

Environment Centre NT
protecting nature | living sustainably | creating a climate for change



Submission to the Senate Environment and Communications
References Committee inquiry into the Middle Arm Industrial Precinct

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I. Summary

The Environment Centre NT (ECNT) is the peak conservation organisation in the Northern Territory. Our vision is for thriving nature and a sustainable future for all Territorians, and our mission is to inspire, support and take action that protects the environment. With the help of our supporters, we have been working to protect the Northern Territory's extraordinary natural places since 1983. Our work aims to shift dominant development paradigms in the Northern Territory that see our landscapes as "undeveloped" and something to be exploited, rather than as unparalleled, precious and biodiverse ecosystems that are in everyone's interests to protect. ECNT conducts this work as a peak body in the Northern Territory, in the public interest.

ECNT's forensic research, investigations and campaigning in relation to the proposed Middle Arm Industrial Hub over the course of the last three years have been instrumental in the establishment of this Senate Inquiry. Together with many people of the Northern Territory, ECNT welcomes the opportunity to make this submission, and encourages close parliamentary and public scrutiny of this project, which is arguably the largest and most environmentally harmful single development proposed in Darwin's 150-year settler history. In ECNT's considered view, the Middle Arm Industrial Hub threatens the health, harbour, climate and liveability of the Northern Territory.

Middle Arm is an ecologically, socially and culturally significant peninsula located in Darwin Harbour, a few kilometres from southern Darwin suburbs (including the city of Palmerston). It is the site of two existing LNG export facilities, run by INPEX (called Ichthys) and Santos (called Darwin LNG, which could be used to process gas from the controversial offshore Barossa project). However, these projects would be dwarfed if the Middle Arm Industrial Hub goes ahead.

Companies and the NT Government (through the Department of Infrastructure, Planning and Logistics, which is the proponent of the project) are proposing to expand industry on Middle Arm to create a hub of factories and industrial facilities, including a new LNG gas processing and export hub, petrochemicals, minerals processing, carbon capture and storage, and hydrogen (blue and green).

Despite recent NT Government rebranding of this industrial zone as the "Middle Arm Sustainable Development Precinct", its primary function is to enable expansion of the gas industry. If built, this hub would accelerate some of Australia's biggest gas projects, becoming a foundational demand source for gas and other hydrocarbons from the Beetaloo Basin, or offshore in the Timor Sea including Santos' highly emitting Barossa gas project and Inpex's proposed expansion from 2030. It is also planned as the site of a carbon capture and storage facility (to be connected to proposed offshore sequestration sites) designed to greenwash these projects.

The development of the Middle Arm Industrial Hub has been characterised by a lack of transparency and misleading information about the project on the part of both levels of government. This is particularly concerning given the range of potentially unacceptable climate, biodiversity, health, social and cultural

heritage impacts which could be caused by the precinct including the following:

- it would accelerate climate change in the Northern Territory, by enabling the processing and export of fracked gas from the Beetaloo Basin via a huge LNG processing and export facility, the construction of toxic petrochemicals factories utilising that gas, as well as the greenwashing of Santos' toxic Barossa gas project – and other proposed offshore fossil fuel projects – via a carbon capture and storage facility;
- it would entail the flattening of 1500 hectares of precious savanna, rainforest and mangrove vegetation – a biodiversity hotspot located within a site of international conservation significance - to enable the dredging of the harbour, up to five industrial-scale wharves and jetties, and the construction of a range of factories;
- it would significantly increase fine particulate air pollution in the Darwin region, potentially increasing cancer risk and adversely impacting the health of Darwin and Palmerston residents, noting that these facilities will be located less than 3 kilometres from the outer suburbs of Palmerston;
- it would irreversibly damage the social and cultural fabric of Darwin, transforming a city defined by its harbour and beloved by residents for fishing, recreation, and tourism into a major industrial city dominated by a skyline of factories;
- it would endanger a precious cultural landscape maintained for many millennia by Larrakia Traditional Owners, including impacting the last remaining petroglyphs in the entire Darwin region.

The Albanese Government confirmed \$1.5 billion of public funding for the project in its first mini-Budget in October 2022. The funding was committed in the absence of a completed environmental impact assessment, a detailed business case or cost benefit analysis, or a recommendation that the funding be committed by Infrastructure Australia. The funding was first secured during the election campaign following the engagement of a lobbyist, [Dragoman](#), by the Northern Territory Government to influence federal politicians and bureaucrats to agree to fund/support the Middle Arm Industrial Hub.

Noting that the Northern Territory is forecast to become uninhabitable due to climate change within two generations, the [UN Special Rapporteur on Toxics and Human Rights](#) recently singled out the Middle Arm Industrial Hub as threatening to turn the Northern Territory into a sacrifice zone for the fossil fuel industry. It requires the highest level of scrutiny.

II. Key concerns regarding the Middle Arm Industrial Hub

A. Greenwashing

1. Middle Arm is a fossil fuel project

Greenhouse gas emissions from coal, oil and gas are the largest drivers of climate change globally, and a rapid reduction in fossil fuel production and use is required for the world to limit warming to 1.5°C. The development of the Middle Arm Industrial Precinct is intertwined with the development of new gas fields against the advice of bodies such as the [International Energy Agency](#) and [IPCC](#), including:

- the hugely polluting Barossa gasfield which is proposed to “backfill” the Darwin LNG plant. The Barossa development is associated with an extraordinarily high level of greenhouse gas (GHG) emissions, given the gas contains 18% carbon dioxide by volume. This is a higher level of CO₂ by volume than any other gas resource currently made into LNG. Total emissions from producing 3.7 million tonnes of LNG per year from the Barossa Development will result in 5.4 Mt of CO₂ per year, or 15.4 Mt per year including scope 3 GHG emissions, which is extreme by any standard and effectively makes the Barossa to Darwin project “[a CO₂ emissions factory with an LNG by-product](#)”;
- fracking in the Beetaloo Basin, [which could increase Australia’s emissions by up to 22%](#), generating 1.4 billion tonnes of greenhouse gas emissions and threatening Australia’s commitments under the Paris Agreement;
- Inpex’s [proposed expansion plans](#) at Middle Arm, including “blue” (ie fossil gas produced) hydrogen and ammonia, and its [recent purchase](#) of the Cash, Maple proposed gasfield which could potentially back-fill its Darwin Ichthys facility;
- Eni’s proposed exploitation of its Verus field (formerly known as Evans Shoal), with its 27% CO₂ reservoir making it the [most polluting project](#) in Australia, if it goes ahead.

In addition, petrochemical manufacturing is proposed for Middle Arm, relying on gas as a feedstock for the creation of ammonia, methanol, ethylene, ethane, urea and other gas-based products. As the world moves away from fossil fuels as an energy source, petrochemicals and plastics production is being used to economically justify continued fossil fuel development. This is dangerous for the climate, as every stage of the life cycle involves carbon emissions – not just the energy-intensive process of cracking gas into feedstock.

Despite public assertions by the Northern Territory Government and a number of federal Ministers that the precinct is “sustainable”, and designed primarily for green industries (critical minerals processing, battery production and green hydrogen are frequently mentioned), the project is, and always was, primarily designed to facilitate gas expansion.

This is demonstrated by the following evidence:

- In November 2018, the [NT and Commonwealth governments signed an MOU](#) recommending the creation of a “Middle Arm Industrial hub” which has the aim of “establishing the NT as a world class gas production, manufacturing and services hub”, including “establishing gas based manufacturing and services”. The parties agree to “delivery of infrastructure and programs in support of the Northern Territory Gas Industry and gas leveraged industries”;

- In November 2020, the Tertiary Economic Reconstruction Commission, co-chaired by former Dow Chemicals boss and SaudiAramco director Andrew Liveris, [released its final report](#) recommending investment in “onshore and offshore gas developments and manufacturing, including low emissions petrochemicals”, mentioning petrochemicals 15 times in the report;
- In November 2020, a [Deloitte report into the viability of fracking in the Beetaloo Basin](#) states that “[s]everal downstream industries are being considered for Darwin (Middle Arm) that could leverage off large volumes of product coming from the Beetaloo Sub-basin”, including a methanol plant, an ethane cracker, and an ammonia plant;
- The Northern Territory Government’s initial submission to Infrastructure Australia for funding for the precinct in 2020, released under [Freedom of Information laws](#), revealed the fundamental objective of the development was to establish a “new gas demand centre” and expand the NT gas industry, including by opening up the Beetaloo Basin for fracking. These documents also identified opportunities for petrochemical production as part of the project, noting that “the potential recovery of natural gas liquids from the onshore Beetaloo Sub Basin project means there is also an opportunity for future production of ethane-based products such as plastics, paints, polymers and rubbers as well as the production of liquid fuels to help address Australia’s energy security”;
- [Lobbying firm Dragoman was engaged](#) by the NT Government between September 2021 and April 2022 to “influence” the Commonwealth government and Opposition to support a gas-based manufacturing hub on Darwin Harbour, primarily LNG processing/export and petrochemicals production;
- In [EIS documentation submitted to the NTEPA](#) in January 2022, the Middle Arm Sustainable Development Program (MASDP), the following list of industries are included as part of the assessment: “Liquefied Natural Gas (LNG), Ammonia and derivatives, Urea and derivatives, Ethylene and derivatives, Methanol and derivatives, Gas to liquids (GTL), Hydrogen, Carbon capture and storage, Minerals processing, Advanced manufacturing, Support service industries”. These industries remain in the scope of the strategic environmental assessment;
- In the [2021-2022 Investment Territory Report](#), the Territory Investment Commissioner and Major Projects Commissioner advertise that the MASDP will include “gas-based processing and advanced manufacturing” (4);
- Infrastructure Minister Catherine King [was briefed](#) as the incoming Minister in May 2022 by her with conceptual drawings showing the infrastructure to be funded by the Commonwealth – four of five proposed wharves are labelled for shipping of LNG, methanol, ethylene, ammonia and “clean petroleum”. The remaining wharf is labelled “hydrogen”, and could presumably be used for either blue (gas-based) or green hydrogen;
- Minister Pliibersek [was briefed](#) in July 2022 that Middle Arm was a “key enabler” for the export of Beetaloo gas from Middle Arm, as well as to add to the feasibility of proposed offshore carbon capture and storage associated with Santos Barossa project;

- On Monday 10th October 2022, the CEO of fracking company Tamboran [told a Senate Inquiry](#) that “gas that will be extracted from the Beetaloo will be necessary for a full range of industrial purposes at the Middle Arm Sustainable Development Precinct, near Darwin. This includes ammonia and urea production for fertiliser, hydrogen production, energy-intensive manufacturing, power generation and LNG export” (1-2);
- [This video](#) that was presented to the Commonwealth Government by the Northern Territory Government shows a simulation of proposed infrastructure at Middle Arm, lists funding, and shows proponents at Middle Arm for the first time. The video:
 - it shows Tamboran as a proponent at Middle Arm, providing a direct link between Middle Arm and the Beetaloo Basin for the first time
 - it shows a petrochemical company called Allied Methanol as a proponent at Middle Arm;
 - it shows Santos and Inpex as responsible for the carbon capture and storage facility proposed at Middle Arm
 - it shows 5 huge jetties/wharves extending into the Harbour - four of which are intended for shipping of gas-based products including LNG (liquefied natural gas), methanol, ethylene, ammonia and “clean petroleum”;
- On 9 June 2023 Beetaloo fracking company Tamboran Resources was [announced](#) as an anchor tenant at the site, announcing that it would construct a 20 million tonne per annum LNG processing and export facility, only 3 kilometres from the outer suburbs of Darwin. If this occurs, the [Australia Institute estimates](#) this would generate 81 million tonnes of life cycle emissions annually, equivalent to the annual emissions of 12 Australian coal-fired power stations.

Misleading and/or vague information about the project has been provided to the public by the Northern Territory Government, including frequent assertions that the project is “sustainable” despite its clear links to fossil fuel expansion. The public and the media have been forced to perform the role of watchdog, engaging in a detective hunt to ascertain the true nature of the developments proposed at Middle Arm and their likely impacts. The greenwashing of the project has eroded trust and confidence in the Northern Territory and Federal Governments, inhibited effective public participation in debate, and damaged the social licence of the project.

2. Current and prospective proponents at Middle Arm

Some information has been selectively drip-fed by the Northern Territory Government to the public about potential proponents at the site, with government communications emphasising the “green” credentials of some of these industries. Five potential proponents have been publicly announced so far at Middle Arm:

- a. Tamboran proposes to construct an LNG processing and export plant, using gas sourced from its fracking operations in the Beetaloo Basin;
- b. Tivan proposes to construct a critical mineral processing facility;

- c. Avenira proposes to construct a lithium iron phosphate battery factory;
- d. Fortescue Future Industries proposes to construct a green hydrogen facility; and
- e. TEH2 proposes to construct a green hydrogen facility.

This list of potential proponents should be approached with some caution, and the feasibility of all proposed facilities must be interrogated. Of all potential proponents at Middle Arm, Tamboran’s plans are arguably the most significantly advanced, with an active exploration program (including drilling and fracking) in the Beetaloo Basin and public capital raising ongoing. There are significant questions about all projects’ feasibility, their local and regional environmental impacts, and whether they should be located within Darwin Harbour at all. Perhaps most significantly, the land they have secured represents only one third of the overall proposed development site, meaning the majority of the land remains unallocated, with a 50-year umbrella approval in train (see section on strategic environmental assessment below).

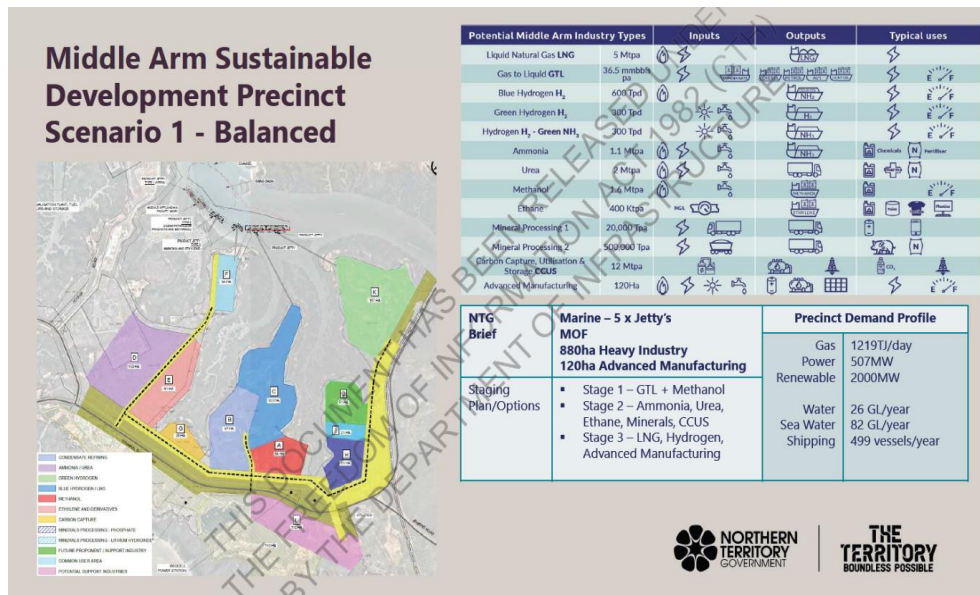
The Infrastructure Australia Stage 2 Submission for Middle Arm makes it clear that close to three quarters of the site is for gas-based industries (this was compiled from Figure 1: Middle Arm Sustainable Development Precinct Study Area):

| October 2023 - IA Stage 2 Business case FOI documentation | Ha | | % |
|---|-----|----------------|---------|
| Allocated lithium hydroxide processing area in Middle Arm | 21 | Clean industry | 2.63% |
| Ammonia/urea production | 153 | Gas | 19.13% |
| Condensate refining | 97 | Gas | 12.13% |
| LNG/blue hydrogen | 151 | Gas | 18.88% |
| Green hydrogen | 167 | Clean industry | 20.88% |
| Methanol | 54 | Gas | 6.75% |
| Carbon capture | 25 | Gas | 3.13% |
| Ethylene | 81 | Gas | 10.13% |
| Phospate | 51 | | 6.38% |
| Common user jetty | 34 | Gas | 4.25% |
| Total (exc corridors, support industries) | 800 | | 100.00% |
| | | | |
| % gas industries | | | 74.38% |

In this vein, ECNT notes that there are a number of gas proponents apart from Tamboran Resources with reasonably advanced plans at Middle Arm, who have not been formally announced as Middle Arm proponents by the Northern Territory Government:

- Inpex has disclosed that they propose to [significantly expand their operations](#) at Middle Arm, including through carbon capture and storage at Middle Arm, [blue hydrogen](#) and blue ammonia utilising carbon capture and storage;
- Santos proposes a carbon capture and storage facility at Middle Arm, which would process carbon dioxide from its toxic Barossa gas field for transport via pipeline to its Bayu Undan field for storage;
- Tamboran Resources told a Senate Inquiry that Beetaloo gas would be used to supply petrochemicals manufacturing at Middle Arm; and
- A company called Allied Methanol has publicly declared itself as a potential tenant at Middle Arm, which contradicts public statements made by the Chief Minister that there will be no petrochemicals facilities at Middle Arm. There is a [website](#) where these plans are detailed, including methanol and blue ammonia using gas as feedstock.

Contrary to public communications by the Northern Territory Government, documents released via freedom of information demonstrate that the majority of the precinct is planned for gas-related industries, including LNG processing, gas to liquids cluster, blue hydrogen, ammonia, urea, methanol, ethane, and carbon capture and storage (see image below, which shows 1 of 3 possible development scenarios at Middle Arm presented to the Commonwealth Government by the Northern Territory Government).



This is confirmed in more recent information - also obtained via FOI - submitted by the Northern Territory Government to Infrastructure Australia as part of its Stage 2 Assessment. The following table indicates clearly that as of March 2023, gas and petrochemical industries remain central to the proposed precinct and the business case being progressed.

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 | |

The conflicting information about the Middle Arm Hub has eroded public trust in the *bona fides* of the project, perhaps irreversibly. Concerns have been exacerbated by actions such as the [deliberate deletion](#) of the word “petrochemicals” from NT Government websites and the revelation that federal funding for the precinct is specifically for [gas and petrochemical wharves and jetties](#) in spite of assertions by Commonwealth Ministers to the contrary. This is unacceptable for any significant project of this type, but particularly one promised such significant sums of public funding.

Paradoxically, the strategic environmental assessment currently underway of the project has exacerbated the lack of public knowledge of the precinct, and provided cover for its greenwashing. This is because the strategic assessment has only (so far) required the disclosure of a vague list of potential industries at the site, rather than disclosure of specific projects and their impacts (see further below).

3. Carbon capture and storage

The sustainability claims about the Middle Arm industrial precinct rest primarily on the success of a planned carbon capture and storage facility at Middle Arm. This would comprise a multi-user CCS hub, where carbon dioxide streams from different sources would be aggregated, and transported via pipeline to offshore sequestration sites (initially Santos’ depleted Bayu Undan field, and then the Petrel sub-basin, where Inpex is undertaking exploration to ascertain the suitability of these geological formations

for this purpose). A [joint venture](#) between Santos, Inpex, Woodside, Eni, and Xodus is currently assessing the feasibility of CCS at Middle Arm with CSIRO.

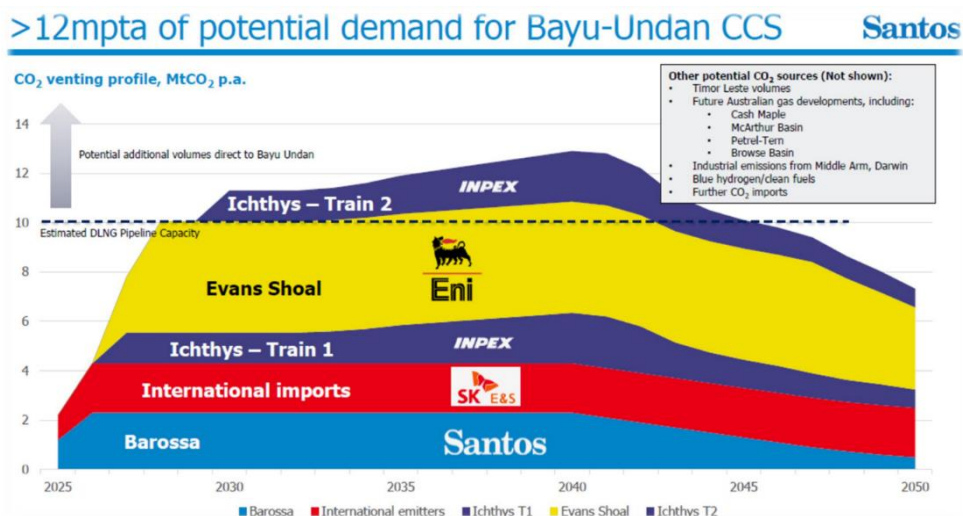
The Middle Arm project has been branded one of many possible “[Net Zero Zones](#)” across Australia by APPEA, where “[carpooling of carbon](#)” (and associated cost reductions) can be realised by CCS facilities being utilised by multiple projects/companies.

However, this CCS facility is a key component of greenwashing of the Middle Arm Industrial Hub, and a crucial plank in the gas industry’s strategy to gain a social licence by appearing to act on climate, while simultaneously opening up new fossil fuel projects against the advice of bodies such as the International Energy Agency and IPPC. The CCS facility is key to the gas industry’s expansion plans in the Northern Territory (onshore and offshore), including its social licence.

Possible users of this facility include:

- Santos’ offshore Barossa project (with 18% CO₂ content), with CO₂ piped to the Bayu Undan field in Timor Leste and injected into the depleted Bayu Undan field;
- Eni’s proposed offshore Verus gasfield (with 27% CO₂ content);
- Inpex’s Ichthys field, and potentially its newly acquired Cash, Maple fields;
- Beetaloo fracking company Tamboran’s proposed LNG processing facility at Middle Arm;
- Proposed petrochemicals, blue hydrogen, ammonia and other CO₂-intensive industries at Middle Arm;
- The countries of Japan, Singapore and South Korea (gas trading partners with Australia), who propose to send CO₂ on ships to Middle Arm, due to a lack of CCS storage locations in those countries.

The connection of the proposed CCS facility at Middle Arm with the opening up of new fossil fuel fields is seen clearly in the Santos graphic below (found [here](#)).



The CCS facility at Middle Arm, far from rendering the precinct ‘sustainable’, will merely enable the gas industry to continue polluting by opening up new and highly polluting fossil fuel projects, using CCS as a justification.

CCS is a false solution for climate change, and is a dangerous distraction from the real work that needs to be done to move away from dependency on fossil fuels. It is unproven at scale, and even if sequestration volumes claimed by the industry for this project were achieved, CCS would be only offset a small proportion of the life cycle emissions of new fossil fuel projects.

Long-term storage of CO₂ beneath the sea is not proven at scale, and large-scale projects frequently fail to meet expectations. Australia’s Parliament has long recognised that one of the “most substantial risks associated with CCS is the leakage of CO₂ from storage sites. While there is some experience with geological storage of CO₂ and natural gas for periods of approximately 10-20 years, long term storage over many hundreds or thousands of years has not been proven.”¹ Similarly, the US government recognised in October 2022 that, for “CCS to succeed in mitigating atmospheric emissions of CO₂, it is assumed that each reservoir type would permanently store the vast majority of injected CO₂, keeping the gas isolated from the atmosphere in perpetuity. That assumption is untested.”²

Even if the CO₂ can be successfully injected in the seabed, Santos has not addressed the real risk of leakage. As the Center for International Environmental Law and US government has noted, geological formations where CO₂ is stored can contain unseen passages through which gas can escape.³ Examples of this have been documented. In the Sleipner offshore CCS project in Norway, CO₂ was injected at a lower-level injection point and migrated into a previously unidentified shallow layer.⁴

A second hurdle is establishing that targeted formations will in fact store as much CO₂ as expected. In the Snøhvit project in Norway, the targeted storage site rejected the most of the CO₂ that was injected. As a result, a “geological structure thought to have 18 years’ worth of CO₂ storage capacity was indicating less than six months of further usage potential,”⁵ demanding urgent and costly response and remedy to prevent the failure of the project. IEEFA has cautioned that these two Norwegian projects are not industry models, but rather cautionary tales.

¹ Australia Parliament, Standing Committee On Science And Innovation, “The environmental benefits and risks of carbon capture and storage and public perception” in “Between a rock and a hard place The science of geosequestration,” (Aug. 2007)

² Congressional Research Service, Carbon Capture and Sequestration (CCS) in the United States Updated October 5, 2022,” p. 9 (2022) <https://crsreports.congress.gov/product/pdf/R/R44902>.

³ Center for International Environmental Law, “Deep Trouble: The Risks of Offshore Carbon Capture and Storage,” p. 2 (June 2023) (citing Rebecca C. Smyth and Susan D. Hovorka, “Best Management Practices for Offshore Transportation and Sub-seabed Geologic Storage of Carbon Dioxide (OCS Study BOEM, 2018), [espis.boem.gov/final%20reports/5663.pdf](https://www.boem.gov/final%20reports/5663.pdf)).

⁴ IEEFA, “Norway’s Sleipner and Snøhvit CCS: Industry models or cautionary tales?” <https://ieefa.org/resources/norways-sleipner-and-snohvit-ccs-industry-models-or-cautionary-tales> (“[h]ad this unknown layer not been fortunate enough to be geologically bounded, stored CO₂ might have escaped”).

⁵ Id.

The viability of the CCS venture at Bayu Undan currently being explored by Santos is questionable. The project rests on repurposing the existing gas import pipeline which transports gas from the Bayu Undan field to Santos' Darwin LNG facility. Pipelines being repurposed for CO₂ transport for geologic sequestration may necessitate the reversal of inlet to outlet. Reversing flow direction can alter where the stresses on the pipeline are the greatest.⁶ These stresses can increase the risk of rupture or damage. There are very few examples worldwide of natural gas pipelines that have been successfully repurposed to transmit pressurised CO₂, and none approaching the distance anticipated for CCS at Bayu-Undan.

This submission addresses some of the [environmental, health and safety risks](#) for communities with CCS infrastructure later in this Submission, under Health Impacts.

B. Integrity and governance questions regarding Commonwealth funding

The processes that led to the funding commitment to this project raise important questions about integrity and good governance that require scrutiny, and could amount to corrupt conduct.

The Middle Arm Industrial Hub has been on the Infrastructure Australia priority list since February 2021. However, the Federal funding commitment for Middle Arm circumvented Infrastructure Australia's own Assessment Framework, including the requirement for a business case prior to the funding being committed ([Stage 3 of the Infrastructure Australia Assessment Framework](#)). Extraordinarily, the funding appears to have been committed without advice at all from Infrastructure Australia. Infrastructure Australia [told the Senate](#) (page 45) that they were not involved in the funding commitment. The funding was initially committed when the project was at Stage 1 of the Infrastructure Australia Assessment Framework. The project by the Northern Territory Government recently progressed to Stage 2.

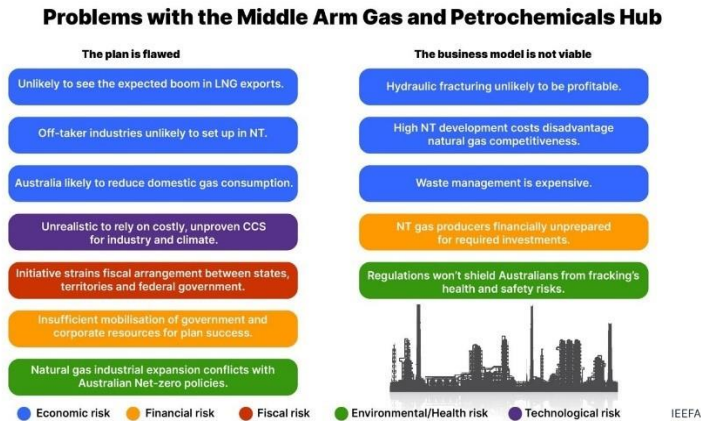
It is noted that Prime Minister Anthony Albanese established Infrastructure Australia in 2008 when he was Infrastructure Minister to take the politics out of infrastructure project selection and funding. Specifically, Minister Albanese [then said](#) that the government was "replacing neglect, buck-passing and pork-barrelling with long-term planning where governments predict and anticipate infrastructure needs and demands." The [NSW ICAC](#) recently defined pork barrelling as:

"the allocation of public funds and resources to targeted electors for partisan political purposes."

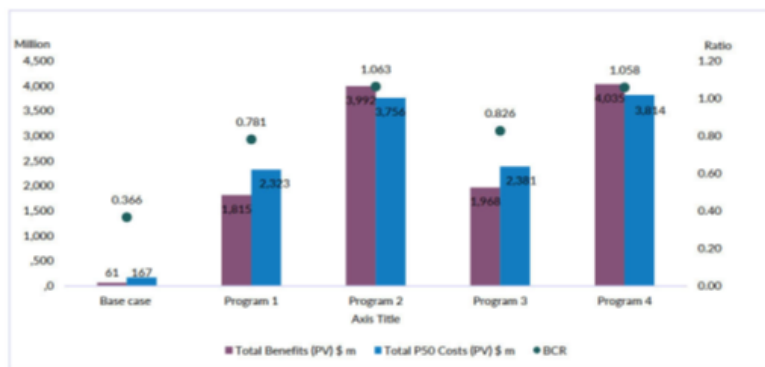
The commitment of \$1.5 billion to the Middle Arm precinct during the federal election campaign can only be described as a "pork barrel". The NSW ICAC has recently found that pork barrelling erodes public trust, is antithetical to democratic government and can lead to public spending that lacks merit, is not based on need, and is wasteful. It can also amount to a breach of the law, and corrupt conduct. For the reasons set out below, ECNT submits that the commitment of \$1.5 billion for the Middle Arm Industrial Hub should be referred for investigation to the National Anti-Corruption Commission.

⁶ Guidance for Pipeline Flow Reversals, Product Changes, and Conversion to Service US DOT PHMSA (September 2014).

Serious questions have been raised about the economic viability of the project, which have not been addressed because of the unusual manner in which the project secured funding. [IEEFA](#) has analysed the feasibility of the project on the basis of the scant information available publicly and concluded that the plan is flawed, and that the business model for Middle Arm is not viable.

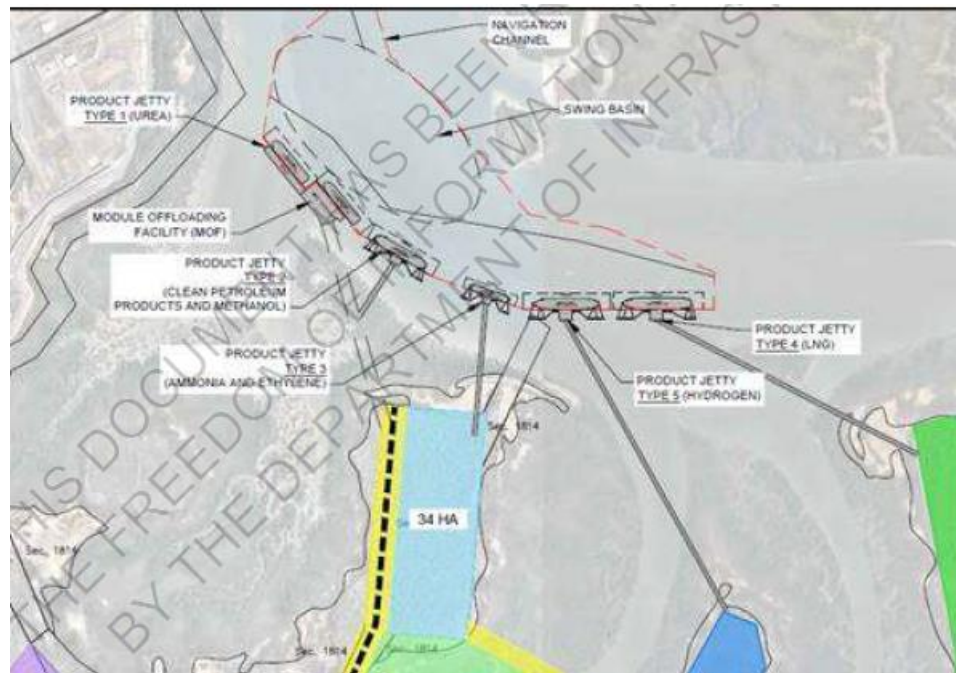


Infrastructure Australia, in responding to the NTG’s Stage 2 Submission, notes that “demand uncertainty for an industrial precinct such as this is high.” The NTG’s own submission finds a troublingly low benefit-cost ratio across all cases:



Source: NTG Stage 2 Submission to Infrastructure Australia, p 90

The funding promised by the Commonwealth is a fossil fuel subsidy, and will directly fund the gas industry. [Freedom of information](#) documents demonstrate that the \$1.5 billion in federal funding is for dredging the harbour and the construction of up to five jetties and wharves labelled for shipping of LNG, methanol, ethylene, ammonia and “clean petroleum”. The remaining wharf is labelled “hydrogen”. Tamboran Resources’ [ASX disclosures](#) confirm that the federal government has funded \$1.5 billion towards marine infrastructure.



There are also grave integrity concerns pertaining to the way the funding for the Middle Arm Industrial precinct was lobbied for and secured. At the heart of the initial design and promotion of the precinct, and attempts to secure funding for the precinct, is former Dow Chemicals boss Andrew Liveris, and former Labor Chief Minister and current lobbyist Paul Henderson.

During the early stages of COVID-19, Liveris was appointed to government bodies to provide advice about 'economic recovery', first at the Commonwealth COVID then at the NT level (the Territory Economic Reconstruction Commission). From both positions, Liveris recommended the governments subsidise a bigger NT gas industry including a [petrochemicals facility in Darwin](#). Liveris said this was essential for job creation and national security.

At the time, Liveris' many conflicts of interest in these roles attracted public controversy. Since that time the integrity concerns have been revealed as more than hypothetical. The \$1.5 billion Middle Arm commitment is by far the most substantial outcome of Liveris' advocacy in those government roles.

Liveris sits on the boards of energy and chemicals giants Worley and Saudi Aramco. Both companies are involved in gas and petrochemical production and could benefit from the federal Middle Arm funding. Worley has already been awarded contracts for Santos, having been hired by Santos to design its Middle Arm/Bayu Undan CCS project.

Liveris has a senior role with Dragoman, a controversial lobbying consultancy. Worley and the Saudi Arabian government have both been registered lobbying clients of Dragoman in the past. During Liveris' federal government advisory role, Dragoman provided Liveris with behind the scenes "pro bono advice"

and support. Liveris' personal wealth manager was also part of his 'taskforce'. Both of these points were only revealed through FOI.

Liveris was joined on the Territory Economic Reconstruction Commission by former NT Chief Minister Paul Henderson, now a lobbyist including for gas companies. The NT body also included Martin Parkinson, another Worley board member. Liveris and Henderson started advocating for a Darwin petrochemical industry back in 2012.

Documents obtained by ECNT [revealed](#) that lobbying firm Dragoman, associated with Saudi Aramco director Andrew Liveris, was engaged by the NT Government between September 2021 and April 2022 to develop and implement a sophisticated and successful strategy to secure \$1.5 billion in Commonwealth funding for the Middle Arm precinct. The strategy was designed and delivered in the lead-up to the federal election).

Middle Arm is described as a gas and petrochemicals manufacturing precinct throughout the procurement documentation, designed to "leverage the potential" of the Beetaloo Basin and offshore gas fields. A deliberate decision was made by the NT Government not to publish a description of the contract, due to the "sensitive nature of the intended outcome". No other firm was considered for the contract, despite it being a level of procurement that required a minimum of 3 quotes and potentially a public tender. There are serious questions about integrity and conflicts of interest regarding the decision to award the consultancy to Dragoman with no alternatives considered, namely:

- Andrew Liveris (former Co-Chair of the Territory Economic Reconstruction Commission) was directly involved in the decision to engage Dragoman, advising the NT Government that Dragoman was the appropriate (and only) consultancy that could deliver the contract. An email summarising this advice says that "through this consultation, no further alternatives were recommended."
- Paul Henderson (former Co-Chair of the TERC) was directly involved in the decision to engage Dragoman, advising the NT Government that Dragoman was the appropriate firm to deliver the contract and no local firms would be appropriate.

The strategy appeared to differently target the Coalition Government and Labor Opposition. Senior Labor figure Simon Crean and senior Liberal figure Robert Hill were involved in developing the strategy. The strategy also targets senior public servants, including CEOs, divisional heads and senior management in agencies. There was urgency to procure Dragoman due to (in the words of NT Gas Taskforce Chair Alister Trier), it being "political giving season". The NT Government appears to have breached multiple procurement rules in engaging Dragoman, including its failure to obtain multiple quotes, go out to public tender for an increase in the contract amount and seek local NT providers.

The [Guardian article](#) that revealed these links states that "[f]rom the start of the Middle Arm project and its associated gas developments, there have been concerns about the potential for actual or perceived conflicts of interest by decision makers."

The circumstances in which Labor, in Opposition, agreed to the \$1.5 billion, require interrogation by the Senate Inquiry, including:

- Disclosure of the Dragoman/NT Government strategy with respect to Middle Arm, including how Labor and the Coalition were differently targeted in the strategy;
- Which Labor politicians and/or staff met with Dragoman, the NT Government, or any Middle Arm proponents during the federal election campaign;
- Which Coalition politicians and/or staff met with Dragoman, the NT Government, or any Middle Arm proponents during the election campaign;
- Which Commonwealth bureaucrats met with Dragoman, the NT Government, or any Middle Arm proponents during the federal election campaign;
- Who, in both the Labor and Coalition, made the decision to commit \$1.5 billion towards Middle Arm during the election campaign, and what information did they have before them when making this decision;
- The implications of the commitment of \$1.5 billion for Infrastructure Australia's assessment of the Middle Arm precinct, including whether the \$1.5 billion commitment constitutes corrupt conduct.

C. Flawed environmental approval processes

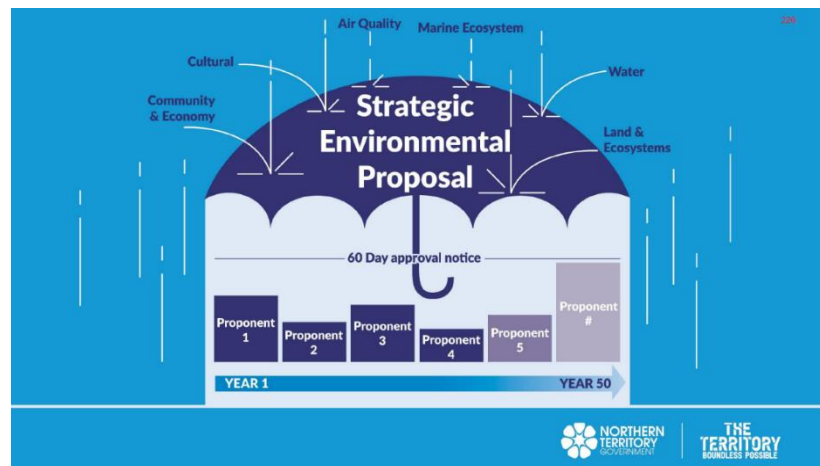
The Middle Arm Industrial Hub is currently undergoing [concurrent strategic environmental assessments](#) under both the *Environment Protection Act (NT)* and the *Environment Protection and Biodiversity Conservation Act (Cth)*. The Northern Territory Government's Department of Infrastructure, Planning and Logistics is the proponent of the Middle Arm Industrial Hub. Approval will be required by both the NTEPA and the Commonwealth Environment Minister.

So far, the following has occurred:

- A referral was made of the project to the NTEPA and Minister Plibersek, containing draft terms of reference and some details of the industries to be located at Middle Arm;
- The public was given an opportunity to comment on the referral and draft terms of reference;
- The terms of reference under the Environment Protection Act were approved by the NTEPA in September 2022;
- The terms of reference under the EPBC Act do not appear to have been approved by Minister Plibersek.

It is understood that the release of the EIS for public comment (which will address both the NT and Federal assessments) may be imminent, having been significantly delayed from its initial proposed release date of early 2023. It is understood that it will need to undergo an "adequacy review" by Minister Plibersek prior to its public release.

A key purpose of the strategic environmental impact assessment for Middle Arm is to achieve “certainty” for business. This would involve Minister Plibersek and the NTEPA giving an overarching (“umbrella”) approval for the precinct for 50 years as part of the strategic environmental assessment, with approvals for potentially highly polluting individual projects being turned around in as little as 60 days once this overarching approval is given. The following image produced by the Northern Territory Government represents specific proponents being literally shielded from environmental assessment by an ‘umbrella’ approval, and then only being required to undergo 60-day licence applications once the overall precinct is approved. A 60-day approval process is entirely insufficient for industries and projects that have the ability to fundamentally change what it means to live in the Darwin and Palmerston region.



While strategic environmental assessments *can* lead to better environmental outcomes, the conduct of the strategic environmental assessment for the Middle Arm Industrial Hub to date has been flawed in a number of key respects, as follows:

- There is a lack of detail in the referral about the industries that are proposed to be constructed at Middle Arm, making meaningful engagement with the referral and draft terms of reference extremely difficult, if not impossible;
- No development scenarios have been disclosed, nor a draft development plan released, beyond a laundry list of “classes of actions” in the referral documentation.
- Methodologies for the calculation of baselines, and impact assessments, for key domains have not been released nor public comment sought on these methods (including the air shed model, marine impacts, health impacts, climate impacts, biodiversity impacts and offsets methodology);
- The strategic assessment area has not been clearly defined and justified.

Further critique of the limitations of referral documentation for the Middle Arm Industrial Hub can be found in [ECNT's submission](#) on the referral.

ECNT is concerned that there is next to no knowledge in the community about the proposed developments at Middle Arm or their impacts, and this lack of knowledge is exacerbated by the absence of meaningful detail in environmental assessment documentation. This has meant that the public has struggled to engage with the strategic environmental assessment process. It is unacceptable that detail about what is proposed (including potential development scenarios) may not be available to the public until the environmental impact statement is publicly released, leaving only a few weeks for the public to become informed about the project and provide meaningful comment on it. The implications of this lack information are extremely serious. If, after the strategic environmental assessment, a 50-year strategic approval is granted, then individual (and potentially highly harmful) projects may be subject to a truncated and less rigorous/accountable assessment and approval process (perhaps as little as 60 days per individual project).

In some senses, the strategic environmental assessment can be seen as having aided the greenwashing of the precinct by government, rather than ensuring rigorous scrutiny of its potential impacts. Furthermore, the commitment of \$1.5 billion by the federal government appears to make a mockery of the arms-length character of the strategic environmental assessment, making the approval of the project appear to be a foregone conclusion.

While the [referral documents](#) submitted to the NTEPA for approval are deficient, they are currently the most detailed publicly available program for the project and clearly demonstrate the current legal status of the project is that it is a predominately gas-based processing precinct. For example, [the draft program](#) submitted as part of the referral states that the following industries are within scope (see page 31):

- “Liquified Natural Gas (LNG);
- Ammonia and Derivatives;
- Urea and derivatives;
- Ethylene and derivatives;
- Methanol and derivatives;
- Gas to liquids (GTL);
- Hydrogen;
- Carbon capture and storage;
- Minerals processing;
- Advanced manufacturing;
- Support services industries.”

Until such time as the project plans for which legal approval are being sought is amended, the precinct must be understood as a gas and petrochemical hub.

Given the potentially catastrophic impacts of the Proposal, the flaws in the strategic environmental assessment to date, and the minimal knowledge base in the community about the Middle Arm Industrial

Hub's impacts, it is crucial that the project be subjected to the highest level of environmental assessment under both the Environment Protection Act and EPBC Act: a public inquiry.

The Hawke Review of the EPBC Act found that assessment by Inquiry was an underused method of assessment, highlighting the benefits of assessment by inquiry, including:

- Greater public confidence in processes, including reduction in potential for perceived bias;
- a means of providing independent input and dealing with controversial issues;
- greater capacity for public input and interaction with the commissioners of the inquiry – including face-to-face interaction; and
- a more transparent process of environmental scrutiny.

It is difficult to imagine an issue more contentious and more suited to the inquiry level of assessment than a gas and petrochemical hub on the doorstep of a residential area.

In the following five sections of this Submission, we elaborate on some of the key environmental and health risks associated with the proposed Middle Arm Industrial Precinct. We ask the Inquiry to consider the gravity of these risks – only some of which are detailed, due to lack of information on the nature of the precinct - in light of the inadequacy of the Strategic Environmental Assessment process to adequately assess and mitigate risks.

D. Climate impacts and climate risk

The expansion of the onshore and offshore gas industries in the Territory will drastically increase greenhouse gas emissions, undermining the NT's emissions reductions targets and increasing the risk of catastrophic climate change. The Middle Arm industrial precinct would facilitate gas expansion in multiple ways, including through the greenwashing of carbon capture and storage (CCS), increasing demand for gas through use as a feedstock for petrochemicals, and expanding gas processing and export (see above under sub-heading 1, "Greenwashing").

[Dr Petroni found that](#) the Middle Arm industrial precinct could increase the Northern Territory's emissions by 15 million tonnes per annum (or 75%), and could be the single highest greenhouse gas emitter in the NT. When indirect, cumulative and life cycle emissions are included (including the opening up of the Beetaloo, Barossa and Verus gas fields), the carbon footprint of Middle Arm is likely to be indefensibly high.

Furthermore, the site itself is likely to be at considerable risk from climate change. Middle Arm is extremely low-lying, with rises in sea levels and flooding endangering Middle Arm itself, which is [predicted to be regularly inundated by as early as 2030](#). In addition, there is a significant risk of

accidental releases resulting from storm surge, cyclones and climate change induced sea level rise. The footprint of the precinct itself, over 1500 hectares, is likely to not only destroy the soil on which it is built, but also degrade, through its toxic releases, the soils and mangrove “conservation areas” on the rest of the peninsula – the very mangroves that would protect the industries from the higher storm surges of the future. The heightened risk of accidents, and [the capacity of the Northern Territory Fire and Rescue Service to respond to these](#), has already been raised as a significant public health and risk issue.

Figure 1. Mid-range sea level rise projection shows that by 2030, annual flooding will reach areas planned for industrial facilities within the Middle Arm Development.¹⁶



Climate change is already a very real threat to us in the Northern Territory, and threatens to exacerbate existing inequalities in health, education, and infrastructure. [Climate modelling has suggested](#) that without drastic reductions in greenhouse gas emissions to avoid catastrophic climate change, the number of days over 35 degrees in Darwin will increase to 187 days per year by 2050 and 275 days per year by 2070. At the beginning of the 20th century, Darwin experienced an average of only 5.6 days per year over 35 degrees. Combined with high humidity, these temperatures pose a distinct threat to human health.

Given our unique vulnerability to climate change, it is particularly unjust for the Northern Territory to be burdened with an industrial precinct that will accelerate the already rapid deterioration of our climate.

A thorough climate risk assessment must be undertaken, including:

- a. An assessment of the direct, indirect and cumulative greenhouse gas emissions of the Middle Arm Precinct (including life cycle emissions associated with the opening up of multiple new gasfields connected to the Precinct), as well as the feasibility of any proposals to mitigate or offset those emissions;
- b. An assessment of the risks to climate posed by these emissions, including more intense bushfires and longer fire season, storm surges, coastal flooding, inland flooding, marine heat waves and other extreme weather events, and also systemic breakdowns and overwhelming of infrastructure networks and critical services, including electricity, water supply, internet, health care and emergency services, food insecurity and breakdown of food systems, and adverse impacts on national and global economies, financial markets, industries, business and professions and living costs;
- c. An assessment of Australia's ability to comply with its commitments made under the United Nations Paris Agreement on Climate Change should the Precinct go ahead;
- d. An assessment of transition risks associated with the actions of other nations in moving away from the use and extraction of fossil fuels, and seeking to reduce greenhouse gas emissions in accordance with the Paris Agreement. Alternatively, an assessment of the risks that the transition will result in a reduction in demand for fossil fuels, including gas, both globally and in Australia, in the future; and the imposition of future trade measures by importing countries on those who fail to meet their obligations under the Paris Agreement.

E. Health Impacts

1. Air pollution

The Greater Darwin region currently faces [extremely poor air quality](#), which will be further deteriorated by the Middle Arm industrial precinct, with significant implications for human health.

Doctors and parents from the Northern Territory, and around Australia, have galvanised a grass roots movement opposing the Middle Arm Industrial Hub on the grounds of its health impacts, with [over 1200 health professionals](#) from across the nation signing an open letter opposing Middle Arm and the decision to greenlight fracking in the Beetaloo Basin. There are strong foundations for these concerns, and ECNT submits that these will not be adequately addressed in the Strategic Environment Assessment.

In 2022, ECNT commissioned a report by Dr Michael Petroni on the potential environmental and human health impacts of the Middle Arm industrial precinct. Dr Michael Petroni is an environmental scientist

with expertise in environmental health and risk assessment, with a focus on petrochemical and large manufacturing. He has experience working for the United States Environmental Protection Agency on health risks associated with industrial facilities.

Dr Petroni’s full report is available [here](#). The report is modelled on the information presented in 2021 by the Executive Director of the Northern Territory’s Gas Taskforce on the likely industrial composition of the precinct. The results of Dr Petroni’s analysis are cause for major concern among residents of Darwin and Palmerston; his modelling suggests an increase in industrial fine particulate emissions by 513%, and a four-fold increase in the industrial cancer hazard.⁷ The image below shows a summary of the emissions changes that Dr Petroni suggested may occur if the precinct goes ahead based on the “balanced” scenario.⁸

| Pollutant | MASDP scenario estimated annual total | Increase in emissions vs region* or territory** |
|----------------------------|---------------------------------------|---|
| Carbon Monoxide | 34770.97 (Tonnes) | 805%* |
| PM2.5 Primary | 633.05 (Tonnes) | 513%* |
| PM10 Primary | 501.83 (Tonnes) | 391%* |
| Sulfur Dioxide | 1278.82 (Tonnes) | 245%* |
| Volatile Organic Compounds | 4753.8 (Tonnes) | 233%* |
| Nitrogen Oxides | 4852.89 (Tonnes) | 192%* |
| Greenhouse Gases (CO2e) | 15.52451 (Megatonnes) | 75%*** |

The connections between gas and petrochemical developments and poor health outcomes are well established. A [2020 meta analysis](#) found that populations living within 5km of petrochemical facilities experience a 30% higher risk of developing leukaemia than those without exposure to petrochemical facilities. The proposed Middle Arm industrial precinct is less than 3km away from populated areas of Palmerston.

⁷ The scenario analysed by Dr. Petroni may be an underestimate of some emissions, as his analysis did not include facilities to produce lithium-ferro-phosphate or vanadium oxides, which the Middle Arm Sustainable Development Precinct announced in September of 2023 would be part of the precinct.

⁸ Note that Dr. Petroni’s calculation relies on direct or ‘primary’ PM2.5 emissions and does not include the ‘secondary’ particulates formed from emissions of sulfur dioxide, nitrogen oxides, or ammonia. As the vast majority of particulates in the atmosphere are secondary, Dr. Petroni’s health and cost calculations of the health impacts of cumulative PM2.5 from Middle Arm Industrial Hub are likely highly conservative.

While not raised in Dr. Petroni’s study, the air quality and public health impacts of ammonia emissions from Middle Arm could be significant in the Greater Darwin Region. While agriculture is the largest source of ammonia, other significant sources include metals manufacturing, chemicals manufacturing, and fertilizer production,⁹ as well as some forms of carbon capture and sequestration,¹⁰ all of which the government has referenced as industries that may be included in the Middle Arm Industrial Hub. In 2021-2022, basic non-ferrous metal manufacturing in Australia emitted 3,000 tonnes of ammonia in 2021-22, while chemicals manufacturing emitted 620 tonnes, steel manufacturing emitted 460 tons, and fertilizer and pesticide manufacturing emitted 450 tonnes.¹¹

Ammonia is the most important precursor of secondary PM_{2.5} in most airsheds around the world, as ammonia mixes in the atmosphere with SO₂, NO_x, and HCl to form ammonium nitrate, ammonium sulfate, and ammonium chloride.¹² Secondary PM_{2.5} makes up most of the PM_{2.5} in the atmosphere,¹³ and harms human health through premature death, cardio-pulmonary disease, and lung cancer.¹⁴ A 2021 study found that abatement of ammonia emissions is a more cost-effective option to reduce PM_{2.5} and public health costs than NO_x abatement, at a global scale.¹⁵ Ammonia emissions also cause eutrophication and acidification of ecosystems, resulting in species loss.¹⁶

Increasing evidence points to the [negative health impacts of gas expansion](#) on not only our physical health, but also on the social, emotional, cultural, spiritual wellbeing of impacted communities. It is not only the residents of Darwin and Palmerston that should be concerned about the health impacts of this project. In facilitating gas expansion across the Territory, the Middle Arm industrial precinct increases the health risks faced by a range of communities, not just those in Greater Darwin. For example, there are distinct health implications for communities close to [fracking operations](#) in the Beetaloo Basin, which will be enabled by Tamboran’s LNG facility at Middle Arm.

⁹ Australian Government, *National Pollutant Inventory 2021-2022*, <http://www.npi.gov.au/npidata/action/load/emission-by-source-result/criteria/destination/ALL/substance/8/source-type/INDUSTRY/substance-name/Ammonia%2B%2528total%2529/subthreshold-data/Yes/year/2022>.

¹⁰ See, eg. European Environment Agency, *Air pollution impacts from carbon capture and storage (CCS)* (2011), <https://data.europa.eu/doi/10.2800/84208>, pp. 6, 10, 27.

¹¹ Australian Government, *National Pollutant Inventory 2021-2022*, <http://www.npi.gov.au/npidata/action/load/emission-by-source-result/criteria/destination/ALL/substance/8/source-type/INDUSTRY/substance-name/Ammonia%2B%2528total%2529/subthreshold-data/Yes/year/2022>.

¹² Katie Wyer et al, “Ammonia emissions from agriculture and their contribution to fine particulate matter: A review of implications for human health” (2022), *Journal of Environmental Management*, <https://www.sciencedirect.com/science/article/pii/S0301479722018588#sec7>; see also Junsu Park et al, ‘Contributions of Ammonia to High Concentrations of PM_{2.5} in an Urban Area’ (2021), *Atmosphere* 12, 12, <https://www.mdpi.com/2073-4433/12/12/1676>; Jason Plautz, ‘Ammonia, a poorly understood smog ingredient, could be key to limiting deadly pollution’ (2018), *Science*, <https://www.science.org/content/article/ammonia-poorly-understood-smog-ingredient-could-be-key-limiting-deadly-pollution>.

¹³ United States EPA, *Particulate Matter (PM) Basics* (2023), <https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>.

¹⁴ Katie Wyer et al, “Ammonia emissions from agriculture and their contribution to fine particulate matter: A review of implications for human health” (2022), *Journal of Environmental Management*, <https://www.sciencedirect.com/science/article/pii/S0301479722018588#sec7>

¹⁵ Baojing Gu et al, ‘Abating ammonia is more cost-effective than nitrogen oxides for mitigating PM_{2.5} air pollution’ (4 Nov 2021), *Science*, <https://www.science.org/doi/10.1126/science.abf8623>

¹⁶ Ibid.

There appear to be serious deficiencies in the way in which health impacts are being assessed via the strategic environmental assessment. Dr Petroni identified the following requirements:

- A robust health impact assessment must occur, including specification of the geographic boundaries of the analysis more precisely, a health baseline study, and a health monitoring plan;
- the airshed model requires excellent input data to provide a meaningful picture of the likely impacts of new facilities.

Instead, no health impact assessment appears to have been undertaken as part of the EIS, contrary to Federal [Health Impact Assessment Guidelines](#). Furthermore, Dr Petroni has raised concerns about the methodology used for the airshed model, which is that industry voluntarily fill out a one-time survey about their emissions. Given the gravity of known risks associated with industries proposed for Middle Arm, an airshed model based solely on voluntarily reported emissions is entirely inappropriate. Voluntary reporting is likely to lead to an inaccurate representation of the baseline landscape of emissions, and an underestimation of the overall harms that communities face. The people of Darwin and Palmerston should be able to access information about the impacts of this project on air quality, and accurate airshed modelling should also be the basis of decisions made by Federal and Territory regulators.

2. CCS Health Risks

Aside from the health implications of planned gas and petrochemical industries, the potential impacts of the CCS hub also warrant closer examination. The type of CCS hub proposed for Middle Arm is unprecedented in Australia, if not the world. CO₂ pipelines endanger the health of surrounding communities.¹⁷ CO₂ is not flammable like natural gas, but instead carries risks of intoxication, disorientation, and asphyxiation to humans and other biological forms of life.¹⁸ CO₂ vapour is 1.53 times heavier than air, meaning that when it is released it can blanket the ground where people are and displace the oxygen they breathe, acting as an asphyxiant to humans and animals.¹⁹

Severe weather increases the risks of straining CO₂ pipelines by eroding their support structures or subjecting them to heavy water flows that can cause them to rupture. On 22 February 2020, a CO₂ pipeline ruptured near Satartia, Mississippi that released an estimated total of 31,4052 barrels of CO₂. The cause of the Satartia rupture was stress on the pipeline when heavy rains led to a landslide, which

¹⁷ Congressional Research Service, Carbon Dioxide Pipelines: Safety Issues (2022), <https://crsreports.congress.gov/product/pdf/IN/IN11944>.

¹⁸ Nigel J. Langford, *Carbon dioxide poisoning*, 24, *Toxicol. Rev.*, 229–235 (2005); Matteo Vitali et al., *Risks and Safety of CO₂ Transport via Pipeline: A Review of Risk Analysis and Modeling Approaches for Accidental Releases*, 14(15), *Energies*, 4601 (2021).

¹⁹ *Id.*

created axial strain on the pipeline and resulted in a full circumferential girth weld failure.²⁰ When the CO₂ pipeline ruptured, it created a low-lying cloud of CO₂ that resulted in a mass poisoning of residents, asphyxiating people who were driving in their cars nearby when it happened, hospitalising 46 people, and requiring the evacuation of hundreds more.²¹ The pipeline operator, first emergency responders, and hospital staff were not prepared to effectively manage the impacts of a CO₂ pipeline rupture.²²

The pipeline that ruptured in Satartia was made of a stronger grade of steel than the Bayu-Undan pipeline and was designed to better transport CO₂. This raises concerns about the risks of rupture for Darwin residents. The strength of the steel or alloy in a pipeline, the ratio of wall thickness to pipeline diameter, and coatings to prevent corrosion are relevant considerations for determining the risk of a pipeline rupture.²³ The pipeline through Satartia was constructed with API 5L X80 grade steel,¹⁶ in comparison to Bayu-Undan's 5L X65 steel,²⁴ which means the Satartia pipeline had a stronger yield and tensile strength and ability to withstand greater pressures.²⁵

With climate change, Darwin is expected to experience storms of increasing severity and coastal erosion due to storm surges and rising sea levels. The low-lying Middle Arm peninsula is predicted to [be regularly inundated by as early as 2030](#). Such severe weather risks could strain the proposed CO₂ pipeline and cause a rupture, which could have significant impacts on human health in nearby Darwin and Palmerston. Given the unprecedented nature of this component of the project and the absence of 'best practice' examples of CO₂ "carpooling", the highest level of scrutiny must be applied to the potential impacts of any onshore CO₂ facilities.

3. Indirect health risks from Harbour contamination

The heavy industries planned for the Middle Arm precinct pose a threat to the health of our Harbour, through planned and unplanned toxic discharges which add to existing levels of contaminants (discussed below in *Biodiversity Impacts*). The industries proposed for the Middle Arm facility can produce discharges of heavy metals including lead, cadmium, lead mercury, chromium, and arsenic. These toxicants can enter the food chain and become a health risk to those who consume fish and shellfish from the Harbour. It is estimated that Territory fishers spend 27% of their annual fishing effort in

²⁰ U.S Department of Transportation, Pipeline and Hazardous Materials Safety Administration, Failure Investigation Report – Denbury Gulf Coast Pipelines LLC Pipeline Rupture/Natural Force Damage, (26 May 2022).

²¹ *Id.* See also, Dan Zegart, 'The Gassing of Satartia,' Huffpost (26 Aug. 2021), https://www.huffpost.com/entry/gassing-satartia-mississippi-co2pipeline_n_60ddea9fe4b0ddef8b0ddc8f.

²² *Ibid.*

²³ See, e.g., E. Østby *et al.*, *Safely repurposing existing pipeline infrastructure for CO₂ transport – Key issues to be addressed*, <https://www.pipeline-journal.net/articles/safely-repurposing-existing-pipelineinfrastructure-co2-transport-key-issues-be-addressed>.

²⁴ U.S Department of Transportation Pipeline and Hazardous Materials Safety Administration, Failure Investigation Report – Denbury Gulf Coast Pipelines LLC Pipeline Rupture/Natural Force Damage, (26 May 2022).

²⁵ American Piping Products, "API 5L SEAMLESS & WELDED PIPE" <https://amerpipe.com/products/api-5l-pipe-specifications/>.

Darwin Harbour²⁶ and seafood products from the harbour are widely consumed. Bioaccumulation of toxicants in the Harbour will pose a threat to the health of nearby populations.

One example of such a risk relates to cadmium. LNG facilities' discharge often includes cadmium, as does some forms of vadamium processing. Australian Government guidelines recommend a limit of 0.2 µg/L of cadmium when shellfish in the area are likely to be used for human consumption.²⁷ This applies to Darwin Harbour, where shellfish species such as mud whelk, long bum, periwinkle and oyster are harvested for consumption, including by Larrakia communities. The long-term average of cadmium in the nearby Santos LNG pond-water between 2016-2022 was already above this limit, at 0.23 µg/L.²⁸ Cadmium levels in nearby Elizabeth River, Berry Creek and Bees Creek are nearing this limit, averaging 0.1 µg/L during the wet season.²⁹ Cadmium can have severe impacts on human health because there is "evidence of it causing prostate and kidney cancer in humans, [it] has been shown to cause lung and testicle cancer in animals," and it "may cause reproductive damage."³⁰ Additionally, "[r]epeated low exposures can cause permanent kidney damage that may go unnoticed" and long-term exposures "can cause anaemia, fatigue and loss of the sense of smell."³¹ Moreover, cadmium is toxic for the immune system itself, contributing to a variety of other diseases,³² and has been shown to alter DNA to produce epigenetic changes that increase risks for many types of cancer.³³

As detailed below in *Biodiversity Impacts*, levels of some other toxicants such as lead, zinc and chromium are already nearing or at trigger levels in the Harbour. The capacity of such toxicants to enter the food chain as a result of industrial activities proposed for Middle Arm needs to be considered in a health impact assessment.

F. Cultural heritage impacts

The Federal funding commitment to the Middle Arm industrial precinct was made without consultation with Larrakia families, despite the fact that Larrakia people have been custodians of the Middle Arm

²⁶ West, L. D., Lyle, J. M., Matthews, S. R., Stark, K. E. and Steffe, A. S. (2012). Survey of Recreational Fishing in the Northern Territory, 2009-10. Northern Territory Government, Fishery Report No. 109.

²⁷ Government of Australia and Government of New Zealand et al., 'Cadmium in freshwater and marine water,' (2000) <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/toxicants/cadmium-2000>

²⁸ Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022 (2022)* p 32, Table 3-5 https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf.

²⁹ NT Government, *Water Quality in the Darwin Region*, p 17 Table 2-4 https://depws.nt.gov.au/_data/assets/pdf_file/0006/254850/finaldraftWQPPreport_2.pdf.

³⁰ Government of Australia, Department of Climate Change, Energy, the Environment and Water, *Cadmium and compounds* (30 June 2022) <https://www.dcceew.gov.au/environment/protection/mpi/substances/fact-sheets/cadmium-and-compounds>.

³¹ Government of Australia, Department of Climate Change, Energy, the Environment and Water, *Cadmium and compounds* (30 June 2022) <https://www.dcceew.gov.au/environment/protection/mpi/substances/fact-sheets/cadmium-and-compounds>.

³² Zhineng Wang et al., 'Effects of Cadmium Exposure on the Immune System and Immunoregulation,' (2021) 12 *Front. Immunol.* 695484.

³³ Giuseppe Genchi et al., 'The Effects of Cadmium Toxicity,' (2020) 17(11) *Int. J. Environ. Res. Public Health* 3782.

peninsula for millennia. The peninsula is a site of immense cultural significance to the Larrakia people, and a unique pre-invasion archaeological record unparalleled in the Darwin region. The peninsula is the site of the only indigenous rock art to have survived colonisation.

Larrakia leaders have warned that the development of the Middle Arm industrial precinct [could lead to “another Jukaan gorge”](#), and lead to the destruction of important sites. Significant sites are threatened not only by direct clearing for construction, but also by the potential for ecological degradation and pollution as a result of the industrial activities of the precinct.

It is imperative that a Larrakia-led and governed cultural values assessment and cultural heritage impact assessment be undertaken in accordance with their protocols, prior to the release of any further environmental impact assessment documentation.

G. Biodiversity impacts

1. Marine environments

Darwin Harbour is home to very many diverse ecosystems, including intact mangrove systems, coral reefs, mudflats and seagrass beds. It supports high biodiversity and provides habitat for nesting turtles, dolphins, dugongs, migratory shorebirds and fish. It also is important as a recreational fishing ground for many Darwin people. The health of Darwin Harbour is also vital for important Northern Territory industries, such as pearling, tourism and barramundi.

The environmental, economic, and social importance of the Darwin Harbour means that its governance and integrated planning is critical. This helps ensure that the balance between different interests is maintained. The Middle Arm industrial precinct appears to be in conflict with prevailing strategies for the development of the Harbour. The Water Act provides for the declaration of permitted “beneficial uses” of the water in certain areas, which then determines the applicable water quality objectives and guidelines and are used to develop water management plans.³⁴ A guiding principle of the Darwin Harbour Strategy is that “Policy settings and regulation must be supportive of the harbour’s beneficial uses in a manner that achieves mutual and balanced recognition of economic, social, cultural and environmental considerations.”³⁵ The beneficial use declarations for the Darwin Harbour Region notably do not include “industry” or “petroleum activity” among the listed uses.³⁶

³⁴ Water Act s 22A. See also Northern Territory Government, *Beneficial Water Use and Declared Areas* (2023) <https://nt.gov.au/environment/water/management-security/water-allocation/beneficial-water-use>.

³⁵ Darwin Harbour Advisory Committee, *2020-2025 Darwin Harbour Strategy* (July 2020) p 9 https://industry.nt.gov.au/_data/assets/pdf_file/0020/1041185/darwin-harbour-strategy-2020-2025.pdf

³⁶ Northern Territory Government, ‘Declaration of Beneficial Uses and Objectives of Surface Water: Darwin Harbour (Natural Waterways and High Water Mark)’, *Gazette No. G27* (7 July 2010).

Marine environments will be impacted by the Middle Arm development. The number of dolphins resident in Darwin Harbour [almost halved](#) following the construction of the Inpex LNG plant on the Middle Arm peninsula in 2011, and ecological research suggests that our brilliant harbour ecosystem is already under strain.

There are serious deficiencies in baseline information about Darwin Harbour by which to rigorously assess the marine impacts of the Middle Arm Industrial Hub. In particular, there are major gaps in understanding around the potential impacts of development including:

- toxicants, contaminants;
- Biological impacts and ecological health indicators;
- Estuarine and land-sea ecosystem processes and function;
- Soft sediment communities; e. Coral reef and seagrass communities;
- Fish nursery and feeding areas; g. Movements and critical habitat of key marine megafauna.

It is critical that baseline ecosystem data about Darwin Harbour is obtained as part of the strategic environmental assessment, including in the above areas. ECNT is concerned that much of the marine research undertaken in Darwin Harbour has been funded and controlled by the gas industry. For example, the Darwin Harbour Integrated Monitoring and Research Program (funded by Inpex) has become the default long-term marine monitoring program for Darwin Harbour, and Inpex retains a veto over the public release of this data. The Australian Marine Science Association has provided a detailed critique of the limitations of baseline data and referral documentation for the Middle Arm Industrial Hub [here](#).

Bioaccumulation of heavy metals and hydrocarbons

The industries proposed for the Middle Arm Industrial precinct have enormous potential to lead to contamination of Darwin Harbour through planned and unplanned discharges, increased vessel traffic, and development of terrestrial surfaces known to be high in acid sulfate soils.

The proposed Tamboran LNG plant and vanadium facility would likely discharge the following toxic substances into the marine environment. LNG facilities' wastewater typically includes heavy metals, such as cadmium, mercury, chromium, and arsenic,³⁷ as well as petroleum hydrocarbons. Hydrocarbons may also be discharged into the harbour from marine vessels servicing Middle Arm, either through routine spills or vessel strikes. In some forms of vanadium processing, the toxicants mercury, chromium, arsenic, lead, and cadmium can enter wastewater easily, resulting in an acute threat to the watery environment if not properly treated.

³⁷ See, eg, Woodside Energy Ltd, 'Pluto LNG Project Treated Waste Water Management Plan,' (2014) p 24 https://www.woodside.com/docs/default-source/our-business---documents-and-files/pluto---documents-and-files/pluto-lng-environmental-compliance-documents/pluto-lng-project---treated-waste-water-marine-discharge-management-plan.pdf?sfvrsn=c7a0e38d_4 (showing Woodside's Pluto LNG facility discharged cadmium above trigger values).

These heavy metals and hydrocarbons bioaccumulate, meaning they cause an artificial increase in the concentration of chemicals in biological organisms over time.³⁸ As cadmium, mercury, and hydrocarbons bioaccumulate, they can harm several marine species. Arsenic and chromium also bioaccumulate, although potentially to a lesser degree. These substances can harm important species for recreational fishers in Darwin Harbour, such as Barramundi that are sensitive to bioaccumulation of heavy metals such as mercury.³⁹

Unfortunately, Darwin Harbour is already under strain from planned and unplanned discharge from existing industries:

- Cadmium levels in Elizabeth River, Berry Creek and Bees Creek average 0.1 µg/L during the wet season.⁴⁰ In places where people are likely to harvest shellfish for consumption (as in Darwin Harbour), the guidelines recommend a concentration limit of 0.2 µg/L, because evidence suggests that cadmium is carcinogenic for humans, and may also impact human reproductive systems.⁴¹ The long-term average of cadmium in the nearby Santos LNG pond-water between 2016-2022 was already above this limit, at 0.23 µg/L.⁴²
- Harbour mudwhelks tested in 2022 were found to have lead levels that exceeded Australian guidelines.⁴³
- Chromium from the existing Santos LNG facility already exceed that facility's licence trigger values.⁴⁴

Further industrialisation may push current concentrations of toxic substances in Darwin Harbour and the Elizabeth River estuary and other sites to levels that are extremely damaging to the Harbour ecosystem and even beyond the national guidelines for safe consumption.

The Middle Arm Industrial Hub would add to levels of toxicants in Darwin Harbour that are already high from existing facilities. For example:

³⁸ Australian Government and New Zealand Government et al., 'Accounting for Local Conditions – Bioaccumulation', *Australia and New Zealand Guidelines for Marine Environmental Quality* (15 April 2020) <https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/water-quality-toxicants/local-conditions#bioaccumulation>.

³⁹ See Edward Butler et al., 'Influence of life history variation and habitat on mercury bioaccumulation in a high-order predatory fish in tropical Australia,' (2022) 212(A) *Environmental Research* 113152.

⁴⁰ NT Government, 'Water Quality in the Darwin Region', p17 Table 2-4 https://depws.nt.gov.au/_data/assets/pdf_file/0006/254850/finaldraftWQPPreport_2.pdf.

⁴¹ Government of Australia, Department of Climate Change, Energy, the Environment and Water, 'Cadmium and compounds' <https://www.dcceew.gov.au/environment/protection/npisubstances/fact-sheets/cadmium-and-compounds>.

⁴² Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022* (2022) p 32, Table 3-5 https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf.

⁴³ Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022* (2022) p 58 https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf

⁴⁴ See Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022* (2022) p 27 https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf ("In Q2 there were exceedances in total nitrogen, phosphorous, ammonia, PO4-P, chromium, copper, lead, silver, and zinc").

- a. Lead discharges from Middle Arm’s proposed vanadium facility could exacerbate levels of lead in harbour mud whelks that are already exceeding recommended guidelines;⁴⁵
- b. Middle Arm’s proposed LNG and vanadium facilities could also add to high levels of chromium from the Santos LNG facility that are already exceeding that facility’s licence trigger values;⁴⁶
- c. Middle Arm’s proposed LNG facility could contribute to existing concentrations of hydrocarbons in Darwin Harbour, which have recently reached “levels greater than the historical range”;⁴⁷ and
- d. Wastewater from both the proposed LNG and vanadium facilities could cause Darwin Harbour to exceed federal environmental and human health guidelines for cadmium.

Zinc can enter the marine environment through the following two processes associated with an LNG export facility. First, tankers loading LNG cargo for export are likely to have scrubbers for exhaust gases that are sprayed with water to meet sulphur fuel content guidelines.⁴⁸ The wastewater from this process can contain high levels of zinc that is discharged into the marine environment.⁴⁹ The Middle Arm Industrial Hub is likely to significantly increase the amount of traffic from LNG tankers in Darwin Harbour; Ichthys already attracts over 1,000 ships loading LNG, LPG and condensate cargo, and the proposed Middle Arm LNG project is predicted to bring around 500 more tankers per year.⁵⁰ Second, wastewater discharge from onshore LNG facilities can also contain elevated levels of zinc.⁵¹ Zinc can “accumulate and cause toxicity, primarily by disrupting the internal calcium balance” of marine

⁴⁵ See Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022* (2022) p 56 https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf (levels of lead in mudwhelk samples exceed recommended guidelines).

⁴⁶ See Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022* (2022) p 27 https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf (“In Q2 there were exceedances in total nitrogen, phosphorous, ammonia, PO4-P, chromium, copper, lead, silver, and zinc”).

⁴⁷ Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022* (2022) p 53 https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf (Total Recoverable Hydrocarbons in sediments in mangroves “reported levels greater than the historical range, with a large spike observed at [sampling site] SP2-A of 2,000 mg/kg”).

⁴⁸ Johannes Teuchies et al., ‘The Impact of Scrubber Discharge on the Water Quality in Estuaries and Ports’ (2020) 32(103) *Environmental Sciences Europe* <https://enveurope.springeropen.com/articles/10.1186/s12302-020-00380-z>.

⁴⁹ Johannes Teuchies et al., ‘The Impact of Scrubber Discharge on the Water Quality in Estuaries and Ports’ (2020) 32(103) *Environmental Sciences Europe* <https://enveurope.springeropen.com/articles/10.1186/s12302-020-00380-z>.

⁵⁰ Under the most likely scenario for the Middle Arm LNG plant proposal, known as ‘Scenario 1’ or the ‘Balance Scenario’, the project will involve 499 vessels per year: NT Government, Document Released Under the Freedom of Information Act 1982 (Cth) by the Department of Infrastructure, FOI 23-216, Doc. 5 (2023).

⁵¹ Woodside Energy Ltd, ‘North West Shelf Project Extension Marine Environmental Quality Management Plan, Appendix D’ in ‘North West Shelf Project Extension Environmental Review Document,’ EPA Assessment No. 2186, pp 19, 23, Tables 4-1, 4-4. (Dec. 2019)

organisms.⁵² Any discharges of zinc from proposed Middle Arm activities would be in addition to high levels of zinc from existing wastewater sources, such as from the Santos LNG facility, where zinc levels exceeded the facility's licence trigger value in 2022.⁵³

Amines are used to remove impurities from gas streams, and have emerged as a top chemical used in the carbon capture process for gas facilities worldwide.⁵⁴ The proposed Middle Arm CCS facility could have high levels of amines in its wastewater.⁵⁵ Amines can also be found in LNG facility wastewater discharges.⁵⁶ Discharge of amines can "promote potential long-term toxicity" and persist in the marine environment because they are very slow to degrade.⁵⁷ Chronic exposure to amines can affect fish at concentrations as low as 0.5 mg/L. A decrease in egg hatching was observed in Carp exposed to 0.5 mg/L of amines.⁵⁸ Discharges of amines from the existing Ichthys LNG facility's jetty outfall into Darwin Harbour have resulted in concentration levels ten times higher than those that affect fish, reaching 5 mg/L in 2022.⁵⁹ The Middle Arm Industrial Hub is likely to increase amine levels substantially because it would house both an LNG facility and one of the world's largest CCS facilities.

Some possible toxicants come from the Peninsula itself; the project area has previously been noted for the prevalence of acid sulfate soils.⁶⁰ Disturbance of acid sulfate soils through construction and clearing can "lead to reduced pH, decreased oxygen concentration in water and the release of heavy metals such as cadmium and lead, and metalloids such as arsenic."⁶¹

⁵² Australian Government and New Zealand Government et al., *Toxicant Default Guideline Values for Aquatic Ecosystem Protection: Zinc in Marine Water* (Technical Brief, September 2021) p 2
https://www.waterquality.gov.au/sites/default/files/documents/zinc_marine_dgv_technical-brief.pdf.

⁵³ Santos, *Darwin LNG Annual Environmental Monitoring Report: 1 January 2022 – 31 December 2022* (2022) p 23
https://ntepa.nt.gov.au/_data/assets/pdf_file/0009/1211040/epl217-02-santos-dlng-annual-environmental-monitoring-report-2022.pdf.

⁵⁴ Ingvild Eide-Haugmoa et al., 'Environmental impact of amines' (2009) 1(1) *Energy Procedia* 1297, p 1298
<https://www.sciencedirect.com/science/article/pii/S1876610209001714>

⁵⁵ See Cong Dong et al., 'Wastewater treatment in amine-based carbon capture,' (2019) 222 *Chemosphere* 742-756
<https://www.sciencedirect.com/science/article/abs/pii/S0045653519300384> (noting CCS wastewater contains high levels of amines).

⁵⁶ For example, an LNG plant in Papua New Guinea contained wastewater in its retention pond, with elevated levels of MDEA. See ExxonMobil, *Papua New Guinea LNG Project Environmental Management Plan: LNG Plant and Marine Facilities* (Report, December 2019) 44, Table 9-7 https://www.pnglng.com/media/PNG-LNG-Media/Files/Environment/Production%20ESMP/EMP-LNG-Plant-and-Marine-Facilities-Rev-3_PUBLIC.pdf; Woodside, MEQ Management Plan pp 14-6

⁵⁷ G. Libralato et al., 'Seawater ecotoxicity of monoethanolamine, diethanolamine and triethanolamine' (2010) 176 (1-3) *Journal of Hazardous Materials* 535, p 539.

⁵⁸ K. Bieniarz et al., 'Effects of N,N-dimethylnitrosamine (DMNA) on in vitro oocyte maturation and embryonic development of fertilized eggs of carp (*Cyprinus carpio* L.) kept in eutrophied ponds,' (March – April 1996) 16(2) *J Appl Toxicol.*, 153.

⁵⁹ INPEX, 'EPL228 Annual Environmental Monitoring Report 2019-2020,' (2020) p 183, Table C.29
https://www.inpex.com.au/media/kxolqyub/l060-ah-rep-70011_0_reviewed_ifu.pdf.

⁶⁰ See, for example, EIS documents for TNG's proposed facility at the site now allocated to Tamboran's LNG facility. TNG, *Acid Sulfate Soils Management Plan* (2019)
https://ntepa.nt.gov.au/_data/assets/pdf_file/0003/761484/draft_eis_darwin_processing_facility_appendixl_acid_sulfate_soils_management_plan.pdf

⁶¹ Water Quality Australia, *Acid Sulfate Soils* (2023) <https://www.waterquality.gov.au/issues/acid-sulfate-soils>

Dredging

The NT Government estimates a dredge volume of 20 million cubic meters, to allow a six kilometer navigational channel to connect to the proposed Modular Offset Facility (MOF) and product jetties. This would allow Panamax vessels with an all-tide depth of 14m and a length of 220m to access the product jetties.

Dredging releases sediment that can remain suspended in the water in turbid blooms and travel long distances before settling.⁶² The INPEX EIS for the Ichthys plant predicted that under some tidal conditions, plumes could reach concentrations up to 50 mg/L and distances up to 10 km from the dredging area, in violation of the water quality objectives for Darwin Harbour, which prescribe a 10 mg/L limit for suspended-sediment concentrations.⁶³ Turbidity is particularly problematic for hard-coral communities because the particles smother the coral and reduce the availability of light,⁶⁴ which can reduce growth and calcification rates and ultimately cause coral bleaching and death.⁶⁵

Increased turbidity can also affect fish by impacting their feeding ability, causing gill damage, and giving rise to behavioural alterations like changes in habitat choice and altered predator-prey relationships.⁶⁶ Invertebrates are impacted as well; increased suspended sediment can cause abrasion, decreased respiration rates due to clogging of filtration mechanisms, and behavioural changes.

It is possible that dredging impacts from the Middle Arm precinct may overlap or add to the cumulative impacts associated with maintenance dredging for the Darwin Port,⁶⁷ which could intensify or prolong the impacts described above.

2. Terrestrial environments

The Middle Arm development proposed to flatten 1,500 hectares of the Middle Arm peninsula. This area has been identified as a key terrestrial biodiversity hotspot - [one of the most significant in the entire Territory](#). Loss or degradation of habitat at the Peninsula has the potential to impact the viability of a number of key threatened terrestrial species, including black-footed tree rats, northern brush-tail

⁶² INPEX, *Ichthys Gas Field Development Project: Draft Environmental Impact Statement* (2010) pp 308-09
<https://www.inpex.com.au/media/vg1lrbdw/draft-environmental-impact-statement-complete.pdf>.

⁶³ INPEX, *Ichthys Gas Field Development Project: Draft Environmental Impact Statement* (2010) p 310
<https://www.inpex.com.au/media/vg1lrbdw/draft-environmental-impact-statement-complete.pdf>.

⁶⁴ INPEX, *Ichthys Gas Field Development Project: Draft Environmental Impact Statement* (2010) p 322
<https://www.inpex.com.au/media/vg1lrbdw/draft-environmental-impact-statement-complete.pdf>; Victoria L. G. Todd et al, 'A review of impacts of marine dredging activities on marine mammals', *ICES Journal of Marine Science* (Feb. 2015)
<https://academic.oup.com/icesjms/article/72/2/328/676320?login=false>.

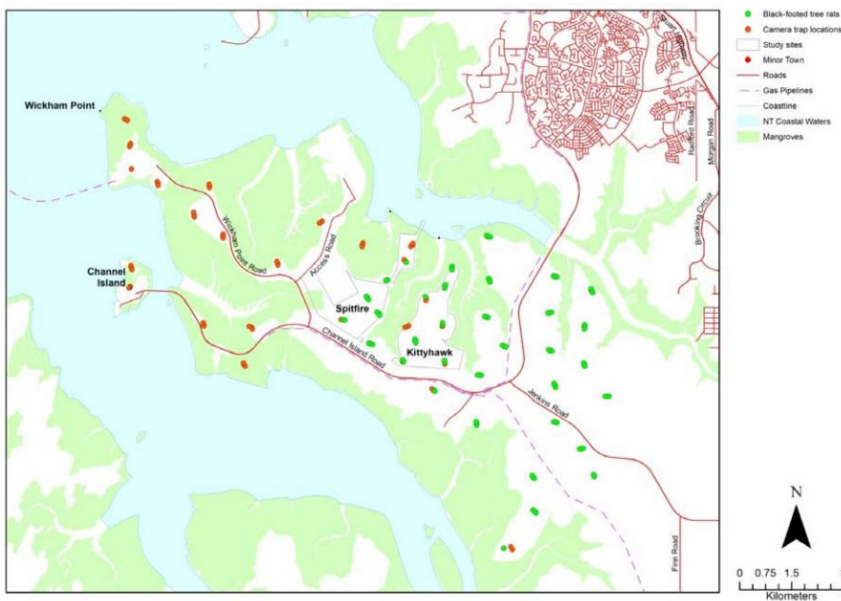
⁶⁵ Victoria L. G. Todd et al, 'A review of impacts of marine dredging activities on marine mammals,' (Feb. 2015) *ICES Journal of Marine Science* <https://academic.oup.com/icesjms/article/72/2/328/676320?login=false>.

⁶⁶ Victoria L. G. Todd et al, 'A review of impacts of marine dredging activities on marine mammals,' (February 2015) *ICES Journal of Marine Science* <https://academic.oup.com/icesjms/article/72/2/328/676320?login=false>.

⁶⁷ AECOM Australia, *Darwin Port Long Term Dredging Management Plan* (2018) p 22
https://darwinport.com.au/sites/default/files/uploads/2018/LTDMP%2060553579_Darwin%20Port%20LTDMP_Rev1%205%20Feb%2018%20with%20Appendix%20A.pdf

possums, and rare and endemic plants such as *Typhonium praetmissum* and a newly-discovered range-restricted species of *Typhonium* (pers comm NT Herbarium).

The near-threatened bare-rumped sheath tail bat is reported to also be present at Middle Arm, according to the results of unpublished DEPWS Flora and Fauna Division surveys, reported in TNG’s draft EIS for its Middle Arm processing facility.⁶⁸ Limited surveys conducted as part of the development of TNG’s EIS conducted surveys of black footed tree rats (shown below⁶⁹) show that Lot 1817 “is in the centre of a population of Black-footed Tree-rat that occupies the centre of Middle Arm.”⁷⁰ Lot 1817 has now been granted to Tamboran for its LNG facility.



The site allocated to Tamboran’s LNG facility is a known roosting site for the critically endangered far-eastern curlew.⁷¹ In fact, the Middle Arm peninsula as a whole meets the criteria for being considered nationally significant with reference to the abundance of four species of migratory shorebird⁷² and also with reference to the diversity of migratory bird species.⁷³ The Middle Arm industrial precinct will impact the availability and integrity of habitat for these and other species.

⁶⁸ TNG, ‘Appendix J – Significant fauna Impact Assessment Part 4’ in *Supplement to Draft EIS* (2021) p 55
https://ntepa.nt.gov.au/__data/assets/pdf_file/0012/986466/Appendix-J-Significant-Fauna-Impact-Assessment_Part4.pdf

⁶⁹ TNG, ‘Appendix J – Significant fauna Impact Assessment Part 2’ in *Supplement to Draft EIS* (2021) p 25
https://ntepa.nt.gov.au/__data/assets/pdf_file/0012/986466/Appendix-J-Significant-Fauna-Impact-Assessment_Part2.pdf

⁷⁰ TNG, ‘Appendix J – Significant fauna Impact Assessment Part 1’ in *Supplement to Draft EIS* (2021) p 21
https://ntepa.nt.gov.au/__data/assets/pdf_file/0012/986466/Appendix-J-Significant-Fauna-Impact-Assessment_Part1.pdf

⁷¹ TNG, ‘Appendix J: Significant Fauna Impact Assessment part 6’ in *Supplement to the Draft EIS* (2021). p 74

https://ntepa.nt.gov.au/__data/assets/pdf_file/0004/986485/Appendix-J-Significant-Fauna-Impact-Assessment_Part6.pdf

⁷² Ibid. p 78

⁷³ Ibid p 76.

3. Threats to mangroves

In less than thirty years, 269 hectares of mangroves in Darwin Harbour have been deforested for infrastructure development, representing an irreversible loss of biodiversity and ecosystem services.⁷⁴ It is unclear to what extent the Middle Arm Industrial Hub will require clearing mangrove forests, but even without this information several key source of potential impact on mangrove ecosystems can be identified: sedimentation, wastewater discharge, hydrocarbon discharge, and alteration of groundwater flow.

Dredging can cause sediment to smother or bury mangrove root systems. Sediment damage to trees ranges from reduced vigour to death.⁷⁵ INPEX's LNG EIS predicted that for that facility alone 28 hectares of mangroves would be impacted by sedimentation rates between 50-100 mm, noting that sensitive mangrove species were at risk of reduced plant growth or death at that sedimentation level.⁷⁶

Further, the Middle Arm Industrial Hub poses risks to mangrove health through wastewater discharges and other industrial activities. Santos' existing Darwin LNG facility acknowledges that wastewater is discharged "indirectly to the Darwin Harbour via the mangrove ecosystem."⁷⁷ Santos notes that discharging wastewater in this way has the potential to affect the "density and diversity" of mangroves as a result of an increase in freshwater inflows, causing excess sediment, and discharging toxicants such as hydrocarbons or heavy metals.⁷⁸ Heavy metals are of particular concern for mangroves since they can bioaccumulate in sediment.⁷⁹ Because of their well-developed root systems, mangrove ecosystems promote increased sedimentation and they are thus major reservoirs of heavy metal pollutants, an issue which harms their ability to serve their usual ecological function.⁸⁰

Mangroves are also "particularly susceptible to pollution from hydrocarbon spills."⁸¹ Hydrocarbons have both short- and long-term effects on mangroves: coating of fresh condensate leads to short-term

⁷⁴ Darwin Harbour Advisory Committee, *2020-2025 Darwin Harbour Strategy* (2020) p 17
https://industry.nt.gov.au/_data/assets/pdf_file/0020/1041185/darwin-harbour-strategy-2020-2025.pdf.

⁷⁵ INPEX, *Ichthys Gas Field Development Project: Draft Environmental Impact Statement* (2010) p 320
<https://www.inpex.com.au/media/vg1lrbdw/draft-environmental-impact-statement-complete.pdf>.

⁷⁶ Darwin Harbour Advisory Committee, *2020-2025 Darwin Harbour Strategy* (2020) p 17
https://industry.nt.gov.au/_data/assets/pdf_file/0020/1041185/darwin-harbour-strategy-2020-2025.pdf.

⁷⁷ Santos, *Darwin LNG Operations Environmental Management Plan* (2020) p 43.

⁷⁸ Santos, *Darwin LNG Operations Environmental Management Plan* (2020) p 81.

⁷⁹ Zhenglei Xie et al, 'Risk assessment of heavy metals in a typical mangrove ecosystem: A case study of Shankou Mangrove National Natural Reserve, southern China', *ScienceDirect* (May 2022)
<https://www.sciencedirect.com/science/article/pii/S0025326X22003241>.

⁸⁰ Daobin Tang et al, 'Heavy metal pollution status and deposition history of mangrove sediments in Zhanjiang Bay, China', (5 September 2022) *Frontiers in Marine Science* <https://www.frontiersin.org/articles/10.3389/fmars.2022.989584/full>.

⁸¹ INPEX, *Ichthys Gas Field Development Project: Draft Environmental Impact Statement* (2010) p 352
<https://www.inpex.com.au/media/vg1lrbdw/draft-environmental-impact-statement-complete.pdf>.

mortality, and longer-term sedimentation of hydrocarbons impedes plant growth.⁸² Increased vessel traffic can exacerbate this risk by increasing frequency of accidents and vessel oil spills.⁸³

Finally, proposed precinct infrastructure can lead to alteration in groundwater flow that can be harmful. The INPEX project, for example, required sealing parts of the ground surface for its infrastructure, and the EIS noted the reduced access to fresh groundwater can cause potentially severe impacts on mangroves, including tree death.⁸⁴ The multi-user Middle Arm industrial precinct will require far wider sealing of ground surfaces, and may irreparably alter groundwater supply to the mangroves of Middle Arm.

4. Risk Mitigation

The Northern Territory does not provide strong mechanisms to identify or protect places of ecological significance. ECNT has previously found that “generally, there are no robust conservation mechanisms to, amongst other things, identify or protect high value habitat and essential ecological processes.”⁸⁵

The NT Government’s [draft program](#) for the Middle Arm industrial precinct recognises that under a “full development scenario”, the project will have “unavoidable impacts on some terrestrial biodiversity values. It is expected that these will be significant and that offsets will therefore be required. Offsets planning for terrestrial biodiversity values is underway.”

Biodiversity offsets and their misuse have been widely critiqued, and the biodiversity offset scheme in the Northern Territory is [particularly incapable of meaningfully addressing ecological harms](#). The NT’s biodiversity offsets model links compensation to biodiversity targets that may or may not be equivalent to the biodiversity lost. The paucity of relevant biodiversity data in the Territory makes it near impossible to assess the extent to which a compensation adequately addresses the biodiversity lost.

ECNT understands that a relatively new, largely untested, biodiversity offset method called the “[expert elicitation method](#)” is proposed to be used for Middle Arm. Troublingly, this is presented as a “quick” and “inexpensive” way of estimating the conservation benefits of proposed offsets.

⁸² INPEX, *Ichthys Gas Field Development Project: Draft Environmental Impact Statement* p 352 (2010) <https://www.inpex.com.au/media/vg1lrbdw/draft-environmental-impact-statement-complete.pdf>.

⁸³ See Rong-chang Chen, Jing Shi & Chen LIU, ‘Study on Oil Spill Risks and Emergency Response Strategy in Xiamen Bay’, *2nd International Conference on Sustainable Energy and Environmental Engineering* (2016) https://scholar.googleusercontent.com/scholar?q=cache:PfbucRo543MJ:scholar.google.com/+vessel+traffic+impacts+on+mangroves&hl=en&as_sdt=0,23&as_vis=1.

⁸⁴ INPEX, *Ichthys Gas Field Development Project: Draft Environmental Impact Statement* (2010) p 386 <https://www.inpex.com.au/media/vg1lrbdw/draft-environmental-impact-statement-complete.pdf>.

⁸⁵ Environment Centre NT, *Nature Laws Discussion Paper* (2023) p16 https://assets.nationbuilder.com/ecnt/pages/759/attachments/original/1670951406/ECNT_Nature_Laws_Discussion_Paper_WEB.pdf?1670951406

It is understood that an area of land near Middle Arm, called Blackmore Peninsula, is being investigated as a possible offset option for Middle Arm. However, Blackmore Peninsula has very few of the significant biodiversity values of Middle Arm, and is already a hunting reserve. ECNT understands it would not satisfy the threshold requirement of “like for like” or “additionality.”

Given the extraordinary conservation values of Middle Arm, and the likely impacts, any proposed methodology must be disclosed, peer-reviewed, and scrutinised.

H. Impacts on water

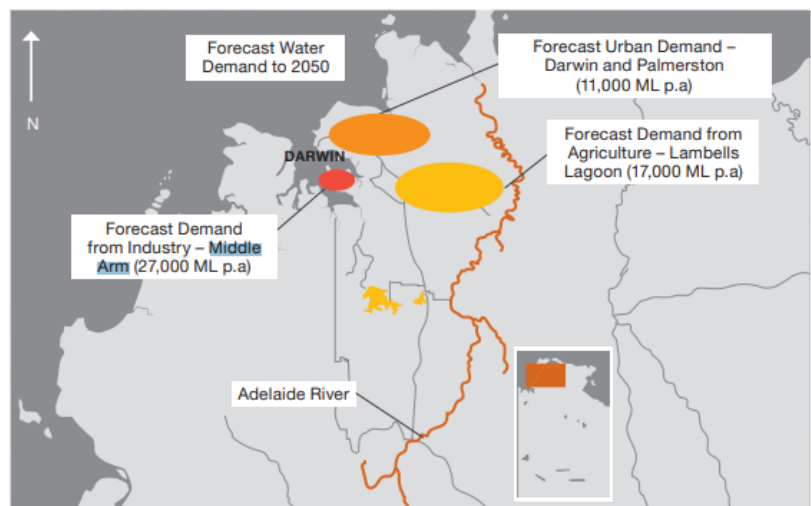
The Middle Arm Industrial Hub will use significant amounts of water. The “balanced scenario” pictured above at page 7 of this submission, suggests that 27GL of freshwater per year will be required for the precinct. Darwin’s existing water supply is insufficient to meet this demand, and thus the NT Government is seeking approximately \$1.4 billion in federal funding to construct a dam on the Adelaide River, called the Adelaide River Offstream Water Storage (AROWS). Thus, the true cost of the Middle Arm Industrial Hub to the taxpayer could be in the vicinity of \$3billion.

The [detailed business case findings](#) for AROWS demonstrate that close to half of the forecast demand for water from AROWS will come from Middle Arm (see figure below).

Building on the findings of the Preliminary Assessment (Part A), a comprehensive assessment of the existing water supply and forecast water demand found that there are three key demand factors, illustrated in Figure 5.

This assessment was underpinned by significant stakeholder consultation across industry and government, with consideration of market trends and the strategic priorities of government.

Figure 5: Forecast water demand and supply sources



The Adelaide River is a beloved and iconic free-flowing river of the Northern Territory, valued for fishing, cultural reasons, as well as for tourism activities including the famous “jumping crocodile” cruises. It is not well understood by people in the Northern Territory, and nationally, that Middle Arm will not only entail the construction of a major gas and petrochemical hub in Darwin Harbour, but also the damming

of one of the Northern Territory's iconic rivers, also at the expense of the Australian taxpayer. The impacts of the proposed Middle Arm Industrial Hub on the water resources of the Northern Territory, including the Adelaide River, should be thoroughly interrogated by the Inquiry, as well as the additional cost to the taxpayer of AROWS going ahead to service the Middle Arm Industrial Hub.

I. Social, recreational and tourism impacts

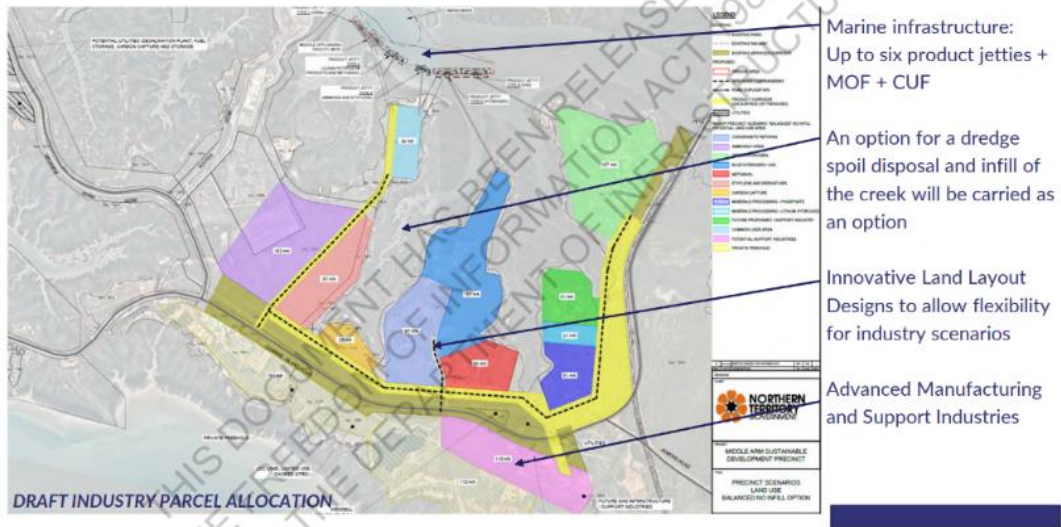
Darwin is defined by its harbour, and it is intrinsic to its social and cultural life, including its [extensive recreational fishing community](#). The 2021 Integrated Darwin Harbour Report Card identified 12 values that are integral to the Harbour, including resilience and climate change, clean water, healthy ecosystems and landscapes, biodiversity, Indigenous values, management, lifestyles and recreation, sustainability and tourism. These values will be irreversibly altered if the Middle Arm Industrial Precinct goes ahead. Darwin Harbour has been subject to considerable industrial development in recent years, including from the construction and operation of the Darwin LNG facility, the construction and operation of the Inpex processing plant, the construction and operation of the Darwin LNG facility, the development of heavy industry at East Arm, and the redevelopment of Larrakeyah Barracks. Moreover, Darwin Harbour's unique values are threatened by climate change, which will lead to sea level rise, high terrestrial and sea surface temperatures, mangrove die-back, coastal inundation and tidal loss, and biodiversity loss.

In Australia we have not seen the development of petrochemical and gas hubs of this scale, and it may be difficult to imagine how this project would change the Harbour. To take one proposed facility as an example, the Tivan (formerly TNG) processing facility, which was previously proposed for the Middle Arm peninsula. The project's (ultimately unsuccessful) EIS documents give us some insight into how transformative the precinct will be. The TNG draft EIS specifies that their project would consist of "approximately 37 stacks or exhaust pipes are proposed, ranging from 9 m – 40 m in height. In addition, the Sulphate Plant will include a 100 m stack."⁸⁶

It is likely that aside from impacts on mangrove and benthic habitats, the construction of product jetties is likely to impact directly on the recreational amenity of the Harbour and the Elizabeth River. The area shown in light green below has been allocated to Tamboran for its LNG facility, which will process gas fracked from the Beetaloo basin. This will be directly opposite the Elizabeth River jetty.

⁸⁶ TNG, *Supplement to the Environmental Impact Statement* (2021) p 85. [Main-Report-TNG-Supplement.PDF](#)

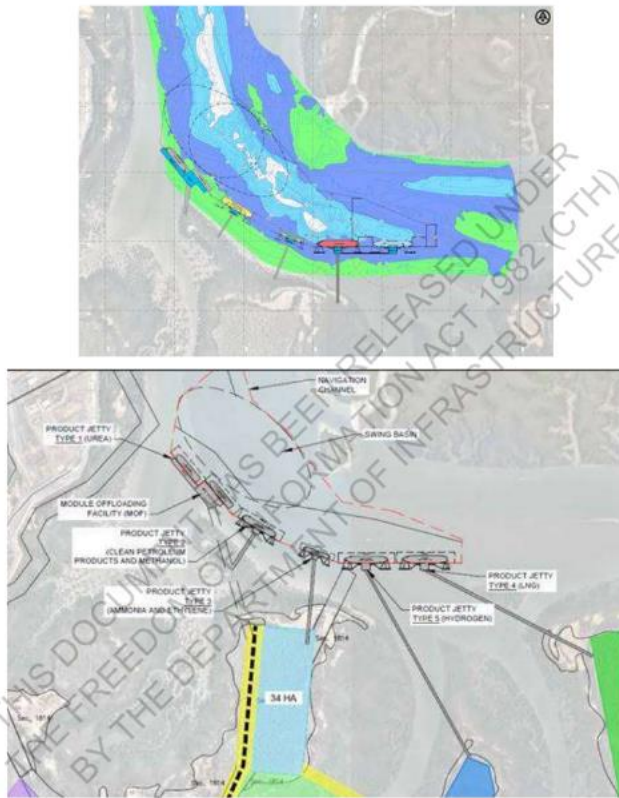
Middle Arm SDP – Current Balanced Scenario Layout



FOI 23-216

Document 6

Middle Arm Sustainable Development Precinct - Federal Funding



As well as creating a skyline dominated by factories, up to five huge jetties will protrude into the harbour, potentially obstructing access to important fishing grounds, such as Elizabeth River. The Stage 2 Submission to Infrastructure Australia suggests that the Federally-funded jetties would reach 300m in length. There will be hundreds of new shipping movements each year, and proposed dredging and infrastructure would allow Panamax vessels with an all-tide depth of 14m and a length of 220m to enter the vicinity. This would fundamentally alter the recreational enjoyment of the Harbour and the Elizabeth River.

The Middle Arm Industrial Hub will further impact Darwin Harbour's precious and at-risk ecosystems, disrupt recreational activity in the Harbour, and potentially adversely impact a number of iconic Northern Territory industries. It is crucial that impacts on all marine uses (existing and forecasted) are assessed as part of the strategic environmental assessment, particularly for conservation, fisheries, aquaculture, defence, tourism, shipping, cultural values and recreation.

III. Recommendations

1. Free, prior and informed consent of Larrakia Traditional Owners must be obtained for the precinct.

Strategic environmental assessment

2. The Middle Arm Industrial Hub should be subject to a Public Inquiry under both the EPBC Act (Cth) and Environment Protection Act (NT).
3. The referral for the Middle Arm Industrial Hub should be withdrawn, and submitted again for public comment with the following changes:
 - a. Gas processing, carbon capture and storage, blue hydrogen production and petrochemicals manufacturing should be removed from the scope of the EIS.
 - b. Development plans for Middle Arm (including likely development scenarios, including the two program) should be publicly disclosed as part of the referral.
 - c. Peer-reviewed proposed methodologies for biodiversity offsets, climate risk assessment, health impact assessment, cultural heritage and cultural values assessment, and cumulative impact assessment should be disclosed as part of the referral.
4. Alternatively to 3, the EIS should not be released for public exhibition until:
 - a. a Larrakia-led and designed cultural heritage and cultural values assessment is completed, endorsed by the Larrakia people, and incorporated into the EIS;
 - b. the offset methodology for the Middle Arm Industrial Hub is peer-reviewed, released to the public for comment, and an offset plan developed in accordance with that methodology is incorporated into the EIS;
 - c. the air shed modelling methodology is peer-reviewed, released to the public for comment, and an air shed model developed in accordance with that methodology is incorporated into the EIS;
 - d. the climate risk methodology is peer-reviewed, released to the public for comment and incorporated into the EIS;
 - e. the health impact assessment methodology is peer-reviewed, and an impact assessment developed in accordance with that methodology is incorporated into the EIS;

f. the cumulative impact assessment methodology is peer-reviewed, released to the public for comment, and incorporated into the EIS.

Commonwealth funding for the project

5. The circumstances in which \$1.5 billion was committed for the Middle Arm precinct should be referred to the National Anti-Corruption Commission, for investigation into whether the commitment amounts to corrupt conduct.

6. Federal Government funding commitments for the Middle Arm precinct should be withdrawn or put on hold, pending a completed environmental impact assessment and approval by Infrastructure Australia in accordance with its Assessment Framework.

7. The following matters must be publicly disclosed:

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.

8. Federal Government funding should be made contingent on the following conditions:

a. Funding shall not be used to directly or indirectly fund gas-related industries at Middle Arm (including LNG processing, petrochemical production, blue hydrogen and carbon capture and storage);

b. Funding shall not be committed without free, prior and informed consent of Larrakia people;

c. Funding shall not be committed until a completed assessment by Infrastructure Australia pursuant to its Assessment Framework, and a recommendation that funding occur;

d. Funding shall not be committed until cost benefit analysis (per what guideline) occurs;

e. Funding shall not be committed until a comprehensive climate risk assessment is undertaken.