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Dear Mr Purdon

Re: Middle Arm Sustainable Development Precinct–Strategic Environmental Assessment & EIS

The Australian Marine Sciences Association (AMSA) welcomes the opportunity to provide comments on a proponent-initiated EIS referral of a strategic proposal for strategic assessment (submitted by the NT Department of Infrastructure, Planning and Logistics) for a program to establish an industrial precinct on Middle Arm Peninsula, Darwin Harbour.

Executive Summary

AMSA greatly appreciates the opportunity to provide a detailed formal public submission on the MASDP EIS and SEA framework (Terms of Reference) for consideration by the NT EPA and Federal Government.

AMSA fully supports the proposed development of a Strategic Environmental Assessment for Darwin Harbour, in light of the recognized major environmental concerns regarding the proposed 1500 ha Middle Arm Sustainable Development Precinct (MASDP). Including the need to assess regional and also, cumulative impacts.

AMSA remains concerned at the major potential marine environmental impacts associated with the proposed MASDP – including impacts on marine megafauna (including dolphins, turtles, dugongs and sharks); fisheries (commercial and recreational); the cumulative impacts of dredging; acid sulfate soils; and the impacts of heavy metals on the food chain, food safety, public health, Indigenous harvest and Traditional Owners. In addition, the potential major climate change risks and impacts on the MASDP (particularly sea-level rise, flooding) and emissions profile of the MASDP, particularly its gas-related activities.

In relation to the specific proposed MASDP referral, AMSA reaffirms its national position statement on climate change and its strong support for urgent, immediate and drastic climate action. We note and endorse the recent International Energy Agency's global call (18 May 2021) for no new fossil fuel supply projects¹.

To this end, AMSA strongly supports low emissions and renewable energy technology, such as green or renewable hydrogen development in the MASDP (and Northern Territory) – as currently being developed in other parts of Australia. However, as an unproven and expensive technology, AMSA strongly recommends against the establishment or public investment in any carbon capture and storage infrastructure.

¹ 'Net Zero by 2050 - <https://www.iea.org/news/pathway-to-critical-and-formidable-goal-of-net-zero-emissions-by-2050-is-narrow-but-brings-huge-benefits>

Similarly, AMSA has serious concerns relating to the development of any industries in the MASDP involving petrochemicals processing (e.g. plastics production), due to their reliance and ongoing demand for oil/gas (as the primary feedstock) – and also, the ongoing and recognized threats to public health and also the major threats posed by current (and increasing) production of plastics to the world's oceans. Significantly, AMSA strongly asserts that this type of industrial activity does not align (either in spirit or intent) with the 'environmental sustainability' principles outlined in the MASDP Program.

Rather AMSA encourages the MASDP to consider investment and development of innovative, low-emissions, petroleum recycling technologies. Particularly the potential for a plastics recycling plant, using the Cat-HDR technology, which uses 'state-of-the-art' processing technology to breakdown plastic back into oil. Significantly, the Australian company, Mura have already built a plant in NSW and importantly, are now exporting this technology around the world (South Korea, UK), including major partnerships with LG Chem and Chevron Phillips².

AMSA is concerned that the current proposed proponent-driven, SEA approach for the MASDP places great emphasis on economic development and incentives for investors (fast environmental approvals, low regulatory burden, no requirement for EIS) – but does not sufficiently prioritize the protection of Darwin Harbour's wide range of environmental, social, cultural values, uses and users. And particularly the commitments under the Darwin Harbour Strategy 2020-2025 to "*protect and enhance the natural environment of Darwin Harbour*" (DHAC 2020) ³.

Specifically, this includes the MASDP SEA's limited consideration of the region's diverse and significant values and 'other marine uses', and also, the specific assessment and detection of 'cumulative impacts'. Including consideration of the current major gaps in marine ecosystem knowledge and also, gaps in marine assessment, monitoring and reporting efforts in Darwin Harbour.

AMSA notes that while there has been investment and considerable work undertaken (particularly over the past decade) in developing and establishing some important marine environmental baselines for Darwin Harbour, ie. water quality, sediment quality, mangroves, coastal dolphins (see Munksgaard et al. 2019), major gaps in marine ecosystem knowledge and understanding remain, which constrain and limit monitoring, risk and impact assessment – and impact detection in the harbour.

To this end, AMSA remains particularly concerned at the current MASDP SEA's adequacy and capability to detect significant anthropogenic impacts on Darwin Harbour's key values and other uses.

AMSA recommends the following major issues, concerns and key knowledge gaps/needs for Darwin Harbour, that need to be specifically addressed in the proposed MASDP 'strategic environmental assessment' (SEA) framework and EIS:

- a) Need to build upon the limited marine baseline surveys and studies to address existing major knowledge gaps and inform the environmental assessment of potential impacts on marine ecosystem values – particularly on critical habitats, key marine species and formally-listed threatened and migratory species, and also, ecosystem services.
- b) Including the need for baseline research that informs subsequent monitoring and risk assessment of potential MASDP impacts on major marine megafauna populations in the harbour and their 'critical habitat' – including fish, sharks/rays, marine turtles, seabirds/shorebirds and marine mammals.
- c) Due to the major methodological challenges with impact detection and monitoring of marine megafauna populations, the need for a 'multiple lines of evidence' approach to monitoring and impact assessment. Including conducting direct megafauna observations whilst monitoring noise, prey abundance, water quality, habitat health and vessel traffic - to understand cumulative impacts and identify causes or source of impacts.
- d) Need for assessment of 'other marine uses' (existing and forecasted) in Darwin Harbour, including trends, and potential environmental and socio-economic impacts – particularly for

² <https://www.licella.com/news/mura-technology-cat-htr-licensee-announces-lg-chem-chevron-phillips-partnerships/>

³ <https://nt.gov.au/darwinharbour/key-deliverables>

- conservation, fisheries, aquaculture, defence, tourism, shipping, cultural values and recreation.
- e) Need for research, monitoring and assess of the potential MASDP impacts on recreational and commercial fisheries, particularly given that 30% of the Northern Territory's recreational catch is from Darwin Harbour region.
 - f) The focus on site-based and activity-based monitoring and assessment (and triggers) and failure to account for ecosystem-wide and 'cumulative impacts' on the marine ecosystem and ecosystem services of the harbour.
 - g) Need for integrated, harbour-wide, marine ecosystem modelling and bioeconomic studies.
 - h) Need for a detailed climate risk assessment - particularly given the location of the MASDP on low-lying, coastal land, and the pronounced vulnerability of the coast to climate change impacts
 - i) Including the need for updated down-scaled climate projections for the region. Particularly given recent major climatic events in Australia (flooding, storms), which have underscored the need for updated coastal risk assessments.
 - j) Need for baseline information on heavy metals, bioavailability and bioaccumulation in the marine food chain in Darwin Harbour and also, its potential public health and socio-economic impacts (fisheries, Indigenous cultural harvest).
 - k) Need for research and monitoring of the ecological impacts of dredging and the current lack of an overall dredging strategy and management plan for Darwin Harbour to guide and manage dredging activities and their impacts.
 - l) Need for an integrated marine monitoring, assessment and reporting framework for Darwin Harbour.
 - m) Consideration of the current limited marine monitoring and regulatory framework with the Northern Territory, to adequately assess and manage environmental impacts within the harbour.
 - n) Including the lack of an independent, adequate and integrated marine monitoring program for the harbour, i.e. the current INPEX-funded Darwin Harbour IMMRP.

In recognition of the goals and objectives of the Darwin Harbour Strategy 2020-2025, AMSA strongly recommends major investment in an adequate and integrated marine environmental baseline and monitoring/assessment (and reporting) program in Darwin Harbour, to ensure the protection of the wide range of environmental values in the harbour - through the detection of potential medium and long-term significant anthropogenic, regional and cumulative impacts.

AMSA notes that the SREBA Framework for the NT provides good guidance on undertaking pre-development, baseline regional strategic assessments. And the recent assessment of Exmouth Gulf undertaken by the WA EPA provides a comprehensive approach to assessing regional and cumulative impacts (from current and projected uses and threats). AMSA strongly recommends that the key elements of these approaches be incorporated into the SEA for the MASDP and Darwin Harbour.

Specifically, AMSA recommends that the NT EPA should ensure the following objectives and elements are incorporated into the design of 'strategic environmental assessment' for Darwin Harbour to:

- identify the key environmental, social and cultural values of Darwin Harbour,
- identify and assess the current and projected uses, threats and pressures within the harbour
- consider the regional and cumulative impacts of current and proposed uses/projects within the harbour, and
- provide specific advice/recommendations on conservation of values, compatibility of uses/activities and the integration of land-sea management.

In undertaking a comprehensive strategic environmental assessment for Darwin Harbour – AMSA recognizes that critical reviews/analyses, additional field research/studies, modelling and major risk assessments will need to be undertaken, in addition to the review, collection and collation of all relevant existing technical information. As with other strategic assessments (conducted in other jurisdictions), this information and technical advice should be provided to the NT EPA, to inform the design of a robust monitoring and environmental impact assessment, risk and monitoring framework that will protect significant ecosystems and values of Darwin Harbour.

In developing the SEA for the MASDP, AMSA also strongly encourages the NT EPA and the Proponent to consider the following specific issues and challenges relevant to Darwin Harbour

- a) Need for independent expert-based review of coastal, estuarine and marine conservation, research, monitoring, ecosystem status and integrated management in Darwin Harbour – including identifying research and monitoring priorities, and potential indicators and monitoring protocols that meet current recommended national and industry ‘best practice’ standards.
- b) The potential to learn major lessons from WA and Queensland – regulating, assessing, monitoring impacts of major oil/gas industry, including the best practice monitoring and assessment protocols.
- c) The need to identify the critical and essential science and knowledge/information requirements for ensuring a robust baseline environmental monitoring and risk assessment program in Darwin Harbour, particularly for marine megafauna
- d) The major potential to promote significantly greater investment in monitoring and critical baseline research and monitoring in Darwin Harbour, through a formal government-industry-academic collaboration and partnership (e.g. Exmouth Gulf - WAMSI model, Gladstone Healthy Harbour Partnership).
- e) The major value and benefit of the collation/integration of all relevant Darwin Harbour technical studies. Including publicly releasing relevant past industry and government studies on Darwin Harbour - and also, relevant NT and Commonwealth-funded, coastal, estuarine and marine assessment, monitoring/reporting studies.
- f) The urgent need to invest and improve marine monitoring in Darwin Harbour (including the IMMRP), particularly the lack of biological and ecological monitoring and integrated ecosystem modelling to enable the assessment of ecosystem condition and health.
- g) The urgent need to finalize and implement a Dredging Strategy and Plan for Darwin Harbour, undertake predictive sediment impact modelling – and adopt national recommended protocols/approaches to sediment assessment/monitoring (ANZG 2018, Simon & Batley 2016).
- h) Establishment of a research and data hub – for all Darwin Harbour-related studies, consultants’ reports, and research and monitoring activities.

Background information to support these views are provided as follows in the body of this submission.

Introduction

1. The Australian Marine Sciences Association Inc. (AMSA) is Australia's peak professional body for marine scientists from all disciplines and for over 50 years has promoted all aspects of marine science in Australia. Including “dissemination of knowledge about the marine environment to the wider public.”⁴ It also has a long history of providing expert scientific advice to Federal and State/Territory governments, industry and other key marine environmental stakeholders, on a wide range of scientific and environmental issues and activities in the marine environment (including environmental impact assessments, marine pollution, Marine Parks, marine threatened species, marine biodiversity and climate change). All of our Submissions and Position Statements are publicly available at: <https://www.amsa.asn.au/submissions> and <https://www.amsa.asn.au/position-statements>.
2. The AMSA Northern Territory Branch is based in Darwin and in recent years has been active in providing technical input to the management of the North Marine Parks Network in northern Australia, as well as providing formal submissions on a range of marine science, marine environmental, Indigenous Sea Country and marine industry-related issues.
3. We confirm that the following formal comments and recommendations are provided on behalf of both AMSA (national) and the AMSA-NT Branch – in response to your email outlining stakeholder consultation in relation to the Middle Arm Sustainable Development Precinct (MASDP). In particular, the draft Terms of Reference for a Strategic Assessment under Section 49 of the *Environment Protection Act 2019*, and the draft MASDP Program.

⁴<https://www.amsa.asn.au/mission-objectives-and-values>

4. The Northern Territory Government (NTG) is working with industry and the Australian Government to transform the Middle Arm Peninsula into a globally competitive, sustainable precinct with a focus on low emission petrochemicals, renewable hydrogen, carbon capture and storage and minerals processing. Middle Arm is already home to a globally significant liquefied natural gas (LNG) export hub, with the Santos-led Darwin LNG and INPEX-led Ichthys LNG onshore processing facilities currently operational.
5. The Middle Arm Sustainable Development Precinct (MASDP) is a whole-of-NTG project being led by the Department of Infrastructure, Planning and Logistics (DIPL), the Proponent. DIPL is leading the feasibility and concept design phase of the project. DIPL will be seeking approval for construction and development activities that may occur over a period of 50 years across the full Precinct life-cycle including design, construction and operational phases.
6. A Development Plan will define the scope of development that is included in the MASDP Program, and therefore the type and scale of activities for which DIPL is seeking approval through a strategic environmental assessment (SEA) process. At the highest level, the Classes of Actions at MASDP will include Land Development, Enabling Infrastructure (land and marine) and Future Industries.
7. AMSA notes that the potential future industry types being considered for MASDP include:
 - 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
8. AMSA notes this is a joint Commonwealth - NT Government environmental assessment process. As such, on 31 March 2022, the Chief Minister of the Northern Territory entered into an agreement with the Commonwealth Minister for the Environment, pursuant to section 146(1) of the EPBC Act, to undertake a strategic assessment of the impacts of actions taken within the defined MASDP SAA on matters protected by a provision of Part 3 of the EPBC Act (environmental values).

Previous Advice on Darwin Harbour & Gas-Related Project Activities

9. The Australian Marine Science Association (AMSA), has provided previous advice on the Santos Barossa Offshore Gas Project – providing a formal response on the feedback request for the Santos Drilling EP (9 July 2021), which raised the globally significant environmental, fisheries and megafauna values of Darwin Harbour and the region, and also, the importance and relevance of the international and transboundary (and legal) issues in the assessing and/or undertaking development activities in the ATS region (i.e. current Australia-Indonesia maritime boundary negotiations).
10. AMSA also noted that the oil-gas industry and its regulator, NOPSEMA, focus on developing and assessing ‘activity-based’ EPs for all exploration and development activities. And for large-scale development activities like the current Santos Barossa Gas Field development, noted the failure of ‘activity-based EPs to adequately assess the need for potential cumulative pressures, multiple stressors and impacts, and interactions of a range of individual activities. With impacts potentially operating at multiple spatial scales (local, national, and international) and in combination with other concurrent stressors.

11. AMSA-NT called for greater environmental consideration and oversight. And highlighted the opportunity for Santos to lead an 'industry best practice' approach to address potentially complex impacts and implement the sustainability principles incorporated into the EPBC Act (as per the Convention for Biological Diversity).
12. Individual members of AMSA have also provided detailed comments to the Northern Territory Environmental Protection Authority (NTEPA) on the Darwin Pipeline Duplication (DPD) project. Specifically, the referral submitted by Santos to construct and operate the 100 km gas pipeline from Darwin to the Barossa gas field in the Timor Sea – which will facilitate the use of the current pipeline to Bayu-Undan for carbon capture and storage (CCS). [Refer to submission by A-Professor Karen Edyvane, Australian National University, 22 February 2022.]
13. All these public submission/s have highlighted the need for a strategic environmental assessment for Darwin Harbour, to address the complexities of cumulative pressures, multiple stressors, and the range of spatial and temporal scales of potential impacts from human uses.
14. The submissions have also highlighted the lack of public investment in marine science and marine monitoring in Darwin Harbour, resulting in major gaps in marine ecosystem knowledge and understanding of ecological processes. And also, have highlighted the significant gaps in past (and current) marine environmental monitoring and impact assessment (and reporting) programs. Including major gaps in the INPEX-funded, \$20M, 40-year Darwin Harbour Integrated Marine Monitoring and Research Program (IMMRP), and significant gaps in the Darwin Harbour Integrated Report Card program (particularly ecological indicators, heavy metals, and stress indicators). [Refer to DPD project submission by A-Professor Karen Edyvane, Australian National University, 22 February 2022.] We also highlight the recent review by Munksgaard et al. (2019)⁵ of marine threats, ecosystem status and monitoring priorities in Darwin Harbour.

AMSA Position Statement on Climate Change

15. Since AMSA's previous public submissions on EIS referrals, AMSA has recently developed a national position statement on climate change - <https://www.amsa.asn.au/amsa-position-statement-climate-change>
16. In the position paper, AMSA has highlighted the importance of drastic and immediate emissions reduction and also, the ineffectiveness of carbon capture and storage (CCS):

"AMSA was one of 111 professional societies representing more than 80,000 scientists to endorse the World Aquatic Societies Statement on Climate Change, which calls for 'drastically curtailed global greenhouse gas emissions to avoid the worst impacts of man-made climate change to fish and aquatic ecosystems'. Further actions related to Australia are listed below:

The only way to minimise or prevent devastating impacts of climate change on marine ecosystems is to **drastically and immediately reduce global emissions**. Australia's coalition government has recently committed to reaching net-zero emissions by mid-century, but much more substantial interim emission reduction goals are required to avoid devastating long-term ecological impacts of climate change on marine ecosystems. Most critically, there needs to be much stronger commitment to urgently reduce reliance on fossil fuels for energy and transport within the next decade.

The Australian Government's continued **focus on carbon capture and storage (CCS) as a viable option to achieve netzero emissions is ineffective**. The time and money spent on CCS projects should instead be applied to supporting the growing renewable energy sector. The majority of CCS projects fail (Abdulla et al. 2020), and the only commercial-scale CCS facility in Australia (Gorgon LNG) conceded in 2021 that the project failed to meet its targets. Moreover, there are significant and complex marine environmental considerations for offshore CCS (Carroll et al. 2014)."

⁵ Munksgaard, N.C., Hutley, L.B, Metcalfe, K.N., Padovan, A.C., Palmer, C & K.S. Gibb (2019). Environmental challenges in a near-pristine mangrove estuary facing rapid urban and industrial development: Darwin Harbour, Northern Australia. *Regional Studies in Marine Science*, 25, 100438.

17. AMSA position on climate change includes the following relevant recommendations:

Recommendation 1 - AMSA strongly supports the drastic and immediate reduction of global emissions through a commitment by the Australian Government to reduce reliance on fossil fuels for energy and transport and avoid emissions pathways that take global warming beyond 1.5°C.

Recommendation 2 - AMSA recommends that the time and money spent on carbon capture and storage projects instead be applied to supporting the growing renewable energy sector.

18. In 2019, the Northern Territory's per capita emissions were higher than all but one country in the world, even before considering the new fossil fuel projects, and the Territory's very high land-use emissions⁶. In relation to the specific proposed MASDP referral, AMSA reaffirms its national position statement on climate change and its strong support for urgent, immediate and drastic climate action. And notes and endorses the recent International Energy Agency's global call (18 May 2021) for no new fossil fuel supply projects⁷.
19. To this end, AMSA strongly supports low emissions and renewable energy technology, such as green or renewable hydrogen in the MASDP (and Northern Territory) – as currently being developed in other parts of Australia. However, as an unproven and expensive technology, AMSA strongly recommends against the establishment or public investment in any carbon capture and storage infrastructure.
20. AMSA has major and serious concerns on the development of any industries in the MASDP involving petrochemicals processing (e.g. plastics), both from their reliance and ongoing demand for oil/gas (as the primary feedstock) – and also, the ongoing and recognized significant threat to public health⁸ and also the major threats posed by current (and increasing) production of plastics to the world's oceans. Significantly, AMSA strongly asserts that this type of industrial activity does not align (either in spirit or intent) with the 'environmental sustainability' principles outlined in the MASDP Program.
21. Rather AMSA encourages the MASDP to consider investment and development of innovative, low-emissions, petroleum recycling technologies. Particularly the potential for a plastics recycling plant, using the Cat-HDR technology, which uses 'state-of-the-art' processing technology to breakdown plastic back into oil. The Australian company, Mura, are leading this Cat-HDR technology in Australia (which was invented in Australia, by Prof Thomas Maschmeyer, University of Sydney). Significantly, Mura have already built a plant in NSW and importantly, are now exporting this technology around the world (South Korea, UK), including major partnerships with LG Chem and Chevron Phillips⁹.
22. AMSA also notes and supports major concerns by leading climate scientists¹⁰, the Australia Institute¹¹, and the Climate Council in Australia¹² regarding the current failure to ensure that there is no net increase in emissions in Australia from the Territory's growing gas industry. This includes major new onshore and offshore gas developments (Beetaloo Basin, Barossa) and also, the carbon emissions and proposed offsets policy framework in the Northern Territory. Specifically, the draft *Northern Territory Offsets Framework (Greenhouse Gas Emissions Offsets Policy and Technical Guidelines)* – and the *Greenhouse Gas Emissions Management for New and Large Emitters Policy (the Large Emitters Policy)*¹. Which together, fail to ensure that gas companies are required to offset all life cycle emissions, include scope 3 emissions (contravening Recommendation 9.8 of the Pepper

⁶ See submission by the Climate Council of Australia – Northern Territory's Climate Change Response (see Figure 3). <https://www.climatecouncil.org.au/resources/submission-northern-territorys-climate-change-response/>

⁷ 'Net Zero by 2050 – a Roadmap for the Global Energy Sector' - <https://www.iea.org/news/pathway-to-critical-and-formidable-goal-of-net-zero-emissions-by-2050-is-narrow-but-brings-huge-benefits>

⁸ Jephcote, C., Brown, D., Verbeek, T., & Mah, A. (2020). A systematic review and meta-analysis of haematological malignancies in residents living near petrochemical facilities. *Environmental Health*, 19(1), 1-18. Available here <https://ehjournal.biomedcentral.com/articles/10.1186/s12940-020-00582-1>

⁹ <https://www.licella.com/news/mura-technology-cat-htr-licensee-announces-lg-chem-chevron-phillips-partnerships/>

¹⁰ <https://australiainstitute.org.au/post/over-60-scientists-experts-call-on-chief-minister-gunner-to-honour-commitment-to-net-zero-fracking-emissions/>

¹¹ <https://australiainstitute.org.au/post/offsetting-up-for-failure-northern-territory-climate-offsets-policy/>

¹² <https://www.climatecouncil.org.au/resources/submission-northern-territorys-climate-change-response/>

Inquiry into the Fracking of the Beetaloo Basin), including allowing a new category of 'indirect offsets' and recognising carbon capture and storage or CCS (or CCS research) as a 'carbon offset'.

23. At the Federal level, AMSA also notes and supports major ongoing concerns by energy experts and the public with the national carbon credits and carbon offsets program coordinated by the Federal Government's Emissions Reduction Assurance Committee and regulated under the Clean Energy Regulator – particularly the need for investigation and major reform.¹³

General Comments on the MASDP Referral

24. AMSA notes that, unlike other areas where gas-related industries/activities have been established (Bonaparte Basin, Browse Basin, Exmouth Gulf, Gladstone Harbour), Darwin Harbour has not (until now) been subject to a detailed formal 'strategic environmental assessment' by the EPA to consider cumulative impacts, and protect the key values and uses of the harbour - only individual 'activity-based' environmental assessments.
25. To this end, AMSA fully welcomes the Commonwealth - NT Government commitment to undertaking a 'strategic environmental assessment' (SEA) and EIS for Darwin Harbour – and the opportunity to provide public comment.
26. AMSA strongly supports the need for a Strategic Assessment as identified in the MASDP Statement of Reasons:

“SEA was developed as a way to address challenges associated with applying project-level assessments at the landscape scale. SEA recognises that assessments of individual projects are typically unable to sufficiently address the broader issues of cumulative impacts, regional impacts to environmental values and threatening processes. Assessing policies, plans and programs means that environmental and social matters are taken into consideration more proactively and holistically than when assessing individual development proposals. SEA also allows policies and plans to better guide project assessments around environmental outcomes. Accepted principles for SEA include being sustainability-led, participatory, and transparent.” (MASDP Statement of Reasons)

27. AMSA notes that under the Darwin Harbour Strategy 2020-2025¹⁴ ecological sustainable development and a strategic environment assessment are key objectives under the goal of 'to protect and enhance the natural environment of Darwin Harbour':

Key objectives

1. Ecosystems of Darwin Harbour remain healthy, diverse and intact and maintain their functional importance.
2. Improve understanding of ecosystems and the services they provide and develop appropriate measures to inform decision-making regarding their conservation, sustainable use and development.
3. Manage to protect and improve resilience of the region so it is adaptive to climate change and natural events.
4. Potentially damaging impacts on the Darwin Harbour are assessed and managed according to the principles of Ecologically Sustainable Development.
5. Undertake a strategic environmental assessment of Darwin Harbour.

Outcomes

- Aquatic ecosystems are intact and functional.
- Measures reflecting the health of Darwin Harbour's natural environment (e.g. air shed, flora, fauna and waterways) show improvement over the medium and long term with no lasting deterioration.
- Management strategies are adaptive in the face of a changing environment.
- Progressive regulatory regimes are in place that safeguard the environmental values of the Harbour.

¹³ <https://www.theguardian.com/environment/2022/mar/23/australias-carbon-credit-scheme-largely-a-sham-says-whistleblower-who-tried-to-rein-it-in>

¹⁴ https://industry.nt.gov.au/_data/assets/pdf_file/0020/1041185/darwin-harbour-strategy-2020-2025.pdf

- Understanding of the natural environment is improved through the strategic environmental assessment of Darwin Harbour.
28. AMSA notes that is also the first joint SEA undertaken between the NT Government and Federal Government, with no established formal bilateral guidelines/processes in place for undertaking a joint SEA:
- “There are no formal bilateral processes that apply to SEAs, however, streamlining arrangements tailored to the MASDP context are currently being investigated. Opportunities for streamlining are available at numerous stages of the SEA process and could involve joint scoping, single sets of documentation and stakeholder engagement that meet the needs of both jurisdictions.” (Draft Program, pp.11).
29. AMSA notes that there appears to be no clear separation between the Proponent (DIPL), industry and the government regulators (NT EPA, DAWE) in developing/undertaking the assessment process:
- “The Northern Territory Government (NTG) is working with industry and the Australian Government to transform the Middle Arm peninsula into a globally competitive, sustainable precinct with a focus on low emission petrochemicals, renewable hydrogen, carbon capture storage and minerals processing.” (MASDP Referral Form).
- “DIPL will actively engage with the Environmental Assessment Division (NTG) and Strategic Assessments Section, Department of Agriculture, Water and the Environment (Commonwealth) to identify opportunities to coordinate and streamline the Territory and Commonwealth environmental assessment processes.” (Draft TOR, Section 1.4).
30. AMSA recommends that both the SEA and EIS process for the MASDP should ensure clear separation between the Proponent, industry and the regulators (NT Government, Federal Government), and public transparency and accountability – through the establishment of independent (non-industry, non-government) advisory structures, independent experts and advice, and independent peer review.

Independence, Accountability, Transparency

31. As a recognised major ‘whole-of-government’, joint NT-Commonwealth governments and industry partnership development activity, there is a critical need to ensure independent technical review of the MASDP environmental assessment, planning and implementation. To minimize the potential for bias, ‘conflicts-of-interests’ and perceptions of ‘corporate capture’ and strengthen public transparency and accountability. Particularly given the scale of the MASDP project and the significant public subsidies (\$1.5B)¹⁵ that have been pledged and allocated to this national infrastructure project.
32. AMSA notes that a proponent-initiated SEA and EIS has been chosen as the preferred method of environmental impact assessment under the EP Act, and “*this allows for the terms of reference (TOR) to be developed by the proponent for approval by the NT EPA.*” (MASDP Statement of Reasons, pp.7). As such the Proponent (DIPL) (and their consultants, EcOz, 2rog) have developed all the relevant documents for the SEA and EIS. Including the ‘Statement of Reasons for a Strategic Assessment’ (8pp), ‘Terms of Reference for a Strategic Assessment’ (47pp), ‘Middle Arm Sustainable Development Precinct Draft Program’ (43pp), ‘Middle Arm Sustainable Development Precinct Referral Report’ (79pp), ‘Middle Arm Sustainable Development Precinct Referral Form’ (6pp). All finalised and approved by the NT Government (DIPL) for NT EPA referral and public release/comment in January 2022.

¹⁵ <https://www.abc.net.au/news/2022-04-13/middle-arm-port-environmental-concerns/100985680>

33. To this end, AMSA supports the establishment of an independent, expert-based, technical authority to provide independent advice and technical guidance on the assessment and implementation of the MASDP. This authority should encompass the multiple expertise and disciplines relevant to the MASDP and also, the values and uses of Darwin Harbour.
34. AMSA notes that strategic assessments being undertaken for other gas-related activities in the NT have included independent advice and review. As such, the Strategic Regional Environmental and Baseline Assessments (SREBA) governance includes the establishment of 'Regional Reference Group', 'Independent Experts' and 'independent peer review, including by the NT EPA' in the development, delivery and approval process (see Figure 2.1, SREBA Framework 2020).
35. AMSA notes that MASDP Draft Program already highlights the value of the SREBA framework in undertaking assessments – "The SREBA Framework for the NT¹⁶ (NTG 2020) provides good guidance on undertaking strategic regional assessments in the Beetaloo Basin, and elements of this framework will be adopted for the MASDP where possible." (Draft Program, Section 3.1.1). We suggest this be extended to also include providing the MASDP good guidance on governance.

Design of the Strategic Environmental Assessment (SEA)

36. AMSA fully accepts the Proponents premise that MASDP potential impacts are significant and a SEA is required:

"DIPL considered that the MASDP has the potential to have a significant impact on the environment due to the considerable scale and extent of the Program, and the values known to exist in the strategic assessment area."

"A SEA process, in addition to facilitating a robust environmental impact assessment, will provide the opportunity for communities that may be affected by the project, including Aboriginal People, to participate in the process and will allow for consideration of cumulative impacts on a precinct-wide scale over the operating life of the MASDP." (MASDP Statement of Reasons)

37. AMSA notes that this is also the first time that a SEA has been undertaken by the NT Government and no specific guidance is available:
38. "The SEA pathway for assessment and approval of actions under the EP Act is allowed under section 49. A strategic proposal is defined under section 13 and can include a policy, a program, a plan or a methodology. There is currently no precedent for assessments of strategic proposals in the NT and specific guidance material relating to the EP Act has not been developed." (Draft Program, pp.6).
39. AMSA notes that in the absence of any specific SEA guidance, the Draft Program proposes that an NT Government industry development masterplan be utilized as the model for MASDP SEA:

"Nevertheless, the Department of Environment, Parks and Water Security (DEPWS 2021) provides the following example of what may be considered a strategic proposal:
'...a masterplan to facilitate development of a new multi-user area with a range of industry types. The strategic proposal might include site preparation, construction of headworks (utilities and services) and cumulative impact assessment of the masterplan, for example, potential impacts to flora and fauna'."

"There is good alignment between this example and the development proposed within MASDP." (Draft Program, pp.6).

¹⁶ 'SREBA Framework. A Guide to Undertaking a Strategic Regional Environmental and Baseline Assessment in the Northern Territory' (NTG 2020)

40. AMSA is greatly concerned that the current proposed SEA approach for the MASDP places great emphasis on economic development and incentives for investors (fast environmental approvals, low regulatory burden, no requirement for EIS) – and does not sufficiently prioritize the protection of Darwin Harbour’s wide range of values and uses. And specifically, includes inadequate consideration of the region’s diverse and significant values and ‘other marine uses’, and also, the assessment and detection of ‘cumulative impacts’. Including consideration of the current major gaps in marine ecosystem knowledge and also, gaps in marine assessment, monitoring and reporting efforts in Darwin Harbour. These issues are further explored below.

Assessment of Cumulative Impacts & Other Uses (current, projected)

41. AMSA has major concerns that the draft MASDP Program (and TOR) currently does not follow ‘best practice’ for a SEA and specifically, fails to adequately consider ‘other marine uses’ (existing and projected) or provide any specific guidance or actions on the specific assessment of ‘cumulative impacts’ within Darwin Harbour.
42. AMSA stresses that Darwin Harbour is a working harbour, with a wide range of values, uses and also, potential future development activities. Any strategic environmental assessment of Darwin Harbour should be based on a comprehensive knowledge of all the harbour’s marine ecosystems and values - and ecosystem impacts from both, current and projected human uses.
43. Significantly, the Darwin Harbour Strategy 2020-2025¹⁷ (page 18) identifies the critical need to consider ‘cumulative impacts’ in assessing developments:

“Increasingly we are forced to confront cumulative impacts and pressures that may interact and cause additive or antagonistic outcomes far greater than the outputs generated by each industry alone. Understanding the nature of these other interactions is essential if we are to manage these threats – and often this will require basic research that will inform management to avoid or mitigate before the damage is done.”

“Ideally, under a framework of cumulative impact assessment, a proposed development would be considered in the context of previous impacts, ecosystem resilience and recovery rates, other potential developments in the broad surrounds and broad-scale impacts of the activity itself. Challenges to this approach are not only administrative, but also scientific.”

“In particular our understanding of the complex biodiversity and ecosystems within the harbour and consequent limits to our ability to accurately assess impacts and measure changes in the harbour’s health are a significant challenge.”

44. The Strategy also highlights the current significant legislative gaps in the Northern Territory in assessing cumulative impacts:

“Currently the treatment of cumulative impacts is not well developed or addressed specifically by legislation for planning and development. However current legislative reforms for environment protection will provide recognition of cumulative impacts and strategic assessments. Effective cumulative impact management will require the development of approaches to facilitate sophisticated, sensible and respectful interactions between managers, researchers, government, industry and communities.”

45. In considering ‘cumulative impacts’ and ‘other uses’, AMSA strongly recommends that the strategic assessment for Exmouth Gulf recently completed by WA EPA¹⁸ – as a similar coastal ecosystem facing similar rapid development pressures – provides a valuable ‘template’ for regulators in designing a robust SEA for the MASDP and assessing its potential impacts on Darwin Harbour.

¹⁷ https://industry.nt.gov.au/_data/assets/pdf_file/0020/1041185/darwin-harbour-strategy-2020-2025.pdf

¹⁸ ‘Potential cumulative impacts of proposed activities and developments on the environmental, social and cultural values of Exmouth Gulf in accordance with section 16(e) of the Environmental Protection Act 1986 (WA EPA 2021)

46. In Western Australia, the recent strategic assessment into Exmouth Gulf was the result of a specific request by Minister for the Environment to the WA EPA, to provide strategic advice under Section 16(e) of the *Environmental Protection Act 1986* on the potential cumulative impacts of proposed activities and developments on the environmental, social and cultural values of Exmouth Gulf ¹⁹.
47. In this regard, the recent strategic environmental assessment of Exmouth Gulf by the WA EPA (2021) – ‘Potential cumulative impacts of proposed activities and developments on the environmental, social and cultural values of Exmouth Gulf in accordance with section 16(e) of the Environmental Protection Act 1986’²⁰ provides an invaluable case study and useful template for the NT EPA, as a regulator in considering cumulative impacts, and protecting the environmental, social and cultural values and uses in Darwin Harbour. And included specific advice on:
- *Identification of key environmental, social and cultural values*
 - *assessment of current and projected uses, threats and pressures*
 - *assessment of the regional and cumulative impacts of current and proposed uses/projects, and*
 - *specific advice/recommendations on the protection and conservation of values, compatibility of uses/activities and the integration of land-sea management.*
48. Significantly, any strategic environmental assess must be based on knowledge of both ecosystems and human impacts and also, current and future uses. For Exmouth Gulf, for delivery of this strategic advice, the WA EPA and the Department of Water and Environmental Regulation partnered with the Western Australian Marine Science Institute (WAMSI), who contributed technical and expert support to the WA EPA on the values and pressures associated with Exmouth Gulf. The WAMSI report²¹ provides information on:
- The key values (environmental, social and cultural) of Exmouth Gulf – including current state of the values, and level of confidence pertaining to the values – in the form of a literature review aligned with the EPA’s environmental themes of sea, land, water, air and people.
 - The current and forecasted uses of Exmouth Gulf.
 - A qualitative risk assessment using a consequence versus likelihood approach to evaluate the impact or risk of a pressure against a key value. A detailed list of key values was consolidated at a high-level, prior to consideration in the qualitative risk assessment.
 - The relationship between key values and environmental pressures of Exmouth Gulf, derived from the qualitative risk assessment process.
 - Knowledge gaps that require further consideration to improve our understanding of Exmouth Gulf, identified against each EPA theme.
49. As such, AMSA notes that the WAMSI report formed the technical basis of the EPA’s strategic advice and provided key information and materials that underpinned the EPA’s recommendations.

¹⁹ <https://www.epa.wa.gov.au/potential-cumulative-impacts-activities-and-developments-proposed-exmouth-gulf>

²⁰ Environmental Protection Authority (2021). Potential cumulative impacts of proposed activities and developments on the environmental, social and cultural values of Exmouth Gulf in accordance with section 16(e) of the Environmental Protection Act 1986, EPA, Western Australia. [EPA s.16e Report -Exmouth Gulf.pdf](#)

²¹ Sutton A.L. and Shaw J.L. (2021). Cumulative Pressures on the Distinctive Values of Exmouth Gulf. First draft report to the Department of Water and Environmental Regulation by the Western Australian Marine Science Institution, Perth, Western Australia. 272 pages. https://www.epa.wa.gov.au/sites/default/files/Publications/Exmouth%20Gulf%20Appendix%20C%20-%20WAMSI%20Report_updated.pdf

Gaps in Marine Ecosystem Knowledge, Inadequate Assessment/Monitoring Tools

Knowledge Gaps, Monitoring/Assessment Tools

50. AMSA notes that there is a significant lack of baseline, ecosystem understanding of Darwin Harbour. While over the past 10 years, the NTG has clearly embraced the concept of 'integrated management' and 'integrated report cards' for Darwin Harbour (see for example <https://dhir.org.au/>), baseline ecosystem understanding of Darwin Harbour required to assess human impacts, remains lacking.
51. AMSA notes that considerable work has been done (particularly over the past decade) in developing and establishing some important marine environmental baselines for Darwin Harbour, ie. water quality, sediment quality, mangroves, coastal dolphins (Munksgaard et al. 2019). However, major gaps in marine ecosystem knowledge and understanding remain.
52. AMSA notes the lack of baseline and ecosystem knowledge/understanding significantly constrains marine assessments and monitoring in Darwin Harbour. A recent multi-disciplinary review by Munksgaard et al (2019)²² provides a comprehensive overview of the current status of knowledge in Darwin Harbour, including major ecosystem threats and knowledge needs. While many scientific and technical studies have been conducted in Darwin Harbour over the past two decades, there has been a strong focus on water quality, sediment quality and habitat mapping, leaving major gaps in understanding of the potential biological, ecological and biodiversity impacts of development. These include:
 - toxicants, contaminants - bioavailability, bioaccumulation, loads/pathways, toxicity studies
 - biological impacts (individuals, populations, communities) and ecological health indicators
 - estuarine (including land-sea interactions) ecosystem processes and function;
 - soft sediment communities, sessile epifauna;
 - coral reef & seagrass communities;
 - fish nursery and feeding areas (particularly for commercial, recreational species); and
 - movements and critical habitat (i.e. feeding, nursery, calving, breeding areas) of key marine megafauna (sharks/rays, sea snakes, turtles, saltwater crocodiles, dugongs, cetaceans).
53. AMSA notes that there remains a critical lack of conceptual models, collation/integration of datasets and 'ecosystem modeling' studies and monitoring/assessment tools in Darwin Harbour. These critical activities underpin the design of effective marine ecosystem monitoring/management for the MASDP:
 - development and integration of hydrodynamic, contaminant and trophic models (e.g. EcoPath)
 - conceptual models;
 - spatio-temporal decision-support systems to support monitoring, assessment and reporting

Incorporation and Integration of Critical, Past Studies

54. AMSA notes that incorporation and integration of critical and existing key past studies would assist with marine ecosystem understanding and monitoring/assessments in Darwin Harbour.
55. This includes extensive in-faunal and epifaunal surveys and decades-long research of the Darwin Harbour undertaken by the NT Museum and international researchers (Hanley et al. 1996)²³, trophic

²² Munksgaard, N.C., Hutley, L.B., Metcalfe, K.N., Padovan, A.C., Palmer, C & K.S. Gibb (2019). Environmental challenges in a near-pristine mangrove estuary facing rapid urban and industrial development: Darwin Harbour, Northern Australia. *Regional Studies in Marine Science*, 25, 100438, ISSN 2352-4855, <https://doi.org/10.1016/j.rsma.2018.11.001>.

²³ Hanley, J. R., (1988). Invertebrate fauna of marine habitats in Darwin Harbour. In: H. K. Larson et al (eds). Proceedings of the Workshop on Research and Management in Darwin Harbour, Australian National University North Australia Research Unit, Mangrove monograph No. 4, pp. 135-152.

modelling of Darwin Harbour, using 'EcoPath' (Martin 2005)²⁴, and the development of water quality and environmental quality indicators (and assessment/monitoring tools) for coastal and estuarine and marine (CEM) environments in the NT (Edyvane & Whiting 2009)²⁵. Past surveys are particularly significant for establishing environmental and biological baselines.

56. AMSA highlights the critical need for an integrated marine monitoring and assessment framework for Darwin Harbour, to detect and assess anthropogenic impacts. And notes that marine ecosystem indicators have been developed for NT – following a bioregion-based, threat and conservation analysis (based on workshops and consultation with key NT Government and non-government stakeholders) and incorporated nationally-agreed water quality (WQ) and environmental quality (EQ) indicators. And also, included the development of the NT Marine Assessment and Reporting software tool (NT-MARS), an aquatic indicator framework and monitoring/reporting software developed for the NT, by the Queensland EPA in 2009 (see Edyvane & Whiting 2009). Both, the NT indicator framework and NT-MARS were based on the 'best practice' VPSIRR-based approach²⁶ to environmental monitoring. To-date, neither the NT CEM indicators, monitoring and report framework, nor NT-MARS software, has been utilized or publicly released by the NT Government or DHAC.
57. AMSA notes that unlike other areas of major oil/gas development in Australia, there are no detailed technical reports of Darwin Harbour which collate, review existing technical studies, and provide a critical and holistic overview of the values, uses, pressures, impacts, monitoring activities and overall ecosystem status. While many marine ecosystem studies, EIS's and technical reports have been undertaken in Darwin Harbour (particularly over the past decade) – integrated reviews by researchers, industry or government are rare.

Low Level of Investment in Ecosystem Knowledge, Environmental Baselines, Monitoring

58. AMSA notes the critical need for major investment in baseline ecosystem understanding of Darwin Harbour. In understanding the major knowledge and monitoring gaps in the Darwin Harbour it is important to consider the past/current low level of public and private investment in understanding the ecosystems and monitoring the ecosystem 'health' of Darwin Harbour.
59. In other jurisdictions where there has been large-scale, oil-gas infrastructure development and activities have been undertaken (i.e. Western Australia - Pilbara, Queensland - Gladstone Harbour), there have been major public and private industry investment (and partnerships) in baseline marine ecosystem understanding, ecosystem modelling and assessment studies to enable robust environmental impact assessments and the development of monitoring protocols, to ensure the protection of environmental values. Often this has included major government and industry partnerships with academic and research institutions (e.g. Western Australian Marine Science Institute²⁷).
60. AMSA notes that there has been relatively minimal public investment into critical research, knowledge, baseline assessment/monitoring and modelling to underpin and develop an integrated monitoring program for Darwin Harbour. Further, current environmental monitoring of Darwin Harbour has primarily been funded by the gas industry. With the securing of \$20 million of funding for the Darwin Harbour Integrated Marine Monitoring and Research Program (IMMRP) over 40 years, as part of an offset agreement between INPEX Corporation and the NT Government – the IMMRP has evolved to become the NT Government's 'de facto' long-term marine monitoring program for Darwin Harbour.

²⁴ Martin J.M. (2005). The distribution, abundance and trophic ecology of the fishes of Darwin Harbour mangrove habitats. Ph.D. thesis, Charles Darwin University, Darwin, Australia.

²⁵ Edyvane K & S Whiting. (2009). *The Northern Territory Marine, Coastal and Estuarine Monitoring, Evaluation and Reporting Framework*. Report prepared for NRMNT. Marine Biodiversity Group, Department of Natural Resources, Environment, the Arts and Sport (NRETAS), NT Government.

²⁶VPSIRR or Vulnerability–Pressure– State – Impact –Risk–Response monitoring.

²⁷ <https://wamsi.org.au/>

61. The NT Government's low level of public investment and commitment to supporting integrated marine monitoring/assessment in Darwin Harbour is clearly highlighted by inspection of the INPEX website for IMMRRP and comparing it with the DEPWS website for the IMMRRP (which was last updated in March 2016):

INPEX - <https://www.inpex.com.au/projects/ichthys-lng/our-commitments/darwin-harbour-integrated-marine-monitoring-and-research-program/>

DEPWS - <https://depws.nt.gov.au/water/water-management/darwin-harbour/darwin-harbour-integrated-marine-monitoring-and-research-program>

62. AMSA highlights the major potential for the Northern Territory and Commonwealth Governments to invest in and establish a government-industry-research partnership and Darwin Harbour Research Hub – to develop the baseline knowledge, assessment, monitoring, models, and management tools for the sustainable management of Darwin Harbour. The successful WAMSI model in Western Australia provides an excellent template for establishing 'industry-government-research' partnerships – particularly a partnership with the oil/gas industry. While the Territory has previously established collaborative research hubs (e.g. North Australia Marine Research Alliance – a partnership between Charles Darwin University, Australian National University, NTG and Australian Institute of Marine Science), there has been limited partnerships and investment by industry.

Lack of an Adequate & Integrated Marine Monitoring/Assessment Program in Darwin Harbour

63. In previous related EIS referrals in Darwin Harbour (e.g. Darwin Pipeline Duplication Project), the Proponents have emphasized the critical value and contribution of the monitoring undertaken under the NT Government's Darwin Harbour Integrated Marine Monitoring and Research Program (IMMRRP), both in assessing the medium and long-term impacts of the INPEX Ichthys Project, and assessing the potential impacts of the proposed activities.
64. AMSA further notes that the NT Government's investment in publicly-funded, marine research and monitoring in Darwin Harbour is limited. And is currently primarily being undertaken by INPEX-funded, 40-year Darwin Harbour Integrated Marine Monitoring and Research Program (IMMRRP), a \$20 million, industry-funded partnership and 'long-term offsets program' for the INPEX Ichthys Project.
65. While the NT has made significant progress towards an integrated marine and estuarine monitoring program in Darwin Harbour through the Water Quality Protection Plan for Darwin Harbour (WQPP), it is important to note that the establishment of the \$20 million, 40-year IMMRRP has primarily remained a 'long-term offsets program' for the INPEX Ichthys Project. And significantly, was never specifically designed as a holistic and integrated marine assessment, monitoring program to assess the ecosystem condition and ecosystem health of Darwin Harbour. As such, the current IMMRRP falls far short of both, an adequate and integrated marine monitoring program to assess potential marine anthropogenic impacts in Darwin Harbour. Below we provide further clarification.
66. AMSA notes that the findings of a national review by Hallett et al (2016)²⁸, have highlighted a range of significant limitations in the NT's marine monitoring, including:

"a continuing lack of ecologically-relevant indicators of habitat, floral and faunal condition, and a failure to ensure that declining estuarine condition triggers practical management interventions. Common limitations include (i) over-reliance on physico-chemical elements of estuarine condition, and primarily water quality, (ii) failure to quantify pressures across varied and appropriate spatial scales, and (iii) dramatic inconsistencies in the spatio-temporal coverage of monitoring."

²⁸ Hallett, C.S., F Valesini, P Scanes, C Crawford, B M. Gillanders, A Pope, J Udy, J Fortune, S Townsend, J Barton, Q Yeh, D J Ross, K Martin, T Glasby, P Maxwell (2016) A review of Australian approaches for monitoring, assessing and reporting estuarine condition: II. State and Territory programs. Environmental Science & Policy 66 (2016) 270–281.

67. The NT remains the only jurisdiction in Australia not to have an integrated monitoring and assessment system underpinned by an understanding of drivers, activities, threats, condition/impacts and responses (see review by Hallett et al. 2016). Current reporting in Darwin Harbour uses just 2 indicators to assess *“Healthy ecosystems and landscapes in the catchment and harbour – catchment disturbance index and mangrove area change.”*
68. While AMSA notes that there has been recent progress by the NTG (DEPWS) in identifying and monitoring a suite of ‘pressure’ indicators for the harbour (see Radke et al 2019, Radke & Fortune 2020, DEPWS 2022²⁹), AMSA highlights that in an integrated approach, additional ‘stress’ and ‘response’ indicators must also be evaluated, identified and monitored for the harbour.
69. AMSA notes that considerable work has been done (particularly over the past decade) in developing and establishing some important marine environmental baselines for Darwin Harbour, ie. water quality, sediment quality, mangroves, and coastal dolphins (see review by Munksgaard 2019). However, we stress that major gaps in marine ecosystem knowledge and understanding remain, which constrain and limit monitoring, risk and impact assessment – and impact detection in the harbour.
70. As such, the current IMMRP in Darwin Harbour remains very focused on water quality and sediment quality monitoring programs – with limited biological and biodiversity monitoring to assess ‘ecosystem condition’. The lack of ecologically-relevant indicators and monitoring has been highlighted in major national reviews of WQ monitoring programs (e.g. Hallett et al. 2016), recent reviews of Darwin Harbour (Munksgaard et al. 2019) and repeatedly, in the multiple reviews of the WQPP – both by DEPWS and DHAC (ERG and EMG). Including the latest Darwin Harbour Integrated Report Card 2021 which highlights this major monitoring gap and has recommended the following urgent action:
71. “Urgent need for systematic and ongoing biodiversity monitoring programs in the harbour and catchment. Opportunities were identified through this project to partner in the future with Indigenous rangers, biosecurity departments and volunteer groups to assist in collecting this information.”
72. AMSA notes that recent studies by DEPWS have confirmed the lack of an effective long-term WQ monitoring program for Darwin Harbour. Specifically, the failure of current water quality monitoring under the IMMRP to address non-anthropogenic, seasonal and climatic factors on water quality variability (see Makarynksa 2019)³⁰. And have also highlighted and recommended the need for routine monitoring (and reporting) of heavy metals in the harbour, particularly known metals of concern (Radke et al. 2021)³¹.
73. In line with the goals and objectives of the Darwin Harbour Strategy 2020-2025, AMSA strongly recommends major investment in an adequate and integrated marine environmental baseline and monitoring (and reporting) program in Darwin Harbour, to ensure the protection of the wide range of environmental values in the harbour. And also, importantly, to ensure the detection of potential medium and long-term significant anthropogenic and cumulative impacts.

²⁹ Radke, L.C. and Fortune, J. (2020). Anthropogenic Pressures on Darwin Harbour: An IMMRP Monitoring Plan (Version 1). Technical Report No. 11/2020, Department of Environment and Natural Resources, Northern Territory Government, NT.

Radke, L., Fortune, J., Townsend, S., Schult, J., Staben, G., Skarlatos-Simoes, M., Palmer, C., and Dostine, P. (2019). Development of Pressure Indicators for Darwin Harbour. Report No. 25/2019D. Department of Environment and Natural Resources, Northern Territory Government, Darwin.

³⁰ Makarynksa, D. (2019b). Developing an integrated long-term monitoring program for Darwin Harbour. Water Quality Pilot Project WP2: Intra-annual water quality variability. Report No. 22/2019D. Department of Environment and Natural Resources, Aquatic health Unit, Water Resources Division.

³¹ Radke, L., Smit, N. and J.Fortune (2021). *Assessment of sediment quality indicators for long term monitoring in Darwin Harbour: Final report*. DEPWS Technical Report 32/2021, Northern Territory Government, Darwin.

Need for a Strategic Regional Environmental and Baseline Assessment

74. AMSA notes that the MASDP has already identified the value of Strategic Regional Environmental and Baseline Assessments (SREBAs) in providing guidance on undertaking a strategic assessment:

“The SREBA Framework for the NT³² (NTG 2020) provides good guidance on undertaking strategic regional assessments in the Beetaloo Basin, and elements of this framework will be adopted for the MASDP where possible.” (Draft Program, Section 3.1.1).

75. The SREBA Framework for the NT describes the purpose of a SREBA:

“to provide the information necessary for appropriate decisions to be made about the development of any onshore shale gas industry in the NT, including assessment of water and biodiversity resources, to inform land-use planning, and the collection of baseline data to provide a reference point for ongoing monitoring”.

76. The SREBA Framework notes that “the lack of adequate pre-development assessment and environmental baseline data was one of the biggest environmental regulation and management-related issues associated with the development of the gas industry”. And notes that adequate pre-development baseline information was important to:

- predict the magnitude of any post-development change and assess its impact
- underpin modelling of the possible impacts of any new industry
- inform site-specific quantitative risk assessments by industry and regulators
- strategically plan for the rollout of any onshore shale gas industry, by industry, government, community and affected stakeholders
- identify key sensitivities in a regional context, and openly and constructively investigate and resolve issues that may arise as a result.

77. In light of the current major gaps in knowledge (outlined above), AMSA strongly recommends a SREBA be undertaken for Darwin Harbour, as part of the MASDP Program.

78. AMSA considers a SREBA essential in providing a baseline and reference point for ongoing monitoring, impact detection, risk assessments, and to inform land-use, sea-use and development planning in the MASDP.

Specific Comments – Draft MASDP Program

79. AMSA fully recognises that the MASDP is a major industry development plan. With a clear intent to attract industry investors to the Northern Territory, through the streamlining and fast-tracking of environmental approvals and minimization of regulatory hurdles or burden. But notes the MASDP commitment to a SEA approach and environmental sustainability, including understanding potential regional and cumulative impacts:

80. “SEA provides a number of benefits in understanding the **regional and cumulative impacts of development** and embedding sustainable outcomes across the life of the Precinct. In the context of the MASDP, using an SEA pathway to progress both NT and Commonwealth environmental approvals is seen as an important component of progressing this world-class, sustainable industry precinct.” (Draft Program)

81. AMSA however notes that the current proposed MASDP Program (and EIS) fails to identify or detail any program, approach or methodology to detect and assess regional and cumulative impacts on values, from current and projected uses in Darwin Harbour.

³² ‘SREBA Framework. A Guide to Undertaking a Strategic Regional Environmental and Baseline Assessment in the Northern Territory’ (NTG 2020)

82. AMSA is also concerned at the current duration of the MASDP Program. Under the Draft Program, DIPL is seeking approval for development activities within the MASDP strategic area that may occur over a period of 50 years (see Section 4.1.2). AMSA notes that Strategic Assessments under the EPBC Act, are usually around 20 years. We propose a duration of 20 years for the MASDP, with an independent review/audit after 10 years.

83. AMSA notes that the MASDP is a “Program (policy or plan), which sets out the scope of future development, as well as measures to deliver sustainability outcomes across economic, environmental, social and cultural and governance settings.” And that, “the MASDP Program is being developed based on three, equally important parts, all of which are supported by a Program-wide sustainability outcomes framework. The proposed core parts of the MASDP Program are:

Development Plan – defines the scope of development allowed under the Program; will be based around Classes of Action approach of the EPBC Act

Sustainability Outcomes Framework – delivers a best practice approach to embedding sustainability principles into the implementation of the Program. Sets measurable outcomes across all four sustainability components (environmental, economic, social and cultural, governance) and includes specific commitments for how outcomes will be delivered. Includes measures to avoid and minimise negative impacts and enhance positive opportunities

Implementation and Assurance Plan – sets out how the Program will be implemented, including mechanisms for all stakeholders to have confidence that the implementation is transparent, effective and adaptive. It includes governance arrangements.” (Draft Program, pp.12)

84. AMSA notes that “an outcomes framework approach replaces the standard mitigation and measures approach to avoid, minimise and offset potential significant and cumulative impacts, thus aligning with the SEA approach. The outcomes framework will encompass not only environmental factors, but economic, social and governance components as well. Together, these four components form the basis of sustainable infrastructure development, as defined by the Infrastructure Sustainability Council of Australia (ISCA). Therefore, defining outcomes across these four components will be a critical part of developing the MASDP Program.” (MASDP Statement of Reasons, pp.7)

85. AMSA notes that the Development Plan has not been completed. And there is limited information on the proposed industries, activities and potential impacts in the Draft Program document. For example, Actions or Classes of Actions (Draft TOR, Section 2.4) to be undertaken within the SAA, includes ‘waste discharge pipelines’ but fails to include the nature/types of potential pollutants, contaminants, or discharges.

86. AMSA notes that the Proponent acknowledges that much of the MASDP Program is currently still under development. “Some early fundamentals about the MASDP Program are currently known. However, a considerable amount of information, analysis and consultation must still be undertaken to fully develop the Program. While there is a good understanding of what this should entail, much of the work to determine the final Program content is still under development. This overview section and those that follow provide as much detail as appropriate at this stage of Program development, both in relation to content and the process which is underway to develop the full Program.” (Draft Program, pp.12).

88. AMSA notes that the proposed 'Sustainability Outcomes Framework' relies on a major investment in knowledge, data-gathering, risk assessment, analyses, tools and key expert and stakeholder consultation (which is not detailed in the referral documents):

"The Program will provide a Sustainability Outcomes Framework designed to effectively manage, protect or enhance environmental, social and cultural values for the life of the Program. The Sustainability Outcomes Framework component of the Program will:

- Summarise the likelihood and severity of the impacts of implementing the Program on the identified values based on the outcomes of the environmental impact assessment process documented in the EIS
- Establish the impact avoidance requirements of the Program.
- Set environmental management standards and controls.
- Provide tools that will be used to understand, predict and respond to potential impacts and opportunities over the life of the Program.
- Demonstrate how negative cumulative impacts to identified values of all proposed activities identified in the EIS will be mitigated and positive impacts enhanced. Identify measures that are most effectively delivered at the Precinct-wide scale, versus those which are specific to individual projects.
- Provide for appropriate offsets in accordance with the NT Offsets Framework and EPBC Act Environment Offsets Policy, where relevant, that address biodiversity loss and greenhouse gas (GHG) emissions.
- Define clear and measurable outcomes and commitments for environmental protection and social, cultural and economic sustainability that are relevant to the Program, including specific, measurable, achievable, relevant and timely performance indicators to demonstrate progress towards achieving these outcomes and commitments.
- Define clear and measurable outcomes and commitments for the achievement of administrative and regulatory efficiencies including specific, measurable, achievable, relevant and timely performance indicators to demonstrate progress towards achieving these outcomes and commitments." (Draft TOR, Section 2.5)

Specific Comments on Draft Terms of Reference for MASDP SEA and EIS

89. AMSA notes the major objectives of the MASDP EIS outlined in the referral documents:

"An Environmental Impact Statement (EIS), which assesses the impact of implementing the Program, on environmental factors, including Matters of National Environmental Significance (MNES). It demonstrates how negative impacts will be avoided, mitigated and offset (as appropriate) and where beneficial outcomes can be enhanced. The EIS allows stakeholders to understand and assess the acceptability of impacts." (Draft Program, pp.3)

"The purpose of the EIS is to assess the impacts of implementing the MASDP Program, including the impacts of actions proposed under the Program, on the environmental, economic, social and cultural values of Middle Arm, Darwin Harbour and surrounding areas. The draft EIS will also assess impacts of actions on environmental values under the EPBC Act. The draft EIS must demonstrate how the Program has been developed to meet the requirements of these TOR and the Program endorsement criteria, as set out in Attachment 2 of the Strategic Assessment Agreement between the Chief Minister of the Northern Territory and the Commonwealth Minister for the Environment. The draft EIS must enable the NT EPA and Commonwealth Minister to evaluate the suitability of the Program to ensure the long-term protection and conservation of environmental values within the SAA." (Draft TOR, pp.2)

Potential Major Impacts and Knowledge Needs for the MASDP

90. AMSA notes that Darwin Harbour has been formally recognised by the NT Government as a site of international and national conservation significance and is currently facing major and rapid industrialization³³ – particularly from the developing and growing oil/ gas industry, including major proposed petrochemical industries.
91. AMSA notes that while Darwin Harbour has a Water Quality Protection Plan, and a Darwin Harbour Strategy 2020-2025, it currently has no regional plan of management, integrated catchment management plan, nor natural resource management or conservation plan - to effectively manage and conserve the significant values of the harbour.
92. AMSA remains concerned at the major potential marine environmental impacts associated with the proposed MASDP – including impacts on marine megafauna (including dolphins, turtles, dugongs and sharks); fisheries (commercial and recreational); the cumulative impacts of dredging; acid sulphate soils; and the impacts of heavy metals on the food chain, food safety, public health, Indigenous harvest and Traditional Owners. And also, the potential major climate change risks and impacts on the MASDP (particularly sea-level rise, flooding) – and correspondingly, the major carbon footprint and climate impact of the MASDP (particularly its gas-related activities).
93. In a recent review of the environmental threats, monitoring and knowledge needs of Darwin Harbour, Munksgaard et al. (2019) identified the following main long-term threats to the ecological health of the harbour:
 - mangrove vulnerability and loss due to climate impacts, particularly sea level rise
 - habitat decline and loss from coastal land clearing, reclamation and catchment development
 - water quality deterioration (particularly in the poorly flushed upper reaches of the harbour), from pollution by catchment-derived nutrients and toxicants and
 - excess sediment deposition from land runoff and dredging of the estuary
94. The review did not assess ecological impacts, impacts to ecosystem services or impacts from increased shipping.
95. AMSA notes that climate change and associated sea level rise has been identified as posing a range of threats to Darwin Harbour, in particular mangrove and wetland communities (and their ecological services) (Munksgaard et al. 2019). Particularly enhanced climatic variability (in relation to the Australian monsoon) and cyclonic activity (decreased cyclone frequency but increased intensity). With enhanced climate variability, principally temperature rise, and low monsoonal rainfall associated with El Niño events, resulting in potential catastrophic events as has been observed in the NT across the Gulf of Carpentaria, where extensive mangrove mortality occurred during the 2015–2016 El Niño event (Duke et al., 2017³⁴).

³³ Munksgaard, N.C., Hutley, L.B, Metcalfe, K.N., Padovan, A.C., Palmer, C & K.S. Gibb (2019). Environmental challenges in a near-pristine mangrove estuary facing rapid urban and industrial development: Darwin Harbour, Northern Australia. *Regional Studies in Marine Science*, 25, 100438, ISSN 2352-4855, <https://doi.org/10.1016/j.rsma.2018.11.001>.

³⁴ Duke, N.C., Kovacs, J., Griffiths, A., Preece, L., Hill, D., van Oosterzee, P., Mackenzie, J., Morning, H., Burrows, D (2017). Large-scale dieback of mangroves in Australia's Gulf of Carpentaria: a severe ecosystem response, coincidental with an unusually extreme weather event. *Mar. Freshw. Res.* 68, 1816–1829.

96. AMSA is concerned at the potential major marine environmental and climate impacts associated with the proposed MASDP – and also, significantly, the ability of the current proposed SEA framework and proposed EIS to adequately detect, assess or monitor adverse impacts of the MASDP on the harbour’s key marine values and other marine uses.
97. In addition to the technical comments raised under ‘General Comments’ (above), AMSA raises the following major issues, concerns and key knowledge gaps/needs, which need to be addressed in the proposed MASDP ‘strategic environmental assessment’ (SEA) framework and EIS for Darwin Harbour:
- a) Need for build upon baseline surveys and studies to address existing major knowledge gaps and inform the environmental assessment of potential impacts on marine ecosystem values – particularly on critical habitats, key marine species and formally-listed threatened and migratory species, and also, ecosystem services.
 - b) Including the need for research, monitoring and risk assessment of potential MASDP impacts on major marine megafauna populations in the harbour and their critical habitat – including fish, sharks/rays, marine turtles, seabirds/shorebirds and marine mammals.
 - c) Need for assessment of ‘other marine uses’ (existing and forecasted) in Darwin Harbour, including trends, and potential environmental and socio-economic impacts – particularly for conservation, fisheries, aquaculture, defence, tourism, shipping, cultural values and recreation.
 - d) Need for research, monitoring and assess of the potential MASDP impacts on recreational and commercial fisheries, particularly given that 30% of the Northern Territory’s recreational catch is from Darwin Harbour region.
 - e) The focus on site-based and activity-based monitoring and assessment (and triggers) and failure to account for ecosystem-wide and ‘cumulative impacts’ on the marine ecosystem and ecosystem services of the harbour.
 - f) Need for integrated, marine ecosystem modelling and bioeconomic studies.
 - g) Need for a detailed climate risk assessment - particularly given the location of the MASDP on low-lying, coastal land, and the pronounced vulnerability of the coast to climate change impacts
 - h) Including the need for updated down-scaled climate projections for the region. Particularly given recent major climatic events in Australia (flooding, storms), which have underscored the need for updated coastal risk assessments.
 - i) Need for baseline information on heavy metals, bioavailability and bioaccumulation in the marine food chain in Darwin Harbour and also, its potential public health and socio-economic impacts (fisheries, Indigenous cultural harvest).
 - j) Need for research and monitoring of the ecological impacts of dredging and the current lack of an overall dredging strategy and management plan for Darwin Harbour to guide and manage dredging activities and their impacts.
 - k) Consideration of the current limited marine monitoring and regulatory framework with the Northern Territory, to adequately assess environmental impacts within the harbour.
 - l) Including the lack of an independent, adequate and integrated marine monitoring program for the harbour, i.e. the current INPEX-funded Darwin Harbour IMMRP.
98. AMSA notes that sea level rise (SLR) poses a major threat to coastal wetlands, mangroves and saltmarsh ecosystems of Darwin Harbour, where SLR is one of the highest in Australia at 8.4 mm y⁻¹ (5-year running average 1996–2013, CoastAdapt, 2018)³⁵. Current rates of sea level rise are higher than at any time in the last 6,000 years. Significantly, recent modelling of the response by Darwin Harbour mangroves to a 0.5 m and 1 m rise in sea level indicates that the *Ceriops*-dominated habitat may be the most vulnerable, with a potential decline in area of up to 92% (Crase et al., 2013, 2015³⁶).

³⁵CoastAdapt (2018). Sea-level rise and future climate information for coastal councils. National Climate Change Adaptation Research Facility. https://coastadapt.com.au/sea-level-rise-information-all-australian-coastal-councils#NT_DARWIN

³⁶Crase, B., Liedloff, A., Vesk, P.A., Burgman, M.A., Wintle, B.A., 2013. Hydroperiod is the main driver of the spatial pattern of dominance in mangrove communities. *Glob. Ecol. Biogeogr.* 22, 806–817.

Crase, B., Vesk, P.A., Liedloff, A., Wintle, B.A., 2015. Modelling both dominance and species distribution provides a more complete picture of changes to mangrove ecosystems under climate change. *Glob. Chang. Biol.* 21, 3005–3020.

99. AMSA notes that SLR and increased climate variability (ie. flooding, storm surge events, cyclonic activity) pose not only threats to coastal wetland ecosystems in Darwin Harbour - but also the Middle Arm Peninsula, and potentially parts of the MASDP. This is supported by national coastal risk assessment tools (eg. CoastAdapt, Coastal Risk Australia³⁷), which highlight the vulnerability of the Darwin Harbour to coastal inundation and flooding, including the Middle Arm Peninsula.

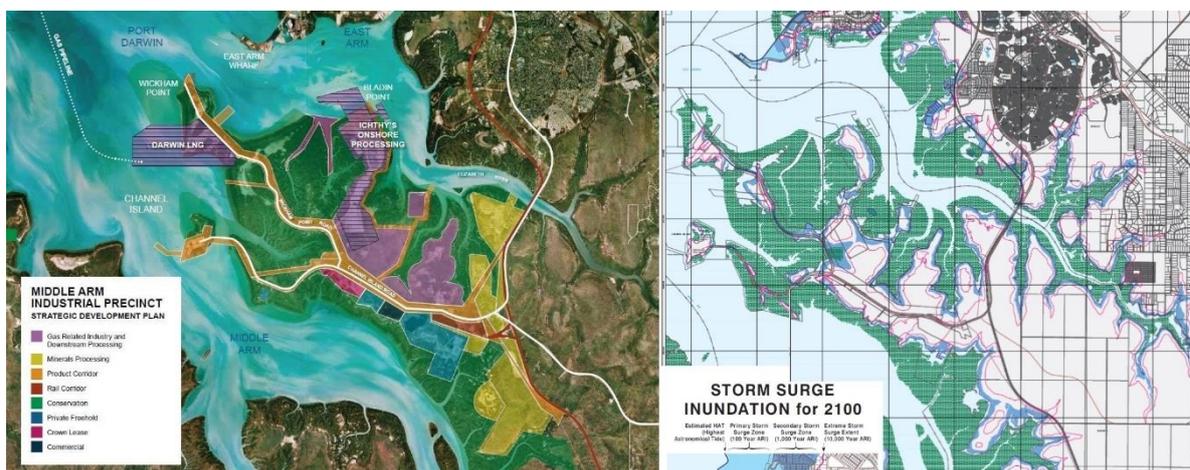


Figure 1. Coastal and climate vulnerability of the Middle Arm Peninsula and MASDP region. Showing SLR and storm inundation mapping for 2100 (based on modelling by SEA 2010 and GHD 2014).

100. AMSA notes that recent major climatic events in Australia (flooding, storms) have also underscored the need for updated coastal risk assessments. For Darwin Harbour, there have been major improvements in the bathymetric data for the harbour, over the past 10 years, with detailed mapping and field studies now available. AMSA notes that current SLR risk modeling for Darwin Harbour region was conducted in 2010 (SEA 2010)³⁸ – no subsequent SLR risk modelling has been undertaken. While more recent storm surge mapping and flooding has been undertaken (GHD 2014) – it is based on SLR modelling by SEA (2010) and 2009 and 2011 topographic information (Figure 1). Further, we note that Rapid Creek floodplain modelling has been re-assessed with more up-to-date DEM mapping (2014) due to significant inaccuracies detected following a major 2011 Darwin flood event.
101. AMSA strongly recommends a detailed and updated climate risk assessment of the Darwin Harbour region be undertaken as part of the MASDP SEA and EIS, using updated ‘down-scaled’ climate projections for the region (based on IPCC Sixth Assessment Report). And incorporating SLR and relevant climate risks (storm surge, flooding, cyclonic activity), and also updated DEM mapping and bathymetric data for Darwin Harbour.
102. Another priority for MASDP SEA and EIS should be addressing the potential major shipping and sediment impacts in the harbour. AMSA supports ‘predictive sediment impact modelling’ (an industry standard for major coastal projects in other States), including hydrodynamic, sediment transport impact and dredge plume modelling (Section 5.7.1, Referral Report). But notes the need to specifically address the current lack of a Dredging Strategy and Plan for Darwin Harbour.

³⁷ Coastal Risk Australia - <https://coastalrisk.com.au/viewer>

³⁸ Systems Engineering Australia (SEA) (2010). High Resolution Storm Tide and Climate Change Impacts Study – 2010. Report to the Department of Lands and Planning, Northern Territory.

103. Significantly, Darwin Harbour Integrated Report Card 2021³⁹ also highlight “a key priority item for water quality in Darwin Harbour is the development of a Dredging Strategy and Plan”, which is in accordance with work currently being conducted by NT Department of Infrastructure, Planning and Logistics. The report card also recommended the “need to adjust sampling locations for sediment metals to include more sites in Buffalo and Myrmidon Creeks. Investigate source of elevated metals identified at sites in East Arm.”
104. AMSA notes that ANZG 2018 provide national recommended protocols/approaches to sediment assessment/ monitoring⁴⁰ which should, as a priority, be considered for Darwin Harbour. Particularly the recommended monitoring protocols and assessing sedimentation impacts, particularly the need to incorporate ‘multiple lines of evidence’ in assessing ecological impacts (Simon & Batley 2016).⁴¹ This is also currently not undertaken in the IMMRP WQ.
105. AMSA also suggests consideration should also be given to the major prevalence of acid sulfate soils in the Darwin Harbour region and with sediment disturbance, the potential for anoxic conditions, acidification and mobilization of heavy metals, and their contamination of surrounding waters and bioaccumulation in the food chain (Munksgaard et al. 2019). Previous Referrals (Darwin Pipeline Duplication project) cite an outdated 2002 soil study, which fails to define the scope and nature of the acid sulfate soil issue (and its impacts on coastal development and infrastructure development, including dredging).
106. As mentioned previously, AMSA considers it important that the MASDP does not follow other related-EIS Referral material (Darwin Pipeline Duplication Project) – by relying very heavily on the INPEX Ichthys Project and the IMMRP, to discount potential environmental concerns, significant impacts and threats, including identified MNES. But rather undertake additional essential baseline studies, monitoring and risk assessments as outlined in this submission.

Potential Impacts, Knowledge Needs and Monitoring Challenges - Marine Megafauna

107. The marine and coastal habitats within Darwin Harbour and around Middle Arm contain marine fauna species that are of local, national, and international significance. Below we outline major issues, threats and also, key knowledge needs, and monitoring challenges for the MASDP EIS and SEA.
108. AMSA notes the major methodological challenges with impact detection and monitoring of marine megafauna populations, particularly with small and vulnerable populations. Including high population variability (even over relatively long-term monitoring, ie. a 10-yr survey period). And in aerial surveys, the difficulties in isolating the source or causes of impact due to scale issues, ie. the scale of the impact (project-site) versus the scale of the population (100s of km).
109. All marine mammal species have life histories that render them highly vulnerable to population decline. Such declines are also difficult to detect given the mobility of these species and challenging behaviours that hamper detection. Unless the impact is observable and drastic, e.g. significant increase in boat strike mortality; most impacts will go undetected.
110. AMSA also notes that it remains a major challenge to directly respond to the current Commonwealth’s Significant Impact Guidelines with marine megafauna under the EPBC Act 1999, in relation to major developments - due to project vs. megafauna ecology scales, knowledge gaps and life history factors. Therefore – ‘no project impact’ is a frequent outcome in these assessments. For this reason, AMSA suggests the need for as conservative approach as possible, when assessing small and vulnerable marine megafauna populations.

³⁹ https://nt.gov.au/_data/assets/pdf_file/0003/1059330/darwin-harbour-2021-integrated-report-card.pdf

⁴⁰ <https://www.waterquality.gov.au/anz-guidelines/resources/guidance/biological-assessment>

⁴¹ Simpson, S. and G. Batley (2016) (Eds.) *Sediment quality assessment: a practical guide*. CSIRO Publishing, Victoria, Australia.

111. AMSA notes that the Commonwealth are currently in the process of developing survey/assessment guidelines for marine mammals and turtles to be applied to 'significant projects' in Australia – and the Commonwealth's Significant Impact Guidelines. AMSA is very supportive of this initiative and view it as a major positive step in improving robustness in this process and improving conservation outcomes.
112. In Darwin Harbour, long-term monitoring study of 3 coastal dolphins species (2008-2019) has detected a decline in dolphin populations (Palmer et al. 2017⁴², Griffiths et al. 2020⁴³). But the cause of the population decline is unknown, because no other factors were monitored/integrated.
113. For this reason, for the MASDP, AMSA strongly recommends a 'multiple lines of evidence' approach to monitoring and impact assessment for dolphins and other marine megafauna populations, ie. multiple suspected impacting factors should be monitored concurrently. Including conducting direct megafauna observations whilst monitoring noise, prey abundance, water quality, habitat health and vessel traffic - all are critical in understanding cumulative impacts to marine megafauna and identifying the causes or source of impacts.
114. AMSA notes the major lack of tagging or movement studies for marine megafauna in Darwin Harbour.

Coastal Dolphins

115. Information on the Australian snubfin (*Orcaella heinsohni*), Australian humpback (*Sousa sahalensis*) (Australian endemic species) and bottlenose (*Tursiops sp.*) dolphins in Darwin Harbour has increased significantly since 2008. Darwin Harbour including Middle Arm consist of estuaries that are biologically productive systems that support the three coastal dolphin species and serve as important nursery grounds for their prey. Using data from long-term dolphin monitoring (Brooks et al. 2017, Palmer et al. 2017, Griffiths et al. 2020), these three species were found to have populations that were small, mobile, and of a variable nature. All three species (Bottlenose, Humpback and Snubfin Dolphins) occur at low densities in this region (1086 m²), with fluctuating population sizes, upper population estimates of 44, 107 and 21 individuals, respectively (Griffiths et al. 2020). The current capture–recapture results have demonstrated that the Darwin region population of all three species of coastal dolphins are small. While the Darwin region is part of larger dolphin habitat system (for the three species), very little is known about animal movement or factors that contribute to movement of dolphins between parts of the system.
116. Importantly, a significant negative trend in abundance has been identified for subpopulations in the Bynoe Harbour, Darwin Harbour and Shoal Bay region. Linear models for each species suggested that all species are experiencing a negative population growth rate. In a Base Population Viability Analysis (PVA) conducted by von Takach et al. (2020)⁴⁴, it was found that there is a high probability that the regional Darwin population of Bottlenose dolphins was at a high risk of extinction with a downward trend in population size also reflected in the parameter estimates for mortality and recruitment (this was the same for the other coastal dolphin species), with high rates of mortality and low rates of recruitment in each species.

⁴² Palmer, C., Brooks, L., Fegan, M. and Griffiths, A.D. (2017). Conservation Status of Coastal Dolphins in the Northern Territory: Final Report. Marine Ecosystems Group, Flora and Fauna Division, Department of Environment and Natural Resources. Darwin.

⁴³ Griffiths, A.D., Groom, R.A., Low Choy, D., Mackarous, K., and L.Brooks (2020). Darwin Region Coastal Dolphin Monitoring Program: Final Report – 2011 to 2019. Department of Environment, Parks and Water Security, Northern Territory Government.

⁴⁴ von Takach, B., Woolley, L. and Banks, S. (2020). Population Viability Analysis (PVA) for Three Species of Coastal Dolphin in Darwin Harbour. Technical Report to the NT Government.

117. AMSA identifies the following MASDP potential threats and knowledge needs for coastal dolphins:

The coastal dolphin studies have identified hotspot foraging areas within Darwin Harbour and Middle Arm for coastal dolphins and in-turn emphasize high density areas of prey that would support multi-species of predators (including coastal dolphins). The studies have identified a baseline of prime dolphin foraging habitat areas that could potentially be monitored overtime to evaluate the effects of anthropogenic impacts. With on-going developments within Darwin Harbour and Middle Arm, prioritisation of selecting prime foraging habitats will aid in planning and response to mitigation measures to minimise impacts on critical habitats and will be a proxy for prey distribution.

118. Complementing ongoing foraging monitoring for coastal dolphins, could also include using coastal dolphins as indicators of the ecological health of Darwin Harbour. Currently, the health of Darwin Harbour is assessed by water quality and sediment monitoring only. As such, coastal dolphins as top order predators, could be used as sentinel species to monitor ecosystem health trends and would enhance the existing water quality indicators by including a marine mammal. Likely threats to coastal dolphins include habitat loss, depletion of prey, chemical discharge, underwater noise, climate change, commercial/recreational fisheries and boat strike.

Dugong

119. Knowledge of dugong abundance and distribution in the Northern Territory is reasonably robust, due to large-scale aerial surveys conducted over the last 30 years. Dugongs are marine herbivores that feed exclusively on seagrass in coastal areas in waters usually greater than 10m deep. Healthy seagrass is essential to maintaining dugong populations. Dugongs choose habitats based on the presence of preferred seagrass food resources and maintain a spatial memory of highly productive seagrass beds that they revisit over time.

120. AMSA identifies the following MASDP potential threats and knowledge needs for dugongs:

Very little is known about animal movement or factors that contribute to movement of dugongs in Darwin Harbour. There is limited understanding of how dugongs use habitats. Maintaining the integrity of all habitats is important given with that Darwin Harbour contains patchy seagrass habitats rather than extensive meadows like the Gulf of Carpentaria. Therefore, likely threats to dugong populations include changes in the extent of seagrass caused by anthropogenic sources (i.e., urban, and industrial runoff, and dredging = sea clearing), disturbance of sediments, eutrophication and flooding and severe weather events.

Marine Turtles

121. Marine turtles are highly migratory, utilising widely dispersed habitats throughout their lifecycle and require both terrestrial and marine habitats to fulfil their life history stages. Marine turtle information within the NT, is mainly limited to the distribution of nesting beaches and much less is known of species foraging ecology and demography.

122. Four species of marine turtles, hawksbill (*Eretmochelys imbricata*), olive ridley (*Lepidochelys olivacea*), green (*Chelonia mydas*) and flatback (*Natator depressus*) are recorded in the Darwin region, and flat-back and olive-ridley turtles regularly nest on beaches within the outer Darwin region (Chatto and Baker 2008)⁴⁵. In relation to marine turtles, green turtles have been observed in reef and non-reef habitats and feed predominately on seagrass and algae (and potentially mangrove leaves); hawksbill turtles feed in rocky reefs; olive-ridley feed in turbid waters but are difficult to observe; flatback turtles are regularly recorded in the outer Darwin Harbour region but do not appear to forage within the harbour (Chatto and Baker 2008). Flat-back turtles are the most common nesting species within the outer Darwin Harbour region (Chatto and Baker 2008). Based on the June/July 2012 aerial and boat-based surveys, 900 marine turtles were sighted in the region, including many around Darwin Harbour (INPEX 2013).

⁴⁵ Chatto, R., & B. Baker (2008). The distribution and status of marine turtles nesting in the Northern Territory. Technical Report No 77. Parks and Wildlife Service of the NT, Palmerston, Australia.

123. AMSA identifies the following MASDP potential threats and knowledge needs for marine turtles:

Very little is known about animal movement or factors that contribute to movement of turtles in Darwin Harbour. Within Darwin Harbour, and specifically Middle Arm, marine turtle species hawksbill, green and flatback turtles have been recorded foraging around Channel Point (in and around Middle Arm) which is potentially important foraging habitat area. Very limited nesting information and baseline population data is available for Darwin Harbour. Marine turtles are subjected to multiple threatening processes driven by natural and anthropogenic processes including ingestion and entanglement in marine debris, interactions with commercial fisheries, boat strike, habitat degradation and loss (seagrass, reef, open water, nesting beaches), underwater noise, increased lighting, nest predation and climate-related impacts.

Specific Comments – MASDP Referral Report

124. AMSA notes that MASDP Referral Report provides supporting information to the Referral Form submitted to the Northern Territory Environment Protection Authority (NT EPA) for the Middle Arm Sustainable Development Precinct (MASDP). The supporting information has been prepared by the Department of Infrastructure, Planning and Logistics (DIPL) to inform the NT EPA's decision to accept the referral of the MASDP as a Strategic Proposal, and an assessment of potentially significant impacts via a Strategic Environmental Assessment (SEA) approach.

125. AMSA fully accepts the need for a Strategic Environmental Assessment for the MASDP.

126. AMSA notes the reliance of previous EIS studies and consultants report. And also, the lack of detail on proposed studies, particularly to fill major marine knowledge gaps in Darwin Harbour.

127. AMSA notes and fully supports the findings of the 2020 Independent Review of the EPBC Act (1999)⁴⁶. Particularly the ineffectiveness of the EPBC Act to protect environmental values, and the need to significantly improve the quality of data and information:

“The environment and our iconic places are in decline and under increasing threat. The EPBC Act is ineffective. The Act is not fit for current or future environmental challenges, including climate change. New legally enforceable National Environmental Standards should be the centrepiece of fundamental reform of the Act.”

“Decision-makers, proponents of development and the community do not have access to the best available data, information and science. There is insufficient capability to understand the likely impacts of the interventions made. Unacceptable information gaps exist, and many protected matters are not monitored. A quantum shift in the quality of data and information including a long-term strategy, standards and clearly assigned responsibility is needed.”

128. AMSA notes that previous public submissions have highlighted concerns specifically regarding the pre-referral ‘screening’ and identification and of Matters of National Ecological Significance (MNES) for Darwin Harbour (see Darwin Pipeline Duplication (DPD) project, submission by A-Professor Karen Edyvane, ANU). Including using the lack of information (i.e.. lack of site records, baseline field surveys and known data gaps) – to discount listed and migratory species.

“Within the DPD Project area, an EPBC Protected Matters search by the Proponent (Appendix E) has identified 42 listed **threatened fauna species** (including 6 turtle species, 4 marine mammal species, 8 shark species) and 74 listed **migratory species** (21 of which are also listed as threatened species) that may occur or have habitat in the area, including 6 seabird species, 6 marine mammals, 7 shark species, and 34 species of shorebirds/terrestrial birds (see Table 2.2, Attachment C, EPBC Referral Supporting Information).”

⁴⁶ <https://epbcactreview.environment.gov.au/resources/final-report>

“Appendix H – the ‘likelihood of occurrence assessment’ - is used to discount species from the Protected Matters Search Tool (PMST) list and very significantly reduce assessment of listed marine threatened species from 18 marine species to just 6 species (all turtles, Table 2.3, Attachment C, EPBC Referral Supporting Information) and 53 listed marine migratory species to just 6 species (3 coastal dolphin species, dugong, saltwater crocodile and the Osprey). Significantly, the omission of listed migratory and marine threatened species is primarily based on the lack of site records and relies heavily on government data which often is dated ie. NT List of Marine Protected Species (2006). “

129. To this end, AMSA strongly recommends that baseline regional (harbour-wide) biological surveys (terrestrial, marine) and monitoring be built into the MASDP Program and EIS, particularly for key megafauna species (fish, sharks/rays, birds, reptiles, mammals).

The Australian Marine Science Association (AMSA), and its Northern Territory members – hope the above technical advice and information assists the NT EPA in considering the MASDP Project for referral as a Strategic Assessment under Section 49 of the Environment Protection Act 2019.

AMSA looks forward to reviewing and providing further comments on the MASDP.

Yours Sincerely



Karen Edyvane, PhD

On behalf of Australian Marine Science Association

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