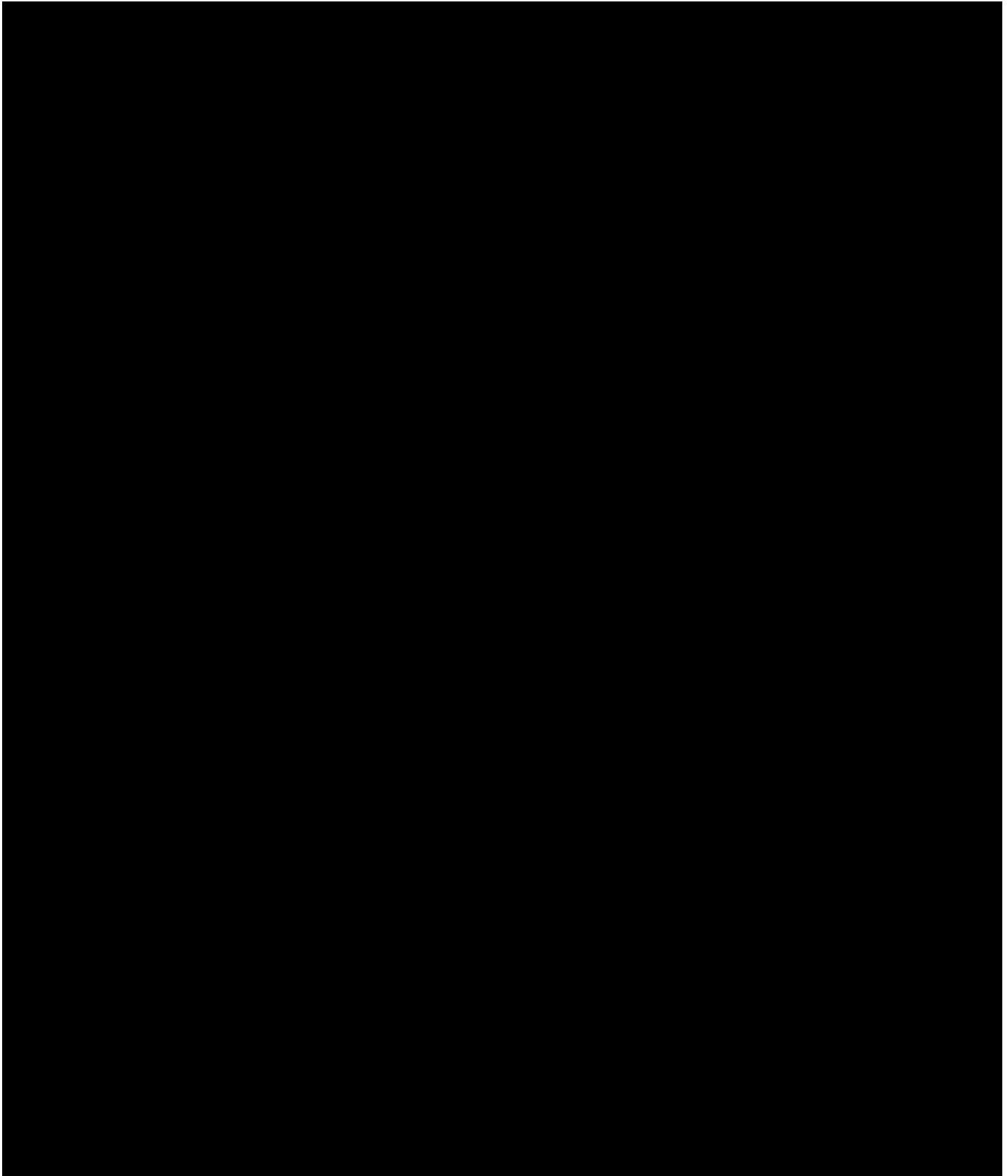
Description	Base case	Program 1	Program 2	Program 3	Program 4
Total benefits (AUD\$m, real)	255	11,815	23,604	12,752	23,813
Total costs (AUD\$m, real) – P50 ³⁵¹	392	4,325	6,678	4,442	6,795
Net value (AUD\$, real)	(137)	7,491	16,926	8,309	17,018
Net value relative to base case (AUD\$, real)		7,628	17,064	8,447	17,156

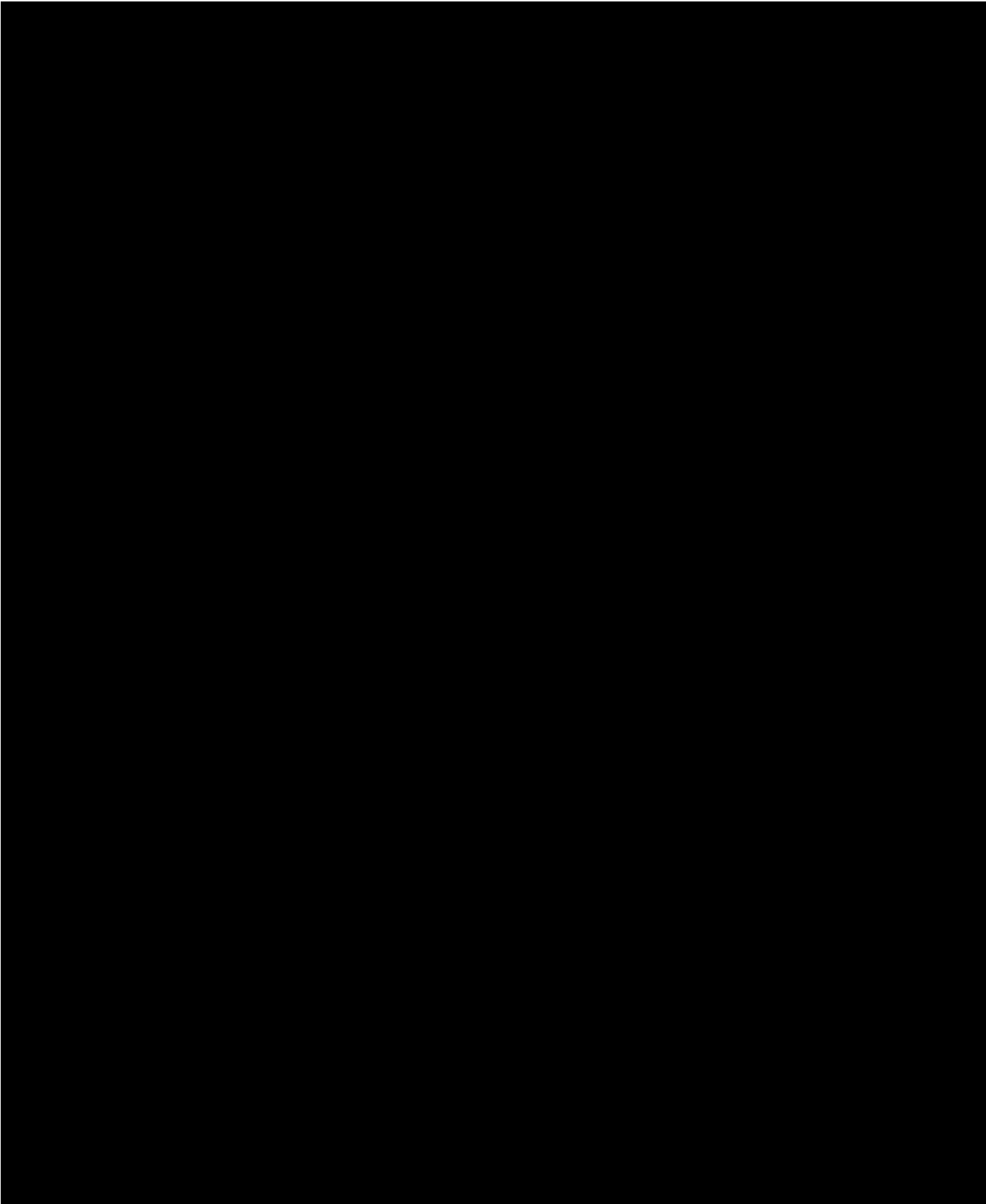
³⁵¹ The present value includes both opex and capex

12.12 Appendix L – Middle Arm Sustainable Development Projects

	Project	Inputs	Outputs	Related Projects
1	Carbon capture and storage common-user hub	Waste or by-product streams from SMR and other hydrocarbon processes	Carbon dioxide	Output of Blue Hydrogen Feedstock to Methanol export plant Feedstock to Urea
2	Liquified Natural Gas (LNG) Train	Natural gas	Liquified natural gas, carbon dioxide (nitrogen, helium and natural gas liquids as potential by-products)	All except lithium and phosphoric acid.
3	Blue Hydrogen	Natural gas, water	Hydrogen Carbon dioxide	Feedstock to Methanol export plant Feedstock to Ammonia export plant
4	Green Hydrogen	Renewable energy, water	Hydrogen	Feedstock to Methanol export plant Feedstock to Ammonia export plant
5	Ammonia export plant	Hydrogen, Zinc Oxide and air (Nitrogen)	Ammonia, Zinc Sulphide	Output of Hydrogen Feedstock to Urea
6	Methanol export plant	Hydrogen, carbon dioxide OR synthesis gas	Methanol, water	Feedstock from Hydrogen
7	Condensate refinery	Condensate, water, gas, renewable energy	Gasoline, Kerosene, Diesel, Marine, Heavy	
8	Phosphoric acid production facility	Phosphate rock, sulphuric acid	Phosphoric acid, calcium sulphate (gypsum)	Output of Ammonia export plant to produce fertiliser products
9	Ethane cracker	Ethane, propane	Ethylene	
10	Urea	Ammonia, carbon dioxide	Urea	Feedstock from Ammonia export plant Feedstock from Carbon capture and storage common-user hub
11	Lithium Hydroxide	Lithium carbonate, calcium hydroxide	Lithium hydroxide	

12.13 Appendix M – Letters of support from possible proponents





Tamboran Resources

110-112 The Corso
Manly, NSW 2095



5 October 2022

Infrastructure Commissioner of the Northern Territory
Infrastructure NT
Department of Infrastructure, Planning and Logistics
Northern Territory Government
Floor 7, Charles Darwin Centre, Smith Street Mall, Darwin NT

Dear [REDACTED]

Thank you for the opportunity to express Tamboran's support for common-user facilities in the proposed Middle Arm Sustainable Development Precinct (MASDP) in Darwin. The proposed precinct is an integral part of Tamboran's aim to maximise the benefits to the Northern Territory from the Beetaloo Basin development: it provides long-term high value jobs to the local workforce; it enables direct economic benefit to local communities and the Northern Territory Government; it facilitates the development of a secure low-carbon energy source to allow global communities an orderly transition towards net-zero carbon aspirations; it provides a new source of gas to stabilise the east-coast energy shortage. The MASDP is a key element to the Northern Territory and Australia managing a stable and cost-efficient transition towards net-zero carbon commitments.

Tamboran Resources Limited (Tamboran) is a next-generation gas producer with a vision of supporting the net-zero carbon energy transition in Australia through developing the low CO₂ gas resource in the Beetaloo Basin. Tamboran is listed on the Australian Stock Exchange (ASX:TBN), and is the owner and operator of the largest and most advanced project within the basin. Our global management team holds deep experience in the successful commercialisation of unconventional gas throughout North America and is complemented by domestic expertise and industry leading community relationships. Tamboran is committed to moving rapidly to finalise appraisal and commit to a pilot development to deliver gas to the NT and east coast domestic markets. Tamboran is in discussions with local gas customers with operations in the Northern Territory. We have a binding gas sales agreement with Origin Energy Ltd, the largest gas retailer in Australia, for 100TJ/d and a binding MOU with Jemena Ltd to transport this gas along their Northern Gas Pipeline. We anticipate our first sales under these agreements in 2025.

The initial gas production from Tamboran's fields will flow along existing pipelines to supply the local market and the east-coast market which is currently facing a gas shortfall next year. However, this existing infrastructure cannot accommodate the large volumes that the market requires, which could reach 1,000-2,000TJ/d by the end of this decade - and new pipelines to the east-coast and/or a new pipeline and new gas demand in Darwin is required: new demand in Darwin, such as a new LNG facility in the MASDP, would be a geographically and economically advantaged destination for Beetaloo gas. Therefore, Tamboran proposes to construct new LNG facilities in the MASDP as part of a broader integrated project which also

includes development in the Beetaloo Basin and a large diameter pipeline connecting the Basin to industries in the MASDP.

Common-user facilities in the MASDP are important to create stakeholder support, to minimise public and environmental impacts, and to drive economic efficiencies. Tamboran applauds the foresight of the Northern Territory Government to propose the MASDP and the efficient common-access approach to key utilities. Access to key utilities, such as power, water, waste systems, and transport infrastructure streamline our development proposal by creating synergies with other users and minimising the environmental impact. Because Tamboran is committed to being a net-zero carbon gas producer we are constantly pursuing opportunities to reduce our carbon footprint: common-user facilities in the MASDP allow us to do this by reducing demand and overspend, and through access to a common power supply which could be connected to a renewable generation source.

The Beetaloo Basin has the ability to rebuild the Northern Territory economy, to transform Northern Territory communities, and to underpin a stable east-coast and global transition to meet its net-zero carbon commitments. The MASDP, and associated common-user facilities, are a core enabler for the success of the Basin. Tamboran has been actively engaged with local and international institutional investors and has received consistent feedback that Governmental and Departmental support for new LNG facilities in the MASDP is viewed very favourably in their decision making to finance projects. If Infrastructure Australia supported the common-user infrastructure in the MASDP, and Tamboran is awarded land in the Precinct, then we feel confident - subject to the standard Final Investment Decision review process - that we could secure funding for the project.

Tamboran sees significant economic and intangible value in the development of common-user facilities in the MASDP, and strongly supports this application.

Please contact me directly [REDACTED] if you would like further information.

Sincerely,



Managing Director & CEO

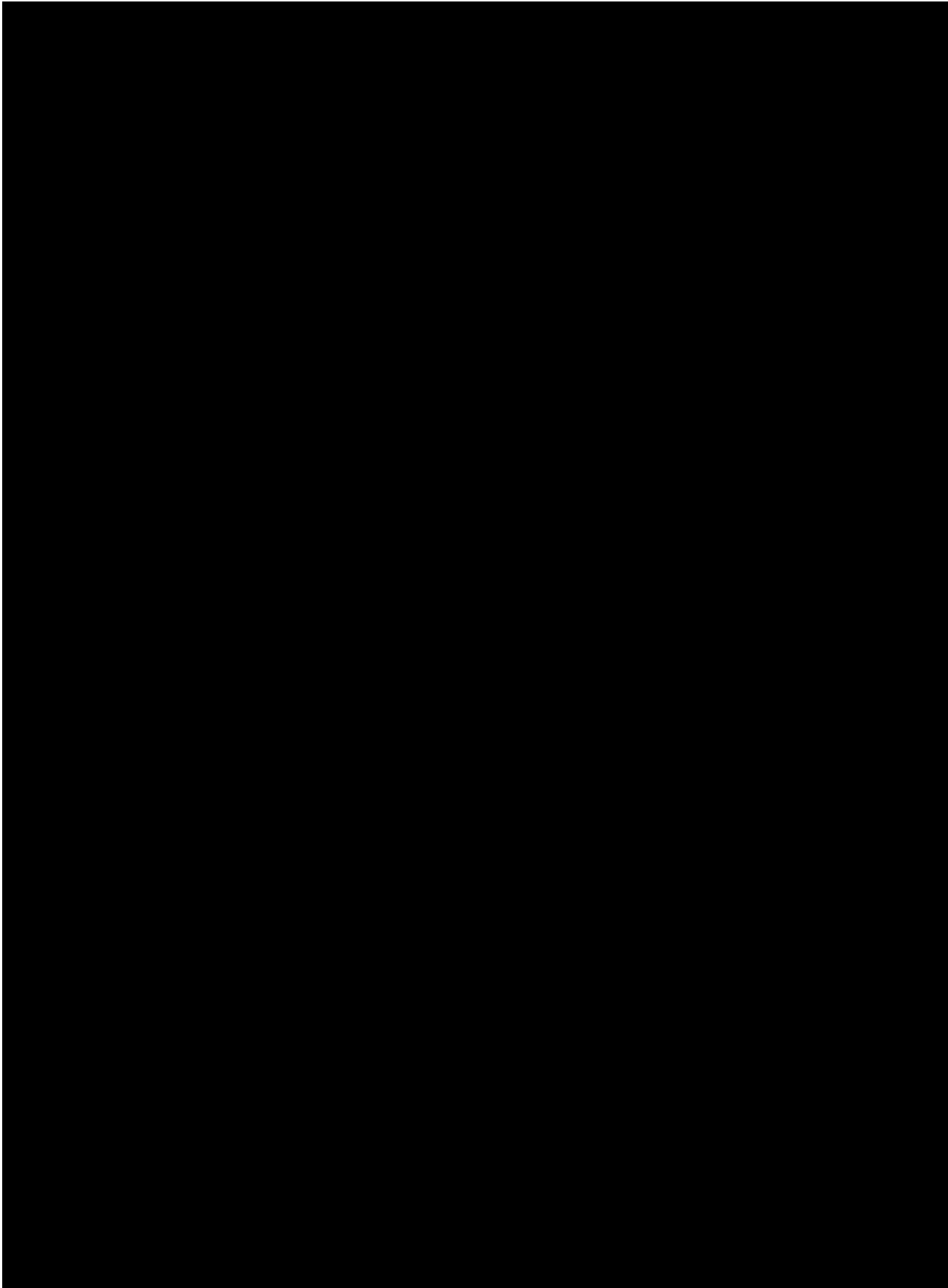
tamboran
RESOURCES

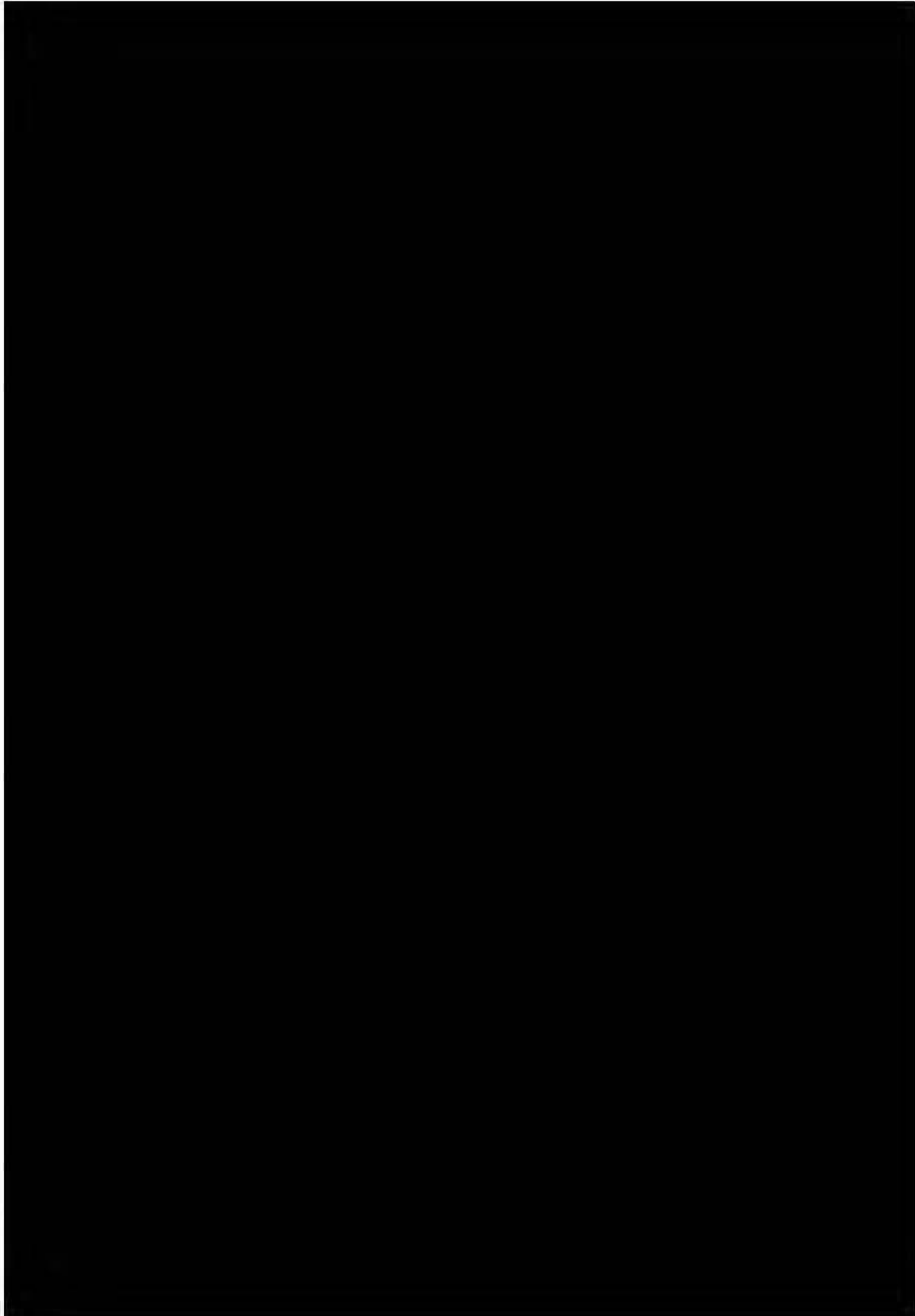
tamboran.com

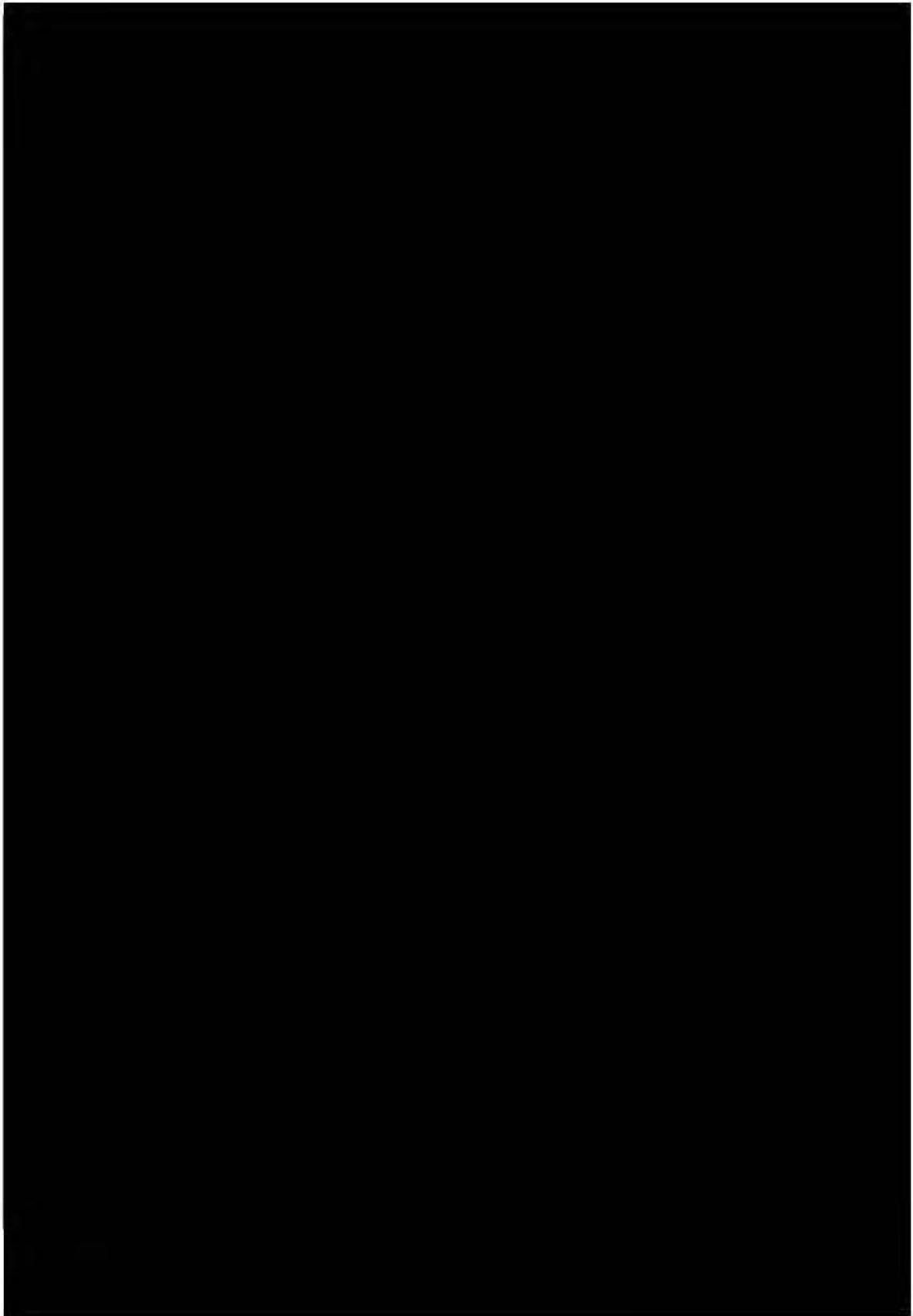
Next Generation E&P Company with a Vision of
Supporting the Net Zero CO₂ Energy Transition

Tamboran Resources Limited. ASX:TBN
ABN 28 135 299 062

Tamboran Resources Ltd







Common User Infrastructure at Middle Arm Sustainable Development Precinct – Stage 2 assessment feedback

27 July 2023

Infrastructure Australia thanks the Northern Territory Government (you) for submitting the Stage 2 business case for the Middle Arm Sustainable Development Precinct to us for assessment. Based on our review, we are pleased to advise that the *Infrastructure Priority List* proposal for *Common user infrastructure at the Middle Arm Precinct* will be updated to reflect the progression of the proposal from Stage 1 to Stage 2.

The next step for this proposal is developing a business case (Stage 3 of Infrastructure Australia's Assessment Framework).

We have assessed the submission against the Stage 2 criteria set out in the [Assessment Framework](#). Below, we have identified areas for feedback to assist with the development of the Stage 3 business case.

General feedback

The submission provides a detailed options analysis process that is well documented, thorough, and followed a logical sequence that relied on input from subject matter experts, government departments, consultations with key stakeholder groups and industry soundings.

The packaging of options based on the outcomes of multi-criteria analysis (MCA), essential dependents and industry soundings is reasonable, and the scoring of program packages through a second MCA and rapid Cost-Benefit Analysis (CBA) including sensitivity testing is robust.

We consider the options analysis and progress towards a package of options, and the rapid CBA analysis alongside this, satisfies the Assessment Framework Stage 2 requirements and supports progressing the preferred program packages for more detailed analysis.

The modelling of emissions scenarios was complementary to the rapid CBA in the submission. Early modelling of precinct enabling emissions demonstrates alignment with national and Territory net zero targets.

We note your intention to continue to test Program Packages 2 and 4 in a detailed business case, and detailed CBA. This is vital to assessing whether capturing a wider set of benefits and costs changes the preferred option. Based on the results of the rapid CBA and the detailed nature of the options analysis, we agree with the your preferred program options for further analysis as part of a Stage 3 business case.

Detailed feedback for future Stage 3 submission

Our Assessment Framework, including Stage 3 guidance and supporting technical guides, sets out our requirements for a Stage 3 business case to identify a preferred package. Based on our review of the Stage 2 submission, we also expect the following specific activities to occur:

Strategic fit

Stakeholder engagement:

- Demonstrate a clearer link between the common user infrastructure that will be delivered and the project types and private proponents that require that infrastructure to invest in the Precinct. This should include evidence of stakeholder engagement, and apparent market appetite/demand for the precinct's common user infrastructure. A Stage 3 submission should also explain how engagement with private proponents has informed the design and deliverability of common user elements (such as delivery staging, precinct structure, governance, revenue assumptions etc.) and the level of engagement with the wider private sector ecosystem (including export finance, banks and financiers). This would support a robust case for latent/incipient demand for the precinct. The Project Team should maintain an open mind about whether specific infrastructure projects (that were ruled out in Stage 2) come back into the assessment for Stage 3 if these are considered as being required by industry to achieve financial close and have characteristics suitable for common user infrastructure (i.e. multiple proponents and the ability to link to existing common user infrastructure).
- Community engagement should also address social and environmental concerns including the impacts of the proposal on Aboriginal sites, First Nations outcomes, workforce and housing affordability in Darwin (e.g. FIFO vs residential workforce), and marine and terrestrial ecosystems (e.g. for tourism and recreation). At this point it is not clear how these stakeholder issues have been addressed. A risk register outlining these key risks and mitigations, including a defined stakeholder strategy, will need to be identified in the business case.

Societal impact

Base case:

- It is not clear how much development occurs under the base case and under the Program options. The base case needs to be more clearly and quantitatively articulated in the Stage 3 submission. A clear base case should establish development activity and GHG emissions in the absence of government provision or coordination of common user infrastructure.

Design maturity:

- Develop designs and more detailed costings for the prioritised common user infrastructure. See Box 8 in our [Guide to economic appraisal | Infrastructure Australia](#) for detail.

Demand analysis:

- Despite the significant work undertaken, **demand uncertainty for an industrial precinct such as this is high**. Strategies to ensure infrastructure decisions are aligned to business investment decisions can mitigate the risk of investing in infrastructure without seeing sufficient demand. The Stage 3 submission should focus on this.
- Develop and provide a robust model linking common user infrastructure to potential private sector projects to establish private demand, as well as the likelihood of private projects occurring (for example noting conditions precedent for private investment as part of program

risks). This would provide the basis for the projection of activity within the Precinct under each of the options.

- Given the Precinct's focus on LNG as a key export industry, and the future uncertainty of that industry in the transition from 'blue' to 'green' energy, we would expect to see more developed future demand scenarios in the Stage 3 submission. We note that an assumption around ongoing LNG demand was based on information provided by potential LNG projects through consultations conducted in 2022. Further modelling and evidence across all the commodities and products expected to be located at the precinct will need to be provided to support an understanding of how macroeconomic trends and global forecasts will impact precinct demand. This may require a global demand model to provide long-term planning assumptions for the industrial products and fuels envisaged to be exported from the precinct, and therefore the precinct projects that should be delivered first.

Cost Benefit Analysis:

- The CBA presented in the Stage 2 submission is a financial CBA based on revenue. The Stage 3 business case should quantify the social, environmental, and economic externality impacts of the program options, where these differ to revenue. This includes the impact of GHG emissions not attributable to CCUS revenue.
- Including producer surplus from potential precinct proponents would support the CBA. A stronger link between the preferred package of infrastructure projects and industrial activities that can therefore occur, would allow an evaluation of the producer surplus expected from the industrial activities.
- Scenario testing should consider impacts from demand and supply side shocks, and climate change.

CCUS assumptions:

- The assumptions regarding Carbon, Capture, Utilisation and Storage (CCUS) revenue will need to be re-tested at Stage 3, noting that the current parameter (\$35) is based on the cost to sequester 1 ton of CO₂, rather than the value-added component that the precinct will provide (underground manifold and pipes connecting to a third-party CCS pipeline).
- The majority of emissions savings is predicated on CCUS. Significant offshore CCUS facilities of the scale required to offset this level of emissions from the precinct have not been developed before in Australia and present a significant risk to the proposal. Further demonstration of the technology's efficacy as well as regulatory progress to enable offshore CCUS in the Stage 3 business case will be required to validate the modelled assumptions.

Environmental & GHG emissions:

- The Stage 3 submission should provide further detail to ensure that GHG emissions impacts cover embodied and operating emissions (scopes 1, 2 and 3) from the common user infrastructure and are consistent with the base case and project case definitions.
- The impacts of the proposal were not included in the rapid CBA, including from positive and negative externalities for human and environmental health and residual GHG emissions. This would be expected for a Stage 3 submission.
- Further detail regarding environmental approvals and the costs and impacts of the precinct development on coastal, marine and benthic ecosystems surrounding Middle Arm will be required as part of the Stage 3 submission.
- Impacts from land-clearing and dredging should be appropriately costed in the CBA, including for CO₂ emissions, biodiversity offsets and cultural values (where these are able to be defined, or qualitatively described where they cannot). In noting this, the social cost of carbon used in the Stage 3 submission should be referenced to jurisdictional and/or national guidance or otherwise justified (the value of \$50 used in the Stage 2 submission was not referenced).

Deliverability

Capability and capacity:

- The business case should develop mechanisms to de-risk the provision of infrastructure so that the government does not invest without high levels of confidence that private proponents will develop their activities within the Precinct.
- Identify the planning pathways for approval of the private projects, and the environmental framework that will be used to assess and progress private proponents seeking to invest in the precinct.
- Market testing to demonstrate that the market has sufficient capacity (labour and materials) to support the delivery of the precinct.

Project governance:

- Develop a governance model to ensure private industry participants have ongoing input to decision making regarding common user infrastructure, particularly where private proponents have indicated potential demand (e.g. wastewater and water desalination).
- Develop and propose a commercial governance structure for how the Northern Territory intends to develop the Precinct and manage the ongoing maintenance and operations of common user infrastructure, including common user agreements and land-lease contracts with private proponents and revenue projections based on private industry willingness to pay.
- Develop user pays models for how private industry participants will fund the infrastructure over time.

Risk:

- Undertake a risk assessment of the program options and identify risk mitigation activities.
- The Stage 3 business case will need to provide a robust analysis of climate hazards faced at the Precinct location (such as sea level rise, increasing severity of cyclones etc) and for infrastructure projects. This analysis should inform the risk register and precinct design. We note the proponent has indicated that option designs will be assessed in part based on their climate change resilience.

Lessons learnt:

- A Post Completion Review or Program Outcomes Management plan that sets out objectives, metrics and measures to monitor and report performance against key indicators during delivery. This may include a Benefits Realisation Plan defining a strategy for benefits measurement and management. As this is a program proposal, there should be a plan in place to learn lessons from delivery of one project to the next.
- Case studies of similar common user projects delivered by governments either domestically or internationally could provide a strong basis for drawing lessons learnt to inform precinct delivery.

Program information

Infrastructure Australia requires additional information to be included in Stage 3 (business case) submissions for Pathway 2 programs, specifically a program business case for an overall program. Please refer to the [Guide to program appraisal | Infrastructure Australia](#) in particular Table 5 p. 51 and Table 6 p. 53 'Pathway 2' for additional requirements for Program Stage 3 submissions.

A Pathway 2 Program Business Case should set out:

- Clear justification for delivery as a program (see our definition in Section 1.4).
- Defined program outcomes.

- Options assessment defining the program options and project makeup in detail. — Where relevant (for inter-related or ongoing programs), the prioritisation framework that will be used on an ongoing basis to select projects.
- Design maturity sufficient to inform investment decision with regard to the program (see Box 15 in Section 2.3).
- Cost maturity sufficient to inform investment decision to provide an estimate of program cost (see Box 15 in Section 2.3).
- Detailed value-for-money assessment (CBA) and financial assessment.
- Report economic benefits and outcomes metrics for monitoring the program.
- Proposed delivery sequence and implementation plan, including deliverability assessment.
- Details of program governance arrangements.
- Program-level risks and mitigations, and a plan for how project-level risks will be assessed, monitored and mitigated as the program proceeds.
- Demonstrate relationships between projects and with other programs (where they exist).
- Program outcomes management plan, including post completion reviews for each project as they are delivered to inform future projects within the program