Government of **Western Australia**
Office of the **Appeals Convenor**
Environmental Protection Act 1986

Appeals Convenor's Report to the Minister for Environment

Appeals objecting to Report and Recommendations of EPA Report 1705 – Perdaman Urea Project, Burrup Peninsula

Appellants	See Appendix 1
Proponent	Perdaman Chemicals and Fertilisers Pty Ltd
Authority	Environmental Protection Authority (EPA)
Appeal No.	034 of 2021
Date	January 2022

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This report

Cover image: EPA Report 1705 – Figure 1: Regional location (page 98)

Please contact us if you need the report in a different format.

Acknowledgement of Country

The Office of the Appeals Convenor acknowledges the traditional custodians throughout Western Australia and their continuing connection to the land, waters and community.

We pay our respects to all members of the Aboriginal communities and their cultures, and to Elders past, present and emerging.

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1 Executive summary

1.1 Decision under appeal

Perdaman Chemicals and Fertilisers Pty Ltd (the proponent) plans to construct and operate the Perdaman Urea Project within the Burrup Strategic Industrial Area on the Burrup Peninsula, northwest of Karratha in Western Australia (Figure 1). The proposed urea plant has a production capacity of 2 million tonnes per annum (Mtpa).

The proposal was referred to the Environmental Protection Authority (EPA) in May 2018 by a third party. Under the *Environmental Protection Act 1986* (EP Act), the EPA set the assessment level at Assess – Public Environmental Review. The EPA identified eight key environmental factors during its assessment, which were:

- Air quality
- Greenhouse gas emissions
- Flora and vegetation
- Terrestrial fauna
- Inland waters
- Coastal processes
- Social surrounds
- Marine environmental quality.

Figure 1 Location of proposal on the Burrup Peninsula (proposed development envelope in blue)[1]

[1] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, Figure 1.

Having formed the view that reasonable conditions could be imposed on the proposal to ensure its implementation is unlikely to be inconsistent with its objectives for the environmental factors, the EPA recommended that the proposal may be implemented subject to conditions.

In September 2021 the EPA published Report 1705, and it is against this report and recommendations that appeals were lodged.

1.2 Grounds of appeal and appellant concerns

Twenty appeals were lodged against EPA's report and recommendations (see Appendix 1 for list of appellants).

Concerns raised by the appeals include the risk that emissions from the proposal pose to Murujuga rock art, human health and exacerbating global warming. Other concerns included impacts to native vegetation, Aboriginal heritage sites and amenity (noise, light, visual). The appellants' main concerns have been summarised in Table 1.

Table 1 Grounds of appeal

Ground	Main concerns the appellants submitted
Rock art	Appellants submitted that Murujuga rock art is of cultural significance to Aboriginal people and of significance locally, nationally and internationally. They submitted that current science indicates that industrial emissions are already impacting on rock art. Because of the values of the rock art and the current state of science, appellants argued that the EPA did not properly apply the precautionary principle and should have considered measures required to prevent, avoid or mitigate the threat, including whether or not to recommend the proposal be implemented or otherwise limit emissions to zero or near zero.
Greenhouse gas emissions	Appellants raised concerns about the emissions of greenhouse gases (GHGe) resulting from the proposal. They contend that the GHGe from the proposal will be significant even with the proposed mitigation measures, and will not be consistent with climate science, Australia's obligations under the Paris Agreement, nor the need to stop burning of fossil fuels. One appellant suggested that this was a missed opportunity to utilise renewable energy. Another appellant raised concerns about the accounting of methane and its assessment. Another appellant suggested that the EPA failed to consider that the proposal underpins the viability of the Scarborough gas development, which is estimated to cause 1.6 billion tonnes of carbon pollution over its lifetime. Appellants sought for additional conditions to: • limit GHG emissions and ensure the proposal achieves net zero emissions over its lifetime

Ground	Main concerns the appellants submitted
	• require an annual review (and implementation) of all reasonable and practicable measures to mitigate GHG emissions. One appellant submitted that the EPA has not considered the loss of carbon sequestration, and the carbon emissions from clearing and a net loss of carbon sequestration is an unacceptable contribution to climate change.
Human Health	Impacts of emissions from the proposal on human health was raised by two appellants. The concerns related to cumulative impacts within the Karratha area generally and the effect of urea dust specifically.
Amenity	Broadly, appellants were concerned about the impact of the expanding industrial development on the cultural, recreational, and tourism use of the surrounding landscape. Specifically, appellants raised concerns about the significant visual, light, and noise impact from the proposal. They contend that the scale of the proposal is considerable, and it will have detrimental effect on the visual amenity of the area. One appellant raised concerns about the proponent's landscape and visual impact assessment. Another appellant submitted that the increased vehicle traffic will impact amenity and the ambience of the rock art.
Direct impact to heritage sites	Broadly, seven appellants raised concerns about the significant Aboriginal heritage in the region and contend that the EPA did not apply adequate weight or value to this in its assessment of the proposal. Specifically, several appellants raised concerns about the disturbance and relocation of registered Aboriginal heritage sites for the construction of the proposal. One appellant submitted that there was no mitigation plan to prevent the destruction of these sites. Another appellant suggested that the relocation of these sites amounts to their destruction, as they have deep spiritual links to place and location. Several appellants also raised concerns that the proposal will impact the values for which Murujuga is nominated for World Heritage listing.
Clearing	One appellant submitted that a large footprint is proposed to be cleared for construction of the proposal and raised concerns about the impact on existing rare flora and fauna habitat. The appellant contended that the area has not been surveyed adequately.

Other concerns including suitability of alternative locations, World Heritage nomination, conflict of interests and downstream use of fertilisers were also raised by some appellants. While these are considered to be beyond the scope of appeal, we have included a brief discussion of each in Section 4 of this report.

1.3 Key issues and conclusions

Having regard for the concerns of the appellants and the scope of the appeal, the key question for the appeal investigation to determine is whether the EPA adequately assessed the proposal in relation to the issues raised by the appellants. We also consider the extent to which the recommended conditions are adequate in the context of the concerns raised in the appeals.

In this context, this report summarises the key appeal issues and our conclusions below, with full details in Section 3. Section 2 sets out the background to the proposal and Section 4 sets out Other Matters raised by the appeals.

Did the EPA adequately assess impacts to rock art?

The proposal is located on Murujuga, which supports more than one million petroglyphs in an area of more than 37,000 hectares (ha), representing one of the most dense and diverse collections of petroglyphs in the world. The rock art is of significant cultural and spiritual value to Aboriginal people, and of significant state, national, and international heritage value.

In its assessment, the EPA concluded that emissions of ammonia and urea from the proposal may pose a threat of serious or irreversible damage to rock art, while acknowledging contested views about the threat.

The EPA ultimately concluded that the proposal could meet its objectives for air quality and social surroundings provided certain measures are applied to the proposal, including a requirement that no emissions from the proposal cause accelerated weathering of rock art. Crucially, this outcome was recommended by the EPA to be supported by (among other things) requirements for the proponent to comply with criteria or standards to be developed which will ensure the rock art is protected.

While there are uncertainties about the nature and scope of these future criteria and standards, we consider it was open to the EPA to recommend the proposal be implemented subject to these requirements.

However, to provide assurance that any proponent-developed criteria are scientifically valid and robust, we recommend that the conditions be varied to require the proponent to engage independent peer review to:

1. Ensure the methodology for the baseline modelling is scientifically valid and robust and will be effective at ensuring the outcome of no impact to rock art is able to be achieved
2. Ensure the criteria, management actions and reporting requirements included in the Air Quality Management Plan (AQMP) are scientifically valid and robust and will be effective at ensuring the outcome of no impact to rock art is able to be achieved.

We have also recommended other changes to the conditions to require reporting of any exceedance of a ‘threshold’ criteria to the Chief Executive Officer of the Department of Water and Environmental Regulation (CEO) within 48 hours of occurrence and that any proposed change to the AQMP relating to matters considered by one or both of the above peer reviews be the subject of a further peer review at that time.

These changes provide greater certainty that the outcome set by the EPA will be met.

We nonetheless acknowledge that the conditions provide for the future consideration of potential impacts to rock art. This raises a risk that the proponent may proceed to construct the plant with certain emission levels, only to find that the yet to be developed criteria or

standards require lower emissions. We consider that, on the basis that protection of rock art is paramount, and that the conditions recommended by the EPA contemplate that the proponent may be required to fit additional pollution control equipment or change processes to reduce emissions, the proponent is aware of the implications of the outcomes of the future studies.

It remains open to the Minister, however, to consider remitting the proposal to the EPA for further assessment of impacts to rock art, for example, requesting that the results of the Murujuga Rock Art Monitoring Program (MRAMP) due in 2023 be considered before a final report is published. As we observe in relation to human health, this would also provide an opportunity to consider the results of revised airshed modelling due in February 2022.

Did the EPA adequately assess greenhouse gas emissions (GHGe)?

We consider the EPA's assessment of GHGe was consistent with the EPA's approach to other recent proposals.

The EPA noted that, without mitigation, the proposal would emit 52 million tonnes (Mt) of scope 1 carbon dioxide equivalent (CO_2-e) emissions to the atmosphere over its project life. The EPA also noted that the proposal was expected to generate an additional 1.83 Mt of CO_2-e scope 3 emissions.

The EPA considered the emissions against its regulatory and policy framework, and requested the proponent prepare a revised GHG Management Plan setting out how plant emissions would achieve net zero emissions by 2050.

The proponent provided a revised GHG Management Plan to the EPA as part of the assessment. This plan set out a trajectory to reduce emissions to net zero commencing in 2030. Over the life of the proposal, the proponent's revised commitment would see residual net emissions of 9.75 Mt. The EPA considered this revised limit and (at worst) linear trajectory was generally consistent with its GHG Guidelines and recommended it be included as a condition of approval.

Consistent with its approach on other recent proposals where GHGe were identified as a key environmental factor, the EPA has expressed the view that its role is to minimise GHGe from new proposals, and a decision on whether residual emissions are acceptable is ultimately a matter for the decision makers under section 45 of the EP Act. The EPA also noted that it is open to the decision makers to consider whether to require the proposal to be net-zero from commencement – that is, require the proposal to be carbon neutral from commencement.

We concur with the EPA that global warming poses a threat to Western Australia. We provide a review of the current science about global warming and potential impacts to Western Australia in particular. We find that the south west of the State faces significant climate-related risks if global temperatures are not kept to 1.5C, including an up to 80 per cent increase in agricultural drought months (defined as a month of extremely low soil moisture) in the south-west by 2070.

We consider that the EPA's approach is consistent with its approach to other recent proposals, and that on that basis, the acceptability of the proposal's residual GHGe is a matter for the decision makers under section 45.

We also note that the approach recommended by the EPA contemplates the emissions limits reflected in the conditions is a current maximum, but that evolving science and policy may require more significant reductions in the future. We consider this contemplation is reflected in the EPA's proposed wording of the conditions, including the power for the CEO to request

a review of the GHG Management Plan at any time (in addition to the power for the Minister to seek a review of the conditions under section 46 at any time).

In relation to the vegetation to be cleared providing a store of carbon, we concur with the EPA's view that the nature of the vegetation means it is unlikely to be significant in the context of climate change, and was therefore not central to the assessment of the proposal.

Did the EPA adequately assess impacts to human health?

While there are some shortcomings in the EPA's assessment of impacts to health, we consider its conclusions were acceptable.

The EPA found that emissions to air (the issue of concern raised by appeals) from the proposal (in combination with all other sources) was below relevant health guidelines with the exception of particulate matter. On the latter, while the implementation of the proposal is predicted to see exceedances of health guidelines at public receptor locations near the plant, this is mainly due to existing natural background emissions levels.

We believe the EPA's assessment was generally appropriate, though we find that during upset (non-routine) conditions, the proposal will be responsible for a higher proportion of cumulative emissions at sensitive receptors than considered by the EPA. Nonetheless, the proposal's contribution is still below 20 per cent of the ambient standard in a worst case scenario, which is not inconsistent with the EPA's advice that the proposal is a relatively minor contributor to total emissions.

In relation to ammonia, while the EPA found that the health guidelines would not be exceeded, we note that additional modelling is being undertaken to address information received by the Department of Water and Environmental Regulation (DWER) in respect to the Yara Ammonia Plant ammonia emissions. This new modelling is not expected until at least February 2022. Advice received from the Chair of EPA acknowledged the revised modelling, but on the basis of the information before the EPA and DWER's advice that it will ensure health guidelines for ammonia are met at public receptors in the area, the Chair advised that the EPA's conclusions would not have changed.

While we accept the Chair's advice, as noted with respect to rock art, it is open to the Minister to remit the proposal to the EPA for further assessment of the implications of the revised modelling for public health (and rock art) when it is available in or after February 2022.

Did the EPA adequately assess impacts to amenity?

We find that the EPA's assessment of noise and visual impacts was satisfactory. We also find the EPA's assessment of traffic was appropriate, despite vehicle movements being considered to be slightly higher than reflected in the EPA's report.

In relation to noise, the EPA found that the proposal is expected to comply with relevant assigned noise levels in the *Environmental Protection (Noise) Regulations 1997.* On this basis, and noting that the proponent will be required to adhere to the assigned levels, the EPA's assessment is supported.

In relation to visual impact assessment, the EPA acknowledged that the proposal will dominate views of people driving north along Burrup Road and west along Hearson Cove Road. However, the EPA found that from the perspective of visitors to Deep Gorge and Hearson Cove, the proposal will be largely obscured from view. The EPA also noted the presence of existing industry in the area, and should be seen in that context.

We consider the EPA's assessment of visual amenity was acceptable. We note, however, the proponent's acknowledgement that the cumulative effect of industrial development may impact on the longer term aspirations for the World Heritage listing of the Burrup Peninsula with respect to its aesthetic values. These are considered to be matters for consideration by decision makers under section 45 of the EP Act.

In relation to traffic, the EPA considered that vehicle movements would increase by less than 10 per cent of current rates, and was therefore acceptable. While we accept the EPA's conclusion, we note that vehicle movements during operations are expected to be about 15 per cent higher than current usage. We do not consider this difference to be material in the context of the EPA's assessment.

Did the EPA adequately assess direct impacts to registered Aboriginal heritage sites?

We consider the EPA's assessment in respect to direct impacts was justified.

The EPA found that there are 33 registered sites within the development area. Through the assessment, the number of sites to be directly impacted (and relocated) was restricted to three. Noting that any disturbance to these sites is subject to other regulatory controls, and noting the EPA's advice that the Murujuga Aboriginal Corporation has indicated that the disturbance of these three sites is acceptable, we support the EPA's assessment and conclusions.

Did the EPA adequately consider impacts from clearing native vegetation?

We consider the EPA's assessment of impacts associated with clearing native vegetation was appropriate and justified.

The appellants' concerns in this regard included impacts to flora, fauna and implications for removing vegetation that provides a source of carbon storage.

The EPA considered that the proposal would result in significant residual impacts associated with the clearing of 64 ha of good to excellent condition native vegetation, 0.16 ha of a priority 1 priority ecological community (PEC), direct impact to 21 locally significant vegetation communities and impacts to fauna species, including ghost bats and northern quoll.

To address these residual impacts, the EPA recommended the application of offsets. We consider these offsets are consistent with the outcomes of the assessment and are supported.

1.4 Recommendation to the Minister

On balance we recommend that the appeals be allowed to the extent that the Minister varies the EPA's recommended conditions as follows:

1. condition 2-3 is amended to require the proponent to:
    a. engage an independent peer review of the methodology of the proponent's baseline monitoring approach under condition 2-3(2) to ensure it is scientifically valid and robust to measure whether the outcome in condition 2-1 has been met
    b. engage an independent peer review of the threshold and trigger criteria (condition 2-3(10)-(11)), management and contingency actions (condition 2-3(13)), adaptive monitoring program (condition 2-3(12)) and reporting arrangements (condition 2-3(14)) to ensure they are scientifically valid and robust to ensure the outcome in condition 2-1 is met
2. condition 2-6 is amended to require the proponent to report on exceedances of threshold criteria under condition 2-6(1) within 48 hours of the exceedance being identified (not 7 days)
3. condition 2-8 is amended to specify that any change to the AQMP that involves an item that was subject to a peer review under condition 2-3 will require a new peer review unless otherwise directed by the CEO.

In the alternative, we note that it is open to the Minister to remit the proposal to the EPA for further assessment in respect to rock art and human health, pending the outcomes of certain studies and modelling.

2 Background

A proposal by Perdaman Chemicals and Fertilisers Pty Ltd (the proponent) to develop a urea plant within the Burrup Strategic Industrial Area (BSIA) was referred to the EPA by a third party (Hon Robin Chapple MLC) on 7 May 2018.

On 28 November 2018, the EPA determined that the proposal should be formally assessed as a 'public environmental review', and a notice to that effect was entered on the public record under section 39(1) of the EP Act.[2] The record identified the following potential significant effects:

> Impacts on flora, vegetation, and terrestrial fauna from the clearing of native vegetation, potential impacts to Aboriginal heritage sites during clearing and construction, potential impacts of air emissions on nearby rock art and public health, and impact on marine environmental quality from the discharge of wastewater into King Bay via the Water Corporation Multi-User Brine Return Line, impacts on tidal flats from the construction of a link between Sites C and F.[3]

The EPA determined that because of the complexity of several of the preliminary key environmental factors, the public review period for the Environmental Review Document (ERD) was set for 12 weeks, the highest level under the EPA's administrative procedures.[4]

A draft Environmental Scoping Document (ESD) was published on 5 June 2019 for two weeks public comment.[5] A final ESD was published on 19 July 2019.[6]

The proponent's Environmental Review Document (ERD)[7] was published on 30 March 2020 and open for comment for a period of 12 weeks.[8]

The proponent's Response to Submissions (RtS) was finalised on 16 April 2021.[9]

Between March 2020 and May 2021, the EPA approved three changes to the proposal under section 43A of the EP Act that, in the view of the EPA, were unlikely to significantly increase the impact that the proposal may have on the environment.[10]

After considering the issues raised through the assessment, the EPA finalised its report and recommendations on the proposal under section 44(1) of the EP Act, and which was published on 6 September 2021 (Report 1705).[11] The RtS and related documents were also published on that date.

By section 100(1)(d) of the EP Act, any person who disagrees with the content of, or recommendation in, a report of the EPA under section 44 may lodge an appeal with the Minister within (at that time) 14 days of the date the report is published. By the closing date of appeals on 20 September 2021, a total of 20 appeals were received.

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[2] EPA, Public Record of the Perdaman Urea Project, 28 November 2018: https://www.epa.wa.gov.au/sites/default/files/Extract_of_determination/CMS17373-CD-031218.pdf
[3] Ibid.
[4] Ibid.
[5] https://consultation.epa.wa.gov.au/assessment-and-compliance/perdaman-urea-project-esd/
[6] Cardno, Perdaman Urea Project Environmental Scoping Document, 19 July 2019.
[7] Cardno, Perdaman Urea Project Environmental Review Document, 26 March 2020.
[8] https://consultation.epa.wa.gov.au/open-for-submissions/perdaman-urea-per/
[9] Cardno, Environmental Review Document – Response to Submissions, 16 April 2021.
[10] https://www.epa.wa.gov.au/proposals/perdaman-urea-project
[11] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021.

2.1 The Proposal

The proposal is to construct and operate a urea production plant on Sites C and F within the BSIA. Sites C and F are located to the east of Burrup Road, approximately 8 kilometres (km) north-east of Dampier and 20 km north-west of Karratha in the Pilbara region of Western Australia.

Sites C and F are located to the east of Burrup Road and in close proximity to the corner of Burrup Road and Hearson Cove Road on the Burrup Peninsula, approximately 8 kilometres (km) north-east of Dampier and 20 km north-west of Karratha. The proposal includes the urea production plant in addition to an enclosed urea product conveyor linking Site C to Dampier Port via the existing East West Service Corridor together with a product storage shed and shiploader located within Dampier Port. An elevated causeway will link Sites C and F and will include a connecting road and other project related infrastructure (see Figure 2).

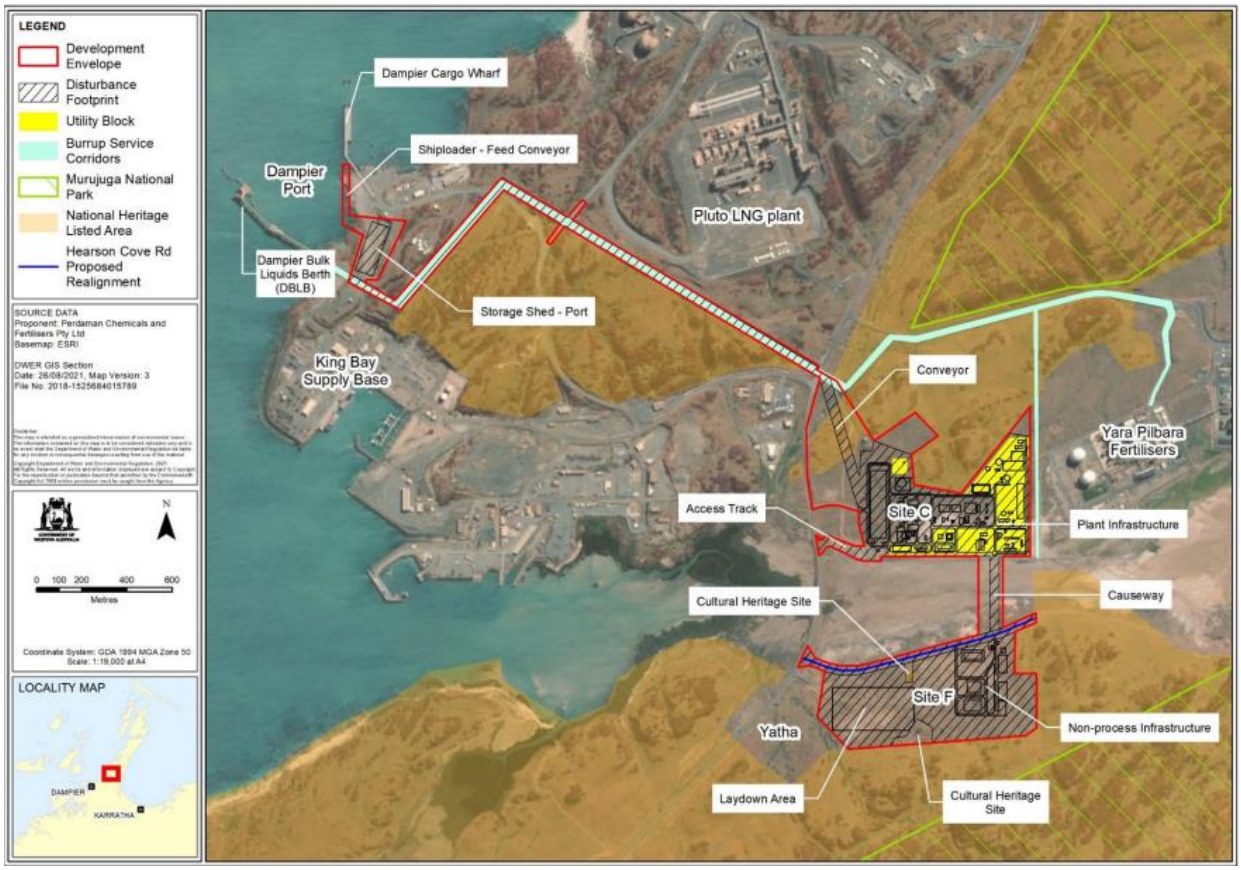

Figure 2 Perdaman Urea development envelope and disturbance footprint, including Site C and Site F[12]

Key elements of the proposal relevant to the appeals are set out in Table 2 below.

[12] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, Figure 2.

Table 2 - Key proposal elements[13]

Element	Maximum extent or range
Project life	Up to 80 years from date of Statement
Urea production	6,200 tpd
Ammonia production	3,500 tpd
Overall area of clearing	73.05 hectares (ha)
Power generation	100 MW combined cycle gas turbine 3.5 MW solar
Shipping movements	50 to 100 per year
Oxides of nitrogen (NOx) (as NO2)	319 tonnes per annum (tpa)
Carbon dioxide (CO2)	0.7 million tpa
Sulphur dioxide (SO2)	5 tpa
Ammonia (NH3)	400 tpa
Urea particulates	353 tpa

2.2 Proposal context

There are a number of industries operating in the BSIA, including two liquefied natural gas (LNG) plants (Karratha Gas Plant and Pluto LNG Plant), an ammonia plant (Yara Pilbara Fertilisers), a technical ammonium nitrate (TAN) plant (Yara Pilbara Nitrates), ship-loading facilities and power stations.

Surrounding the BSIA is the Murujuga National Park (Figure 3 below), which is co-managed by the Department of Biodiversity, Conservation and Attractions (DBCA) and Murujuga Aboriginal Corporation (MAC).

[13] These values are as set out in EPA Report 1705. During the appeals investigation, the proponent indicated that some values are expected to be lower and some higher. These are discussed further in the consideration of the appeal grounds below.

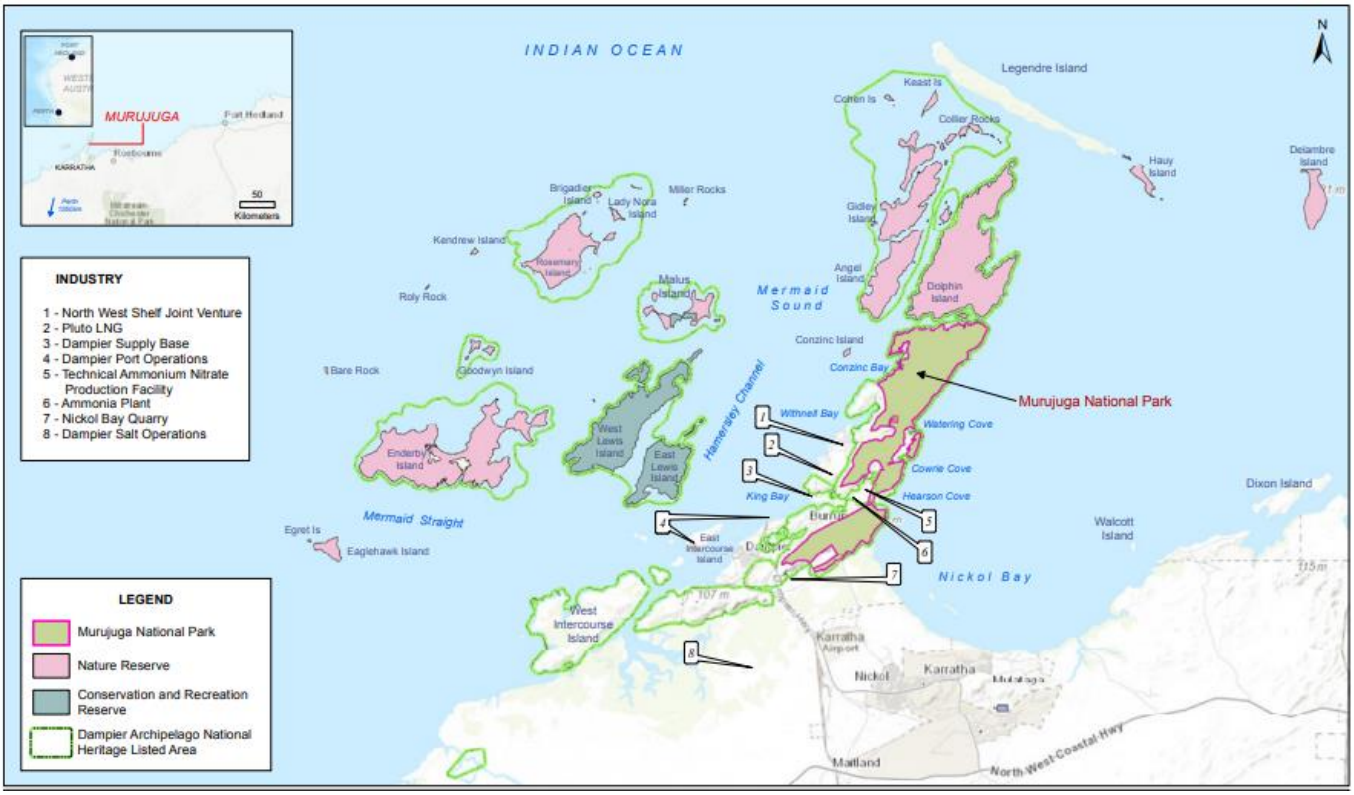

Figure 3 Dampier Archipelago National Heritage-listed Place, Murujuga National Park[14]

2.3 Appeal Process

The EPA's report was published under section 44(3) of the EP Act on 6 September 2021.

By section 100(1)(d) of the EP Act, any person who disagrees with the content of, or recommendation in, a report of the EPA under section 44 may lodge an appeal with the Minister within (as the law then stood) 14 days of the date the report is published. By the closing date of appeals on 20 September 2021, a total of 20 appeals were received.

On receipt of appeals, the Appeals Convenor requested the EPA to report to the Minister on the issues raised in the appeals under section 106(1)(a) of the EP Act. The proponent was also provided with the details of the appeals and provided an opportunity to respond.

All appellants were consulted through the appeal investigation, including meetings with those appellants raising detailed or technical grounds of appeal. Meetings were also held with representatives of the proponent.

Consistent with section 109(1)(aa) of the EP Act, the Appeals Convenor also consulted with officers of the Department of Water and Environmental Regulation (DWER) and Curtin University on certain technical issues relating to aspects of the proposal.

Discussions were also conducted with the Chair and Deputy Chair of the EPA through the investigation.

This report is prepared for the consideration of the Minister for the Environment under sections 106(1)(d) and 109(3)(b) of the EP Act. In reporting to the Minister, the Appeals

[14] DWER, Murujuga Rock Art Strategy, August 2019.

Convenor is confined to environmental factors: broader economic, commercial and social factors are relevantly a matter for decision makers under section 45 of the EP Act.[15]

The Minister has three options in dealing with appeals against a report of the EPA:

- Dismiss the appeals (section 101(1)(a))
- Allow the appeals by remitting the proposal to the EPA for further assessment or reassessment (section 101(1)(d)(i))
- Allow the appeals by varying the EPA's recommendations by changing the implementation conditions (section 101(1)(d)(ii)).

The Minister's decision under section 101(1) is final and without appeal.

The Minister does not, on appeal, have authority to decide that the proposal should not be implemented.[16] Rather, this along with broader economic and social considerations are matters for the decision makers under section 45 of the EP Act.

2.4 Issues for determination

Given the nature of the appeals as discussed above, the issue for determination in these appeals is (in effect) whether the EPA's assessment was appropriate and justified based on the information available at the time of the assessment or any new information made available through the appeal investigation.

If defects or shortcomings in the EPA's assessment are identified, the question is whether this requires further assessment or reassessment through remittal to the EPA, or whether it can be remedied through varying the EPA's recommended conditions.

It follows from the above that this report will consider:

- the nature of the environmental concerns raised by the appeals
- how each of the environmental concerns were assessed by the EPA
- whether the EPA's assessment and recommended conditions were adequate
- if shortcomings are identified, whether these are best remedied through either:
    - remitting the proposal to the EPA for reassessment etc
    - varying the EPA's recommended conditions

The environmental concerns raised by appeals are:

1. Impacts to rock art
2. Greenhouse gas emissions
3. Human health
4. Amenity (visual, noise, light, traffic)
5. Direct impacts to registered Aboriginal heritage sites
6. Clearing of native vegetation

These issues will be considered in turn. For concerns raised in appeals that do not relate to environmental matters relevant to the proposal, these will be detailed separately in Section 4 as Other Matters.

[15] *Conservation Council of Western Australia Inc v Hon Stephen Dawson* [2019] WASCA 102 per Buss P and Beech JA at [130]
[16] Ibid at [131].

3 Reasons for recommendation

3.1 Impacts to rock art

This ground of appeals relates to the effect to rock art of emissions of pollutants to the air from the proposal.

Appellants argued that the EPA did not properly apply the precautionary principle and should to have considered measures required to prevent, avoid or mitigate the threat, including whether or not to recommend the proposal be implemented or otherwise limit emissions to zero or near zero. Appellants also raised concerns about the application of best available technology to the proposal and the EPA's consideration of the available science about impacts to rock art.

Taking into account these concerns, we conclude that the EPA was justified in finding that the proposal may pose a threat of serious or irreversible damage to rock art and in recommending that conditions be applied to the proposal to protect rock art from damage by emissions from the proposal.

To ensure the outcome set by the EPA is met, we consider there is a need for significant rigour in the development of the baseline and ongoing monitoring and management of the facility. We have therefore recommended that the proponent be required to ensure that key technical aspects of the development of the air quality management plan (AQMP) are subject to independent peer review to provide guidance to the CEO before the plan is approved.

We also recommend that the time for reporting exceedances of threshold criteria are reduced from 7 days to 48 hours.

Despite these changes, we acknowledge that the outcome set by the EPA is reliant on the outcomes of future investigations. This may, for example, result in the proponent constructing the plant only to later find that it needs to make changes to protect rock art. We conclude that while there is a risk in the approach adopted by the EPA, the proponent has acknowledged the paramountcy of protecting rock art and has stated that should the outcomes of future studies require it, it will take such measures as necessary to ensure emissions meet those future outcomes. We note that the proponent did not appeal the EPA's recommended conditions and consider therefore that the proponent has accepted the risk in complying with the outcome set by the EPA.

Rock art of Murujuga is significant

The proposal will be located in Murujuga which is home to a dense collection of rock art. All appellants emphasised the values of the rock art of Murujuga.

From the EPA's assessment, it is understood that Murujuga supports more than one million petroglyphs in an area of more than 37,000 ha, representing one of the most dense and diverse collections of petroglyphs in the world. Rock art has significant cultural and spiritual value to Aboriginal people, and significant state, national, and international heritage value. Murujuga has been listed on Australia's National Heritage List under the Dampier Archipelago (including Burrup Peninsula) by the Australian Government since 2007.

The values of the Murujuga Cultural Landscape are reflected in its addition to the tentative list of World Heritage in January 2020. That application process was led by the Traditional Custodians of Murujuga, the Ngarluma, Yindjibarndi, Yaburara, Mardudhunera and Wong-Goo-Tt-Oo groups, collectively referred to as *Ngurra-ra Ngarli* (represented by the Murujuga Aboriginal Corporation (MAC)).

The supporting submission for the listing states:

> For the Aboriginal people of the Pilbara region, including the Ngurra-ra Ngarli, the petroglyphs are the work of the Marrga, the ancestral creator beings. They are a permanent reminder of Traditional Lore and retain their spiritual power. On Murujuga, the petroglyphs are an inherited and ongoing responsibility of the Ngurra-ra Ngarli (Jo McDonald Cultural Heritage Management 2011). The songs and mythologies for many of the images, such as Minyuburru (Seven Sisters), the fruit bat and Archaic Face, have important meaning across the whole of the Pilbara region and are central to Ngurra-ra Ngarli culture.[17]

The values of the rock art are also acknowledged in the proponent's ERD.[18]

We find (and we consider this to be undisputed) that the Murujuga Cultural Landscape, and the rock art in particular, are of exceptional value and are therefore a paramount consideration in the investigation of the appeals.

Weathering of rock art and effect of industrial emissions

Over time, natural processes can lead to the deterioration in rock art by reducing the colour contrast between the engravings and surrounding patina.[19] Referred to as 'natural weathering', these processes are defined as:

> … the alteration of a rock surface through natural agents such as the impacts of temperature cycles and interactions with water and aerosols/gases released by the surrounding terrestrial and marine environments. Weathering can be subtractive (erosion) or additive (mineralisation or accretion).[20]

Examples of natural weathering processes include exposure to climatic variables (e.g. sun, wind and rain) and emissions from natural sources such as vegetation and fires.[21]

Figure 4 is taken from a Conceptual Models report prepared for DWER to inform the Murujuga Rock Art Monitoring Program (MRAMP) and shows an example of petroglyph weathering by loss of patina.

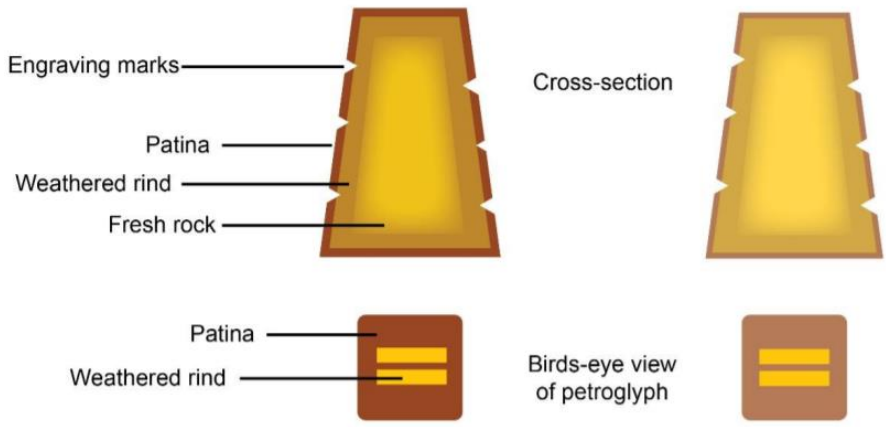

Figure 4 Example of petroglyph weathering by loss of patina[22]

It is understood from the above that natural processes will eventually lead to a loss of contrast between engravings and the rock patina.

[17] Department of Environment and Energy, Murujuga Cultural Landscape World Heritage Submission, 23 January 2020, page 1.
[18] Cardno, Environmental Review Document – Response to Submissions, 16 April 2021, page 182.
[19] DWER, Murujuga Rock Art Monitoring Program: Conceptual models, June 2021, page 3.
[20] Ibid, page 25.
[21] Ibid, page iii.
[22] Ibid, page 3.

The concerns raised by appeals are that industrial emissions (and emissions from the Perdaman Plant in particular) will accelerate weathering, such that the colour contrast between engravings and the rock surface will be lost much more rapidly than through natural processes alone. In this report, we will refer to the concerns raised by the appellants as 'accelerated weathering'.

The concept of accelerated weathering has been referenced in numerous publications. Importantly, the theory that human activities may cause accelerated weathering of rock art is the primary reason for the establishment of a number of studies and monitoring programs in the area over the last two decades.

In July 2002, the then Minister for State Development announced 'a comprehensive study into the possible effects of industrial emissions on Aboriginal rock art located on and around the Burrup Peninsula.'[23] In the announcement, the Minister stated that the Government 'retained its position that evidence was yet to be provided that proved industrial emissions from existing industry on the Burrup were harming the area's rock art.'[24]

The above program was reflected in the Burrup and Maitland Industrial Estates Agreement (BMIEA) Additional Deed in January 2003 which committed the Government to organise and fund a minimum four-year study into the effects of industrial emissions on rock art within and in the vicinity of that part of the industrial estate that was on the Burrup Peninsula.

That program was coordinated by the Burrup Rock Art Monitoring Management Committee (BRAMMC) and included measurements of air quality, microclimate, dust deposition, colour change, mineral spectrometry, microbiological analyses, accelerated weathering studies, and air dispersion modelling studies.[25]

In its final report in 2009, BRAMMC concluded:

> … that at March 2009 there is no scientific evidence to indicate that there is any measurable impact of emissions on the rate of deterioration of the Aboriginal rock art in the Burrup. Since the rate of deterioration of rock surfaces is very time-dependent the present results act as a base line for continued and future monitoring programs.[26]

The Committee recommended that monitoring of the colour contrast and spectral mineralogy be continued on an annual basis for ten years and be reviewed after five years but that:

> … monitoring of ambient air quality and rock microbiology be suspended and only commenced if warranted by a major increase in emissions or if evidence becomes available to require further monitoring.[27]

In 2010, the rock art monitoring program was extended for a further 10 years.[28] CSIRO undertook annual monitoring to detect changes in the colour contrast and spectral mineralogy of the rock art from 2004 at seven sites, with three additional sites incorporated in 2014.[29] This monitoring was the subject of review by Data Analytics Australia (DAA) in 2016 and 2017. In the second review, DAA advised that while CSIRO:

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[23] Government of Western Australia, Minister announces comprehensive Burrup rock art study, Media Statement, 25 July 2002 (https://www.mediastatements.wa.gov.au/Pages/Gallop/2002/07/Minister-announces-comprehensive-Burrup-rock-art-study.aspx)
[24] Ibid.
[25] BRAMMC, Report and Recommendations to the Minister for State Development, April 2009, page 2.
[26] Ibid, page 8.
[27] Ibid, page 9.
[28] Ibid, page 5.
[29] DWER, Summary of scientific studies and monitoring programs commissioned and overseen by the Burrup Rock Art Monitoring Management Committee and the Burrup Rock Art Technical Working Group, April 2021, page 5.

> … made a number of changes relative to previous years' report, in part in response to Data Analysis Australia's recommendations of 2016 … much remains to be done. In particular the conclusions for the Draft Report, namely that there is no evidence of a significant change affecting the rock art near to the industrial developments are not convincing in their current form.[30]

In relation to the statistical analysis of colour measurements, DAA stated:

> The adage that "absence of evidence is not evidence of absence" is pertinent here. It is not sufficient simply to find no problem. The question is whether the search has been sufficiently thorough and looking for the right things. It is required to demonstrate that a sufficiently diligent investigation has been carried out, together with a statement of the nature and size of any problem that would be revealed if it was present.
>
> It might be argued that the irreplaceable significance of the rock art provides a case for applying the precautionary principle, whereby strong support is needed for a statement of "no harm".[31]

In February 2019, the then Minister for Environment released the Murujuga Rock Art Strategy (MRAS) with the aim of developing a 'world best practice program to monitor, evaluate and report on factors that could affect the condition of the rock art.'[32]

The purposes of MRAS is stated to be:

> … to protect the Aboriginal rock art located on Murujuga by providing a long-term framework for the monitoring and analysis of changes to the rock art and describing a process by which management responses will be put in place to address adverse impacts on the rock art..[33]

After the EPA's assessment commenced, Ian MacLeod and Warren Fish delivered a paper at the International Council of Museums Conference in Beijing in May 2021. The paper, based on findings taken from ongoing monitoring associated with Yara Pilbara Nitrates Pty Ltd Technical Ammonium Nitrate (TAN) Plant, concluded (among other things) that:

> The present monitoring data shows that there is presently no adverse impact on the rock engravings from industrial pollution owing to a lower NOx level than when the studies commenced 14 years ago.[34]

In the paper, MacLeod and Fish noted that:

> Any significant deviation from [the mean pH] value will bring about changes in colour contrast; acidification leads to surface loss and alkalisation (from sea salt or ammonia leaks) causes fresh minerals to deposit and thereby change the appearance of the engravings.[35]

Among other things, MacLeod and Fish noted:

> The Deep Gorge[36] site was the only area that had a significant decrease in acidity, with the pH increasing from 5.7 pH in 2017 to 6.7 in 2018. Photographs showed possible subtle changes in the rock patination, with an increased amount of the purple-black patina on the right-hand side of the rock during the less acidic period. Analysis of the rainfall at the

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[30] DAA, Review of CSIRO Report on Burrup Peninsula Rock Art Monitoring, May 2017, page 13.
[31] Ibid, page 9.
[32] Government of Western Australia, New strategy to protect Pilbara rock art, Media Statement, 15 February 2019 (https://www.mediastatements.wa.gov.au/Pages/McGowan/2019/02/New-strategy-to-protect-Pilbara-rock-art.aspx)
[33] DWER, Murujuga Rock Art Strategy, February 2019, page 4.
[34] Ian MacLeod and Warren Fish, 'Determining decay mechanisms on engraved rock art sites using pH, chloride ion and redox measurements with an assessment of the impact of cyclones, sea salt and nitrate ions on acidity' (2021) International Council of Museums 19th Triennial Conference, Beijing, page 8.
[35] Ibid, page 4.
[36] Deep Gorge refers to a site that is proximate to Ngajarli, the first recreation site to be developed within Murujuga National Park, and which includes viewing platforms and an elevated boardwalk showcasing rock engravings, shell middens, grinding stones and other cultural artefacts, with some estimated to be more than 47,000 years old: https://www.murujuga.org.au/our-land/national-park/, accessed January 2022.

> adjacent monitoring station showed that the decrease in acidity was due to significant leakage events from the NH3 plant.[37]

The abstract for the paper concluded that 'accidental release of ammonia, deposition of sea salts and periodic cyclonic rainfall all decreased acidity, which stabilises the engravings.'[38]

The findings of MacLeod and Fish are the subject of a peer-reviewed (but yet to be published) paper by Benjamin Smith and others, which found claims that industrial emissions are having no impact on Murujuga rock art is 'not scientifically credible and not supported by the evidence presented'.[39]

While the forgoing is not intended to be a comprehensive analysis or represent a concluded view on the validity of work undertaken or the outcomes, programs and papers published in respect to potential impacts to rock art at Murujuga, it serves to illustrate that there has been a considerable amount of work done over the last two decades and there remains a differing views as to whether industrial emissions could be leading to accelerated weathering of rock art.

Urea and ammonia emissions from the proposal may pose a threat of serious or irreversible damage to rock art

The EPA identified urea dust and ammonia emissions from the proposal as or primary concern in respect to rock art. In that regard, the proposal will account for all urea emissions in the Murujuga airshed and over 90 per cent of ammonia emissions (assuming normal operations). The proposal will also be a source of oxides of nitrogen (NO_x), but this represents a small proportion of cumulative emissions in the airshed.

Noting that the proposal will make a substantial contribution to ammonia and urea emissions in the airshed, the EPA concluded:

> … that there may be a threat of serious or irreversible damage to rock art from industrial air emissions (in particular, urea particulates and NH3) from the proposal accelerating the natural weathering.[40]

The possibility that ammonia emissions may impact rock art is reflected in a number of documents. For example, we understand that ammonia may react with other gases or particulates in the atmosphere and form an acidic substance that can be deposited on rock art. For example, a study commissioned by DWER into air quality in the Murjuga airshed (the Ramboll Airshed Study) observed:

> Ammonia emissions from industrial sources [in the Murujuga airshed] have the potential to increase $PM_{2.5}$ concentrations near the source by forming ammonium sulphate and/or ammonium nitrate…[41]

Both ammonium sulphate and ammonium nitrate are understood to be mildly acidic.[42]

The role of ammonia as a potential risk to rock art through acidification is also reflected in the Conceptual Models document:

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[37] Ian MacLeod and Warren Fish, 'Determining decay mechanisms on engraved rock art sites using pH, chloride ion and redox measurements with an assessment of the impact of cyclones, sea salt and nitrate ions on acidity' (2021) International Council of Museums 19th Triennial Conference, Beijing, page 4.
[38] Ibid, page 1.
[39] Benjamin Smith et al, 'The Impact of Industrial Pollution on the Rock Art of Murujuga, Western Australia' (2022) 39 (1) *Rock Art Research* page 3.
[40] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page iii.
[41] Ramboll, Study of the Cumulative Impacts of Air Emissions in the Murujuga Airshed, July 2021, page 151.
[42] https://www.worksafe.qld.gov.au/safety-and-prevention/hazards/hazardous-chemicals/specific-hazardous-chemicals/ammonium-nitrate; https://pubchem.ncbi.nlm.nih.gov/compound/Ammonium-sulfate#section=pH&fullscreen=true

> It is generally believed that acidification (acids formed from nitrogen and sulfur oxides **and ammonia**) are likely to be the dominant mechanism affecting the rock art.[43] (emphasis added)

In addition, ammonia has also been submitted to be a source of nitrogen that could alter the balance of microbial growth on rocks, leading to accelerated weathering. This was acknowledged in the proponent's ERD:

> Dr MacLeod clarified that any change of micronutrients may in theory have the possibility of activating a group of microflora that have hitherto been dormant, owing to the lack of suitable niche nutrients. If such theoretical reactivation occurs this could also potentially lead to acidification through metabolic processes.[44]

Similarly, the Conceptual Models document identified working hypotheses that relate to the interaction of organic and inorganic pollutants on rock surfaces (including nitrogen):

> Our working hypothesis is that the deposition of organic and inorganic pollutants and possibly elevated CO_2 levels will trigger the formation of a highly diverse and fastgrowing microbial biofilm (e.g. Kose et al., 2018). These communities are likely to produce organic acids that lower the pH to less than 4, which would result in the dissolution of the Fe and Mn oxides to reveal the lighter-coloured weathered rock below. Alternatively, the pollutants may increase the growth rate of patina-building Fe- and Mn-oxidising bacteria and/or fungi, including those that form lichens (e.g. MacLeod, 2005). These bacteria and/or fungi then start to overgrow the lightcoloured carved, weathered rock. Both scenarios are likely to result in a reduced contrast between the rock art and the surrounding patina or between the rock art and the weathered rock.[12]

For the above reasons, we consider the EPA was justified in finding ammonia and urea emissions from the proposal may pose a threat of serious or irreversible damage to rock art.

The science on the effect of industrial emissions on rock art is complex

There is significant complexity in understanding the interaction between industrial emissions and changes to rock art. These include the type of rock, the nature of the rock microbiome, meteorological conditions, atmospheric interactions between chemicals, sources and locations of emissions, acidity levels, effect of natural events etc:

> Impacts of industrial output on petroglyphs are likely to involve complex interactions between industrial output, weather, environment, and rock/patina constituents (minerals, molecular compounds, microbiological populations and physiology).[45]

The EPA considered that the science about impacts to rock art from emissions generally (and the proposal emissions specifically) are contested and uncertain.

As discussed above, we consider the EPA was broadly justified in reaching this conclusion. The EPA considered that the Environmental Quality Management Framework (EQMF) and associated Environmental Quality Objectives (EQOs) and Environmental Quality Criteria (EQCs) to be developed under MRAS will 'inform the protection of rock art and reduce the risk of adverse consequences of cumulative industrial emissions to rock art.'[46] In that regard, the EPA stated that it:

> … expects that the results obtained from the MRAMP (available mid-2023) will enable the level of risk of degradation of the rock art from cumulative air emissions from industrial activities to be determined. The EPA also expects that data contributing to interim and final

[43] DWER, Murujuga Rock Art Monitoring Program: Conceptual models, June 2021, page 21.
[44] Cardno, Environmental Review Document – Response to Submissions, 16 April 2021, page 168.
[45] Calibre and Curtin University, Draft Murujuga Rock Art Monitoring Program: Monitoring Studies Data Collection and Analysis Plan, November 2021, confidential unpublished draft report, page 26.
[46] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 142.

> results of the MRAMP, anticipated by 2024 and prior to the commencement of the proposal operations, will facilitate the development of air quality standards. The air quality standards will include environmental quality objectives and environmental quality standards for the purpose of avoiding the cumulative risks of adverse impact of the rock art within the Murujuga Cultural Landscape. The EPA has recommended the proposal be required to be implemented in compliance with these standards.[47]

The MRAS proposes to address a number of uncertainties associated with previous studies. One the objectives of MRAS is to establish a scientific evidence base about the processes that cause deterioration of rock art:

> In order to obtain an evidence base of high standard, — that is, one which can withstand a high level of scientific scrutiny and will be accepted by the international scientific community, — it will be necessary to undertake a thorough and wide-ranging investigation of the many natural and anthropogenic processes that are involved or could be involved in the degradation of the rock surface condition. This will be necessary in order to exclude potential alternative explanations and to establish unequivocal evidence. Great care is required in the design and execution of the study, and a wide range of advanced technical instrumentation and technique will need to be deployed.[48]

We agree with the EPA that the proposal should only be implemented if damage to rock art is prevented

The EPA concluded that:

> … given the significant environmental values associated with the rock art, the EPA is not satisfied the proponent's measures, even if coupled with other minimisation measures, will ensure the proposal is implemented in a way which will be sufficiently consistent with the EPA's environmental objectives for air quality and social surroundings. This is particularly the case for the proposal's expected emissions of urea particulates and NH_3.
>
> The EPA has therefore considered whether it should recommend that the proposal not be implemented, or whether measures which are additional to those proposed by the proponent can be recommended to sufficiently reduce the potential for inconsistency with the EPA's environmental objectives for air quality and social surroundings.[49]

Key among these measures is an outcome that 'no air emissions from the proposal have an adverse impact accelerating the weathering of rock art within Murujuga beyond natural rates'. The EPA stated that without its additional measures, it would recommend the proposal not be implemented.[50]

The overarching prohibition on air emissions from the proposal leading to the accelerated weathering of rock art will be met by the proponent adhering to criteria it develops under its AQMP and otherwise complying with any air quality standards that the Minister may set for the proposal (by notice to the proponent).

In addition, the proponent's AQMP will also be required to demonstrate the proposal is consistent with best available technology (BAT) and to set out a trajectory to reduce emissions over the life of the proposal.

The conditions recommended by the EPA will require the proponent to report exceedances of the criteria set under the AQMP and to implement management and contingency actions where criteria are not met, in the manner to be determined in the AQMP.

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[47] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 142.
[48] Calibre and Curtin University, Draft Murujuga Rock Art Monitoring Program: Monitoring Studies Data Collection and Analysis Plan, November 2021, confidential unpublished draft report, Appendix 1, page 2.
[49] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 18.
[50] Ibid.

The AQMP is to be submitted to the CEO for approval not more than six months prior to the commencement of operations (which is defined to include pre-commissioning and commissioning).

The EPA's measures rely on the outcome of future studies

The outcome that air emissions from the proposal do not impact on rock art is dependent on the outcome of future studies.

First, the conditions require the proponent establish a 'scientifically valid and robust baseline' for the airshed and condition of rock art, such that future monitoring will be able to measure whether the emissions from the proposal are the cause of any accelerated weathering of rock art.

Second, the proponent will need to comply with any air quality standards set by the Minister, which would most likely be derived from MRAMP standards that are expected to be available by 2024. It is understood the MRAMP standards will be developed through a combination of work currently underway, including the outcomes of chamber studies (laboratory experiments) and field work (such as air quality monitoring and rock art monitoring).

It follows that the standards by which the proposal's compliance with the outcome of no impact is to be met are not yet known – that is, it is not presently clear what level of emissions from the plant (singularly and in combination with other natural and anthropogenic emissions) are acceptable to ensure rock art is not damaged.

The results of future studies may require emissions lower than predicted for the proposal

Reliance on the outcomes of future studies creates a risk that the construction of the proposal commences with a given emissions profile which may be higher than the yet to be developed standards. By way of example, the proponent could commence constructing the proposal on the basis that it will emit 10 grams per second of substance 'X' to air; but the outcomes of the further work required of the proponent or otherwise through MRAMP may require those emissions to be reduced by half to 5 grams per second.

In the view of the EPA, this risk is borne by the proponent, which will be required to develop contingency measures if criteria are exceeded that include changes in operations and reductions in emissions. This is reflected in recommended condition 2-3(10) which requires the AQMP to:

> specify trigger criteria that will trigger the implementation of management and/or contingency actions (**including changes to operations and reductions in emissions**) to prevent non-compliance with the Air Quality Management Plan and to ensure that the outcome in condition 2-1 and outcomes and objectives in condition. (emphasis added)

By referring to changes to operations, the EPA appears to contemplate that if reductions are not available through installation of additional pollution control equipment, they can be achieved with process changes.

Protection of rock art is paramount: the proponent, in response to the appeals, accepted the conditions recommended by the EPA, and submitted that:

> [T]he EPA has applied the precautionary principle by recommending controls that for all intents and purposes *guarantee* the Project emissions will not accelerate impacts to the rock

> art. These controls are set out in condition 2, and in particular condition 2.1.[51] (original emphasis)

This comment, and the fact the proponent did not lodge an appeal in objection to the recommended conditions, provides confidence that the proponent recognises the paramountcy of protecting rock art, and that should the outcomes of future studies require it, the proponent will take such measures as necessary to ensure emissions meet those future outcomes.

'Scientifically valid and robust baseline' is key

For the EPA's intended outcome to be met, the rigour of the work required to measure against that outcome is key. This is reflected in the EPA's recommended wording for the condition requiring the proponent to submit a revised AQMP which shall:

> … be informed by monitoring data collected before **Commencement of Operations** which establishes a scientifically valid and robust baseline which is sufficient to measure whether the environmental outcome specified in condition 2-1(1) and the environmental outcomes and objectives specified in condition 2-3(1) have been achieved. (original emphasis)

This requirement is identified by the EPA as reflecting the proponent's commitment in the ERD to 'to undertake monitoring during construction and before commissioning to establish a robust baseline against which to compare its contribution to the regional airshed, and impacts from its contribution which may impact rock art'.[52]

In Response to Submissions, the proponent characterised its proposed baseline monitoring of urea as being 'preferably through a contributing participation in MRAS monitoring'.[53] The proponent noted that Yara Pilbara Nitrates is required to undertake monitoring at three locations in the vicinity of its TAN Plant under its Federal approval. The proponent submitted that:

> … as part of the implementation of an approved project, the existing data could be augmented by additional monitoring at these established monitoring sites prior to Project start-up. This will establish a more fully informed "pre-production" baseline without a Project contribution for comparative purposes. This monitoring program should also be designed to develop a baseline for the natural levels of urea in the ambient airshed before the commencement of urea production by the Project. The ERD draft AQMP has been reviewed and revised to outline the design and implementation of this strategy with an objective to establish a pre-operation regional ambient airshed background of relevant emission species to be available for comparative purposes after the completion of Project commissioning…[54]

The appropriateness of relying on Yara monitoring as part of the baseline for the Perdaman proposal requires further consideration. We know from MacLeod and Fish that there was a significant leak from the Ammonia Plant in the second half of 2018, which the authors say resulted in higher pH being recorded on rocks in the Deep Gorge area that year.[55] National Pollution Inventory (NPI) data for 2018/19 shows the Ammonia Plant emitted 320 tonnes of ammonia to air, which presumably included the 'leak' reported by MacLeod and Fish. However, Yara monitoring data for the Deep Gorge site appears to show no significant variation in recorded ammonia levels at that location in the second half of 2018.[56]

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[51] Perdaman, Response to Appeal 034/21.003, 30 September 2021, page 9.
[52] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 143.
[53] Cardno, Environmental Review Document – Response to Submissions, 16 April 2021, page 283
[54] Ibid, pages 283-284.
[55] Ian MacLeod and Warren Fish, 'Determining decay mechanisms on engraved rock art sites using pH, chloride ion and redox measurements with an assessment of the impact of cyclones, sea salt and nitrate ions on acidity' (2021) International Council of Museums 19th Triennial Conference, Beijing, page 6.
[56] Strategen JBS&G, Ambient Air Quality Monitoring Report 2018-2019 EPBC 2008/45546, 3 October 2019.

It is possible, as the proponent observed in the Response to Submissions, that the 14-day averaging period for the Yara data would not identify short term spikes in ammonia emissions.[57] Given the MacLeod and Fish observation that ammonia leaks in 2018 were responsible for changes in patination on rocks at Deep Gorge, it is critical that baseline monitoring adequately accounts for short term variations.

It is also noted that modelling of ground level concentrations (GLCs) of ammonia as part of the assessment of the TAN Plant in 2011 showed significant variations in concentrations with elevation – for example, during upset conditions at the TAN Plant, ammonia emissions at Hearson Cove (close to sea level) were identified as being 21 micrograms per cubic metre ($\mu g/m^3$), but at the top of the highest ridge to the north of the plant, concentrations were predicted to be more than double those for Hearson Cove, at over 50 $\mu g/m^3$.[58] A similar effect was also shown for nitrogen dioxide emissions, which were modelled as being significantly higher at elevation, particularly south of the facility.[59]

To ensure the baseline work is scientifically valid and robust, if the proposal is approved for implementation, it is recommended that condition 2-3 is amended to require the proponent's proposed baseline methodologies to be subject to a peer review to verify it is adequate to measure compliance against condition 2-1 for the 80-year life of the proposal. That is, the peer reviewer (or reviewers) will need to consider the adequacy of the proponent's intended methodology to provide a scientifically valid baseline of air quality and rock art such that compliance with condition 2-1 can be established with confidence.

Peer review of best available technology

As noted by the EPA in Report 1705, the peer review it commissioned 'concluded that the design of the plant generally aligns with the expectations of best available technology (BAT)'.[60]

However, in relation to ammonia and dust emissions specifically, the peer review stated:

> Whilst the emission levels are within the BAT ranges presented and therefore could be considered to be compliant with BAT, new plant could be expected to be designed to achieve the lower end of the BAT range … in normal circumstances.[61]

As part of the appeal investigation, the proponent was asked to clarify why emissions of ammonia and particulates (urea dust) were not towards the lower end of applicable BAT associated emission levels (AELs) referenced in the peer review. Our queries included, in relation to urea dust, why the plant is proposed to emit about twice the volume of emissions per unit of production (0.159 kg/tonne urea produced) as similar sized and recently approved plants in the United States.[62]

The proponent responded that:

> The ambient environment for these quoted US plants is significantly different to Karratha and thus the comparisons re granulator performance are not a relevant "like for like" BAT benchmark.

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[57] Cardno, Environmental Review Document – Response to Submissions, 16 April 2021, page 245.
[58] Burrup Nitrates Pty Ltd, Technical Ammonium Nitrate Production Facility – Response to Public Submissions (PER), August 2010, Table 8.33 and Figure 4.
[59] Ibid, Figure 3.
[60] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 6.
[61] Ramboll, Ammonia and Urea Production Technology for the Perdaman Urea Project, 19 May 2021, page 11.
[62] For example, Cronus Chemicals in Illinois is subject to a limit of 0.12 lb/US ton urea production (0.07 kg/metric tonne) and Koch Nitrogen Company in Oklahoma is subject to a limit of 0.1 lb/US ton (0.06 kg/metric tonne). Source: EPA (USA), RACT/BACT/LAER Clearinghouse, accessed 3 December 2021. Other plants with lower limits include Midwest Fertilizer Plant, Indiana; CF Industries Port Neal, Iowa; Iowa Fertilizer Company, Iowa.

> When evaluating the application of BAT, it is relevant to note the plant site Karratha design temperature is 32C. This is hotter than ISO standard BAT specification for benchmarks/ most other locations. ie to provide a consistency, ISO BAT standards are established at a defined set of operating conditions and comparisons must be adjusted where the actual operating environment diverges, such as for the higher temperatures at Karratha.
>
> The density of air is highly sensitive to temperature, and both combustion and granulation are air driven processes.
>
> As such the Perdaman Urea Project represents BAT within the design conditions for the site, and on cooler days (and during cooler night time operations) is anticipated will demonstrate better performance numbers and enhanced environmental performance.
>
> All of these design conditions were briefed to EPAS Team during the EIA process.[63]

As noted in the next ground of appeal (greenhouse gas emissions), the peer review acknowledged ambient conditions when considering the efficiency of power generation at the site.

While the above is noted, for the reasons stated above, it is expected that the proposal will be required to meet emissions levels commensurate with achieving the object in condition 2-1. This may require emission levels below what might be regarded as best available technology for the ambient conditions of the Burrup. As such, we do not consider it is necessary to modify the conditions in respect to BAT or the ambient conditions.

Other changes to conditions to ensure rock art is protected

Trigger criteria, contingency actions and ongoing monitoring need review

Having established a robust and valid baseline for air quality and rock art, conditions requiring the proponent to monitor against the baseline and take action where exceedances are observed are equally critical to the achievement of the outcome in condition 2-1.

The validity and robustness of these conditions is therefore as important as for the baseline requirements. That is, the frequency of monitoring, the type of monitoring and related matters require careful consideration to ensure rock art is protected.

It is recommended therefore that these elements of the AQMP are also the subject of peer review before the AQMP is submitted to the CEO for approval. The peer review will be to verify the triggers are sufficiently conservative and the management actions effective to avoid or reduce impacts/emissions before damage to rock art materialises.

Reporting exceedances must be timely

If the proposal is approved for implementation, reporting of exceedances of criteria to the CEO need to be timely.

The EPA's recommended conditions allow the proponent 7 days to report an exceedance of a trigger or threshold criteria. Noting a threshold criteria is one that (if exceeded) would suggest damage may be caused to rock art, we consider it appropriate for those more serious exceedances to be reported to the CEO within 48 hours of occurrence. This will provide the CEO time to take action to ensure the exceedance is under control and damage to rock art is avoided.

Noting in the conditions alters the proponent's responsibility to report emissions as required under other written laws, including section 72 of the EP Act.

[63] Perdaman, email to Office of the Appeals Convenor, 18 November 2021.

Changes to conditions will reduce uncertainty

The changes recommended to the conditions above will reduce uncertainty and provide greater confidence that the EPA's intended outcome – that there be no impact to rock art from the implementation of the proposal – is met.

However, notwithstanding these changes, there remains some uncertainty that the proponent's baseline monitoring and criteria etc will be sufficient to guarantee rock art is protected before the outcomes of MRAMP are available.

Appellants contend that this uncertainty should be addressed by awaiting the outcomes of MRAMP before determining whether or not the proposal should be approved. To address these remaining uncertainties, it is open to the Minister to consider whether or not he should remit the proposal to the EPA to await the outcomes of the MRAMP process. In considering this question, the Minister may also weigh whether revised airshed modelling from Ramboll (expected in February) would benefit from further consideration from the EPA, notwithstanding advice from the Chair that the basis for that revised modelling would not have altered the EPA's approach to ammonia emissions.[64]

3.2 Greenhouse gas emissions

Appellants raised concerns about the emissions of greenhouse gases (GHGe) resulting from the proposal. They contend that the GHGe from the proposal will be significant even with the proposed mitigation measures, and will not be consistent with climate science, Australia's obligations under Paris Agreement, nor the need to stop burning of fossil fuels.

One appellant suggested that this was a missed opportunity to utilise renewable energy.

Another appellant raised concerns about the accounting of methane and its assessment.

One appellant submitted that the EPA has not considered the loss of carbon sequestration, and the carbon emissions from clearing and a net loss of carbon sequestration is an unacceptable contribution to climate change.

Another appellant suggested that the EPA failed to consider that the proposal underpins the viability of the Scarborough gas development, which is estimated to cause 1.6 billion tonnes of carbon pollution over its lifetime.

Appellants sought for additional conditions to:

- limit GHG emissions and ensure the proposal achieves net zero emissions over its lifetime
- require an annual review (and implementation) of all reasonable and practicable measures to mitigate GHG emissions.

In summary, we find that the EPA identified the proposal's emissions, including at commencement and over its lifetime. The EPA reviewed the proposed technology and considered that best endeavours had been used to minimise the proposal's GHG emissions. The EPA concluded that the proposal had reduced lifetime emissions from 52 million tonnes (Mt) to 9.75 Mt CO_2-e through adoption of efficient technology.

The EPA considered that the proposal's emissions trajectory was generally consistent with its GHG Guideline.

[64] EPA, Letter to the Appeals Convenor, 7 January 2022.

Based on the available evidence, the investigation considers that the above findings are justified.

However, we note that the proposal will contribute approximately 9.7 Mt CO_2-e to the global atmosphere. Noting the EPA's advice that the acceptability of the residual emissions are a matter for the decision makers under section 45 of the EP Act, we provide additional guidance on the current state of science to assist with that process.

The proposal is a significant source of GHGe

The ERD says total net scope 1 GHGe from the proposal are estimated to be equal to 650,000 kg CO_2-e per annum.[65] Over the estimated 80-year life of the proposal, total unmitigated scope 1 emissions would be 52 million tonnes CO_2-e.[66]

In its assessment, the EPA stated that it considered the following in its assessment:

> … public concerns about the potential for GHG emissions from the proposal to contribute to global climate change, and the need for the proponent's GHG emissions targets to align with current Government policy, and for the proponent to use of best available technology to reduce GHG emissions.[67]

The EPA advised that it 'encouraged the proponent to revise and improve the Greenhouse Gas Management Plan originally submitted within the ERD'.[68] A revised plan (the revised GHGMP) was submitted to the EPA in March 2021 and formed the basis of the EPA's assessment.

The revised GHGMP proposes 'a GHG reduction trajectory to achieve net-zero Scope 1 GHG emissions by 2050 by reducing emissions by 20% (0.13 Mtpa) every 5 years from 2030 to 2050'. With this and other measures, the EPA noted this would reduce lifetime emissions from 52 Mt to 9.75 Mt CO_2-e.[69]

Figure 5 shows Perdaman's proposed trajectory to net zero emissions by 2050, based on five yearly reductions. The proponent proposed that the first 10 years of this reduction be 'committed', with the balance of the reductions being 'aspirational'.[70]

[65] Cardno, Environmental Review Document, 26 March 2020, page 180.
[66] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page iii.
[67] Ibid, page 23.
[68] Ibid.
[69] Ibid.
[70] Perdaman, Environmental Management Plan Greenhouse Gas Emissions (Final Version PCF 2), March 2021, page 34.

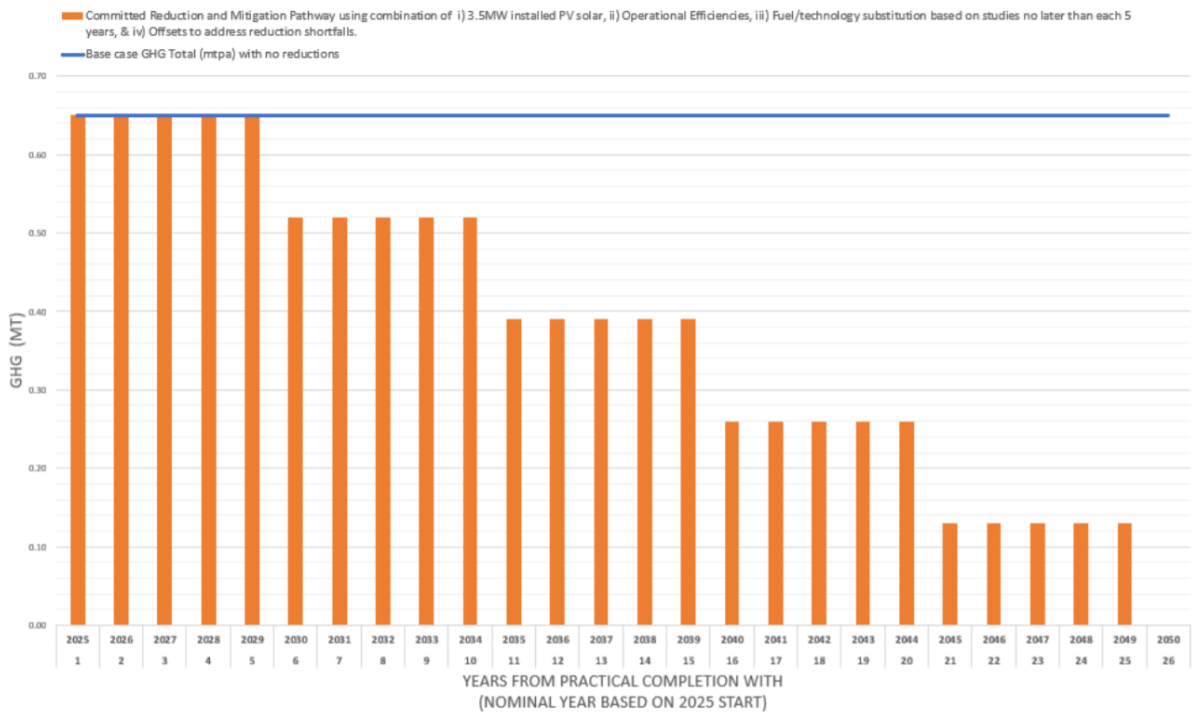

Figure 5 Proposal pathway to net zero Scope 1 GHG emissions by 2050[71]

The proposal is not predicted to result in any Scope 2 GHGe.

In relation to Scope 3 emissions (that is, other indirect greenhouse gas emissions, other than Scope 2 emissions), the proponent advised these derived from upstream and downstream sources:

> The upstream Scope 3 emissions include natural gas supplied to the Project from sources not owned or controlled by Perdaman. Downstream Scope 3 emissions including the sale, export, distribution and use of urea to fertilise food crops, and the subsequent crop harvesting, distribution and consumption of crops as food source by end consumers, but from sources not owned or controlled by Perdaman's business.[72]

In providing an estimate of Scope 3 emissions, the proponent noted that this:

> … would rely on multiple assumptions and speculations about potential supply chains that are not yet sufficiently mature in their planning to be considered a likely or representative description. Perdaman considers that presenting such information prematurely is inappropriate, and in due course may be perceived as misleading rather than being a product of early supply chain assumptions.[73]

Notwithstanding these limitations, the proponent indicated that the majority of Scope 3 emissions would likely fall within one of the following categories:

- third party supplied fuel and energy
- downstream transportation and distribution of product
- the use of urea products by third parties in agriculture.[74]

[71] Perdaman, Environmental Management Plan Greenhouse Gas Emissions (Final Version PCF 2), March 2021, page 35.
[72] Ibid, page 9.
[73] Ibid, page 19.
[74] Ibid, page 20.

The proponent estimated that, with the above caveats noted, total Scope 3 emissions are estimated as 1.83 Mtpa CO_2-e.[75]

The EPA says an 'approximately linear' reduction in net emissions from 2030 is consistent with guidelines

Citing the objective of its GHG Environmental Factor Guideline[76] (GHG Guideline) as being to reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change, the EPA noted that the State's GHG emissions are expected to continue to increase in the short to medium term:

> The EPA notes that the GHG Guideline does not mandate net zero emissions over the life of a proposal. Rather, its objective is reduction of emissions having regard to the United Nations Framework Convention on Climate Change (UNFCC) Paris Agreement and the Intergovernmental Panel on Climate Change's (IPCC) 1.5 report which recommend achievement of net zero emissions by 2050. When assessing proposals where GHG emissions are a key environmental factor, the EPA therefore usually considers a proposal's annual and total life-time contributions to GHG emissions, and also assesses the proponent's contribution and trajectory towards net zero by 2050 goal.[77]

Having considered the proponent's revised GHGMP and its objective for GHGe, the EPA recommended conditions be applied to the proposal, including:

> … a condition which requires the proposal to achieve GHG emissions limits along a linear trajectory (based on 5 yearly limits) to net zero by 2050. To provide certainty and transparency, the recommended condition is based on the proposal achieving (or exceeding) emission reduction limits, rather than the approach based on committed and aspirational targets as proposed in the GHGMP.[78]

The EPA also recommended that the proponent implements the GHGMP, that the plan is subject to five yearly reviews to support continuous improvement.[79]

Current science confirms urgent reductions in GHGe are required globally

Every tonne of GHGe contributes to global warming

In August 2021, IPCC published a report The Physical Science Basis (IPCC AR6), which (among other things) reaffirmed earlier findings 'that there is a near-linear relationship between cumulative anthropogenic CO_2 emissions and the global warming they cause'.[80] Figure 6 shows the IPCC findings in respect to the near linear relationship between GHGe and global warming.

[75] Perdaman, Environmental Management Plan Greenhouse Gas Emissions (Final Version PCF 2), March 2021, page 26.
[76] EPA, Environmental Factor Guideline: Greenhouse Gas Emissions, April 2020.
[77] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 25.
[78] Ibid, page 27.
[79] Ibid.
[80] IPCC, Summary for Policymakers in Climate Change 2021: The Physical Science Basis, August 2021, para D.1.1.

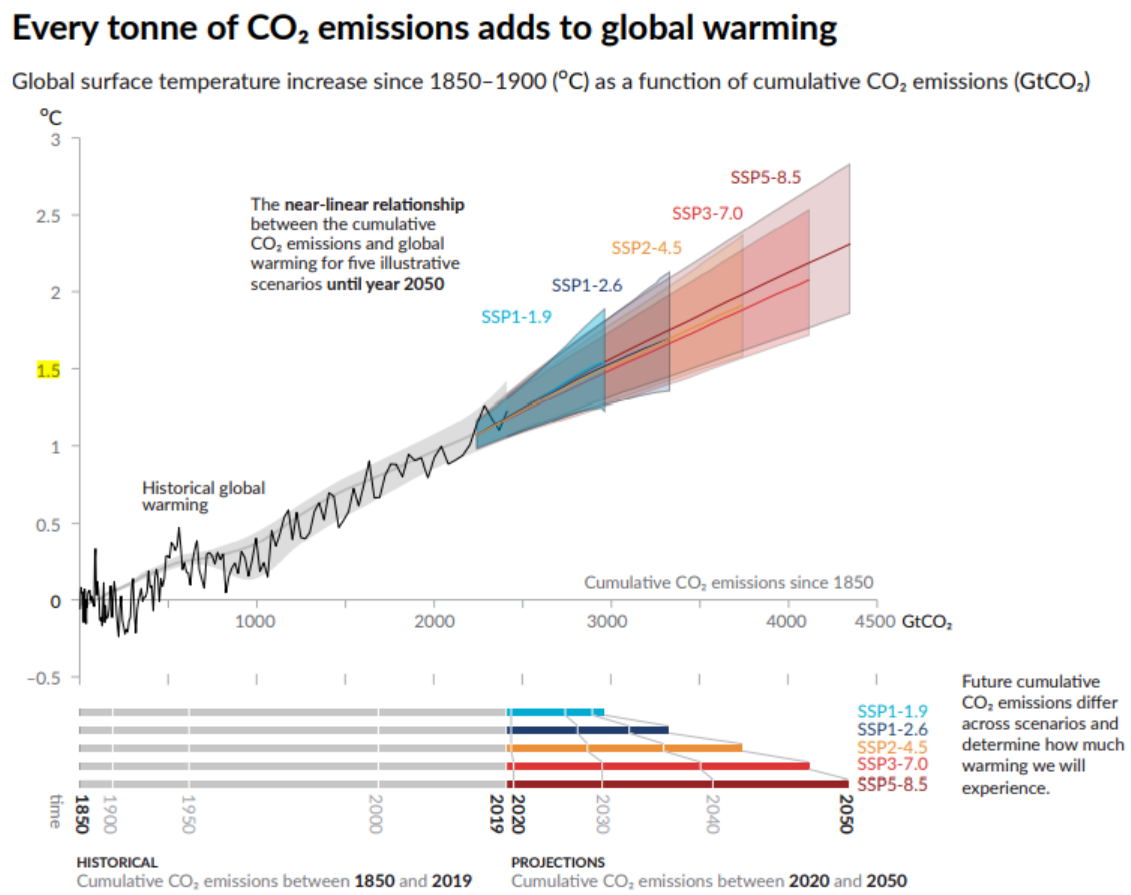

Figure 6 Near-linear relationship between cumulative CO_2 emissions and the increase in global surface temperature[81]

The IPCC AR6 Report is referenced by the EPA in Report 1705 in the context of the review of the GHG Guideline:

> This will review whether the [EPA's] objective is still appropriate in light of rapidly evolving science and policy, such as the IPCC "The Physical Science Basis" report August 2021 which shows Southern Australia as already having observed change in hot extremes and agricultural and ecological drought, that 1.5 degrees of global warming is more likely than not to be exceeded in the near term (2021-2040) even under low and very low GHG emissions scenarios, and that global temperatures could decline back toward 1.5 degrees of global warming by the end of 2021 under a very low GHG emissions scenario (IPCC 2021).[82]

The above text refers to the IPCC's assessment of global warming against five different emissions scenarios in AR6, which are shown in Figure 7.

[81] IPCC, Summary for Policymakers in Climate Change 2021: The Physical Science Basis, August 2021, page 28.
[82] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 26.

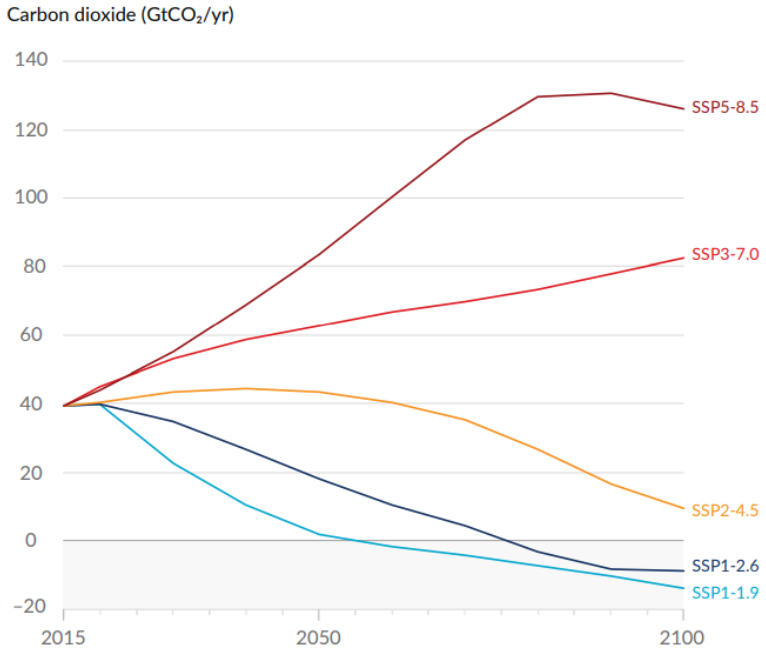

Figure 7 Future annual emissions of CO_2 across five illustrative scenarios[83]

The five scenarios shown in Figure 7 are described by IPCC as:

- Very high emissions SSP5-8.5 – doubling current emissions by 2050
- High emissions SSP3-7.0 – doubling current emissions by 2100
- Intermediate emissions SSP204.5 – emissions at about current levels until mid century
- Low emissions SSP1-2.6 – emissions reducing to net zero by about 2075
- Very low emissions SSP1-1.9 – emissions reducing rapidly to about half 2020 levels by 2030 and reaching net zero by 2050.[84]

The reference by the EPA to near term and longer term global temperatures is taken to be a reference to Table SPM.1 of the IPCC AR6, which is extracted below (Table 3).

Table 3 Changes in global surface temperature for selected 20-year time periods and five illustrative emissions scenarios[85]

	Near term, 2021–2040		Mid-term, 2041–2060		Long term, 2081–2100	
Scenario	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)	Best estimate (°C)	*Very likely* range (°C)
SSP1-1.9	1.5	1.2 to 1.7	1.6	1.2 to 2.0	1.4	1.0 to 1.8
SSP1-2.6	1.5	1.2 to 1.8	1.7	1.3 to 2.2	1.8	1.3 to 2.4
SSP2-4.5	1.5	1.2 to 1.8	2.0	1.6 to 2.5	2.7	2.1 to 3.5
SSP3-7.0	1.5	1.2 to 1.8	2.1	1.7 to 2.6	3.6	2.8 to 4.6
SSP5-8.5	1.6	1.3 to 1.9	2.4	1.9 to 3.0	4.4	3.3 to 5.7

In relation to longer term predictions, the EPA notes that it is only in the very low emissions scenario (SSP1-1.9) where the IPCC's best estimate is below 1.5°C warming. As shown in

[83] IPCC, Summary for Policymakers in Climate Change 2021: The Physical Science Basis, August 2021, page 13.
[84] Ibid, page 12.
[85] Ibid, page 14.

Figure 7, that scenario assumes rapid reductions in GHGe emissions this decade, reducing by about 50 per cent against 2020 levels by 2030.

Steep reductions in emissions required this decade to limit warming to 1.5C

In our investigation of earlier appeals, we considered the UNFCCC Paris Agreement, an international treaty on climate change, with the goal of providing a global framework to avoid dangerous climate change by limiting global warming to well below 2°C and pursuing efforts to limit it to 1.5°C.[86] The Paris Agreement acknowledges that emissions will need to reach net zero in the second half of this century.[87]

Australia is a signatory to the Paris Agreement, which entered into force in 2016. Consistent with the Agreement, Australia is committed to reducing GHG emissions by 26 to 28 per cent below 2005 levels by 2030. Ahead of the Conference of Parties 26 (COP26) in Glasgow in 2021, the Commonwealth reconfirmed its 2030 target, with an additional notation that it is expected that the target will be exceeded by up to 9 percentage points such that there will be a reduction in emissions by up to 35 per cent below 2005 levels by 2030.[88]

The IPCC Special Report on Global Warming of 1.5°C (IPCC 1.5)[89] found that the then current (2018) pledges under the Paris Agreement (referred to as nationally determined contributions (NDCs)) were unlikely to limit global warming to 1.5°C, even if supplemented by very challenging increases in the scale and ambition of emissions reductions after 2030.[90]

The IPCC 1.5 Report states:

> Pathways limiting global warming to 1.5°C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). …
>
> Under emissions in line with current pledges under the Paris Agreement (known as Nationally Determined Contributions, or NDCs), global warming is expected to surpass 1.5°C above pre-industrial levels, even if these pledges are supplemented with very challenging increases in the scale and ambition of mitigation after 2030 (high confidence). This increased action would need to achieve net zero CO2 emissions in less than 15 years.[91]

A key element of IPCC 1.5 Report is the use of a carbon budget approach:

> Limiting global warming requires limiting the total cumulative global anthropogenic emissions of CO_2 since the preindustrial period, that is, staying within a total carbon budget (high confidence)[92]

In that regard, the IPCC estimates that for at least a 66 per cent chance of staying below 1.5°C, total global GHG emissions must be less than 420 gigatonnes of CO_2 ($GtCO_2$) calculated from the end of 2017.[93] Figure 8 shows pathways for limiting warming to 1.5°C with no overshoot, and pathways with higher overshoot.

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[86] United Nations, Framework Convention on Climate Change, Adoption of the Paris Agreement, 21st Conference of the Parties, 12 December 2015, Article 2.
[87] Ibid, Article 4.
[88] Australian Government, Australia's Nationally Determined Contribution, 2021, https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/Australia%20First/Australia%20Nationally%20Determined%20Contribution%20Update%20October%202021%20WEB.pdf.
[89] https://www.ipcc.ch/sr15/
[90] IPCC, Summary for Policymakers in Special Report on Global Warming of 1.5°C, 2018, para D.1.
[91] Ibid, para C.2.
[92] Ibid, para C.1.3.
[93] Ibid.

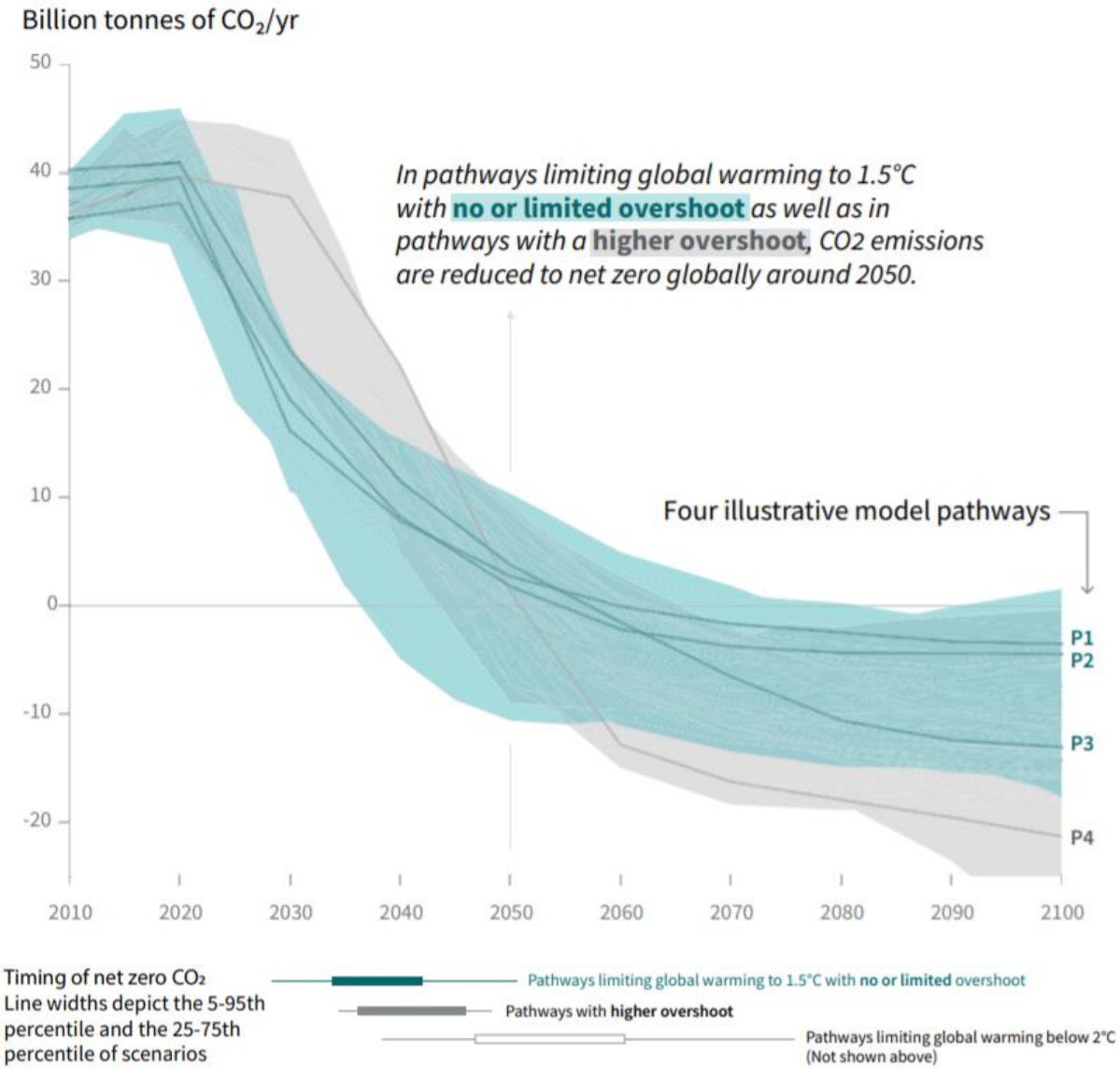

Figure 8 Global emissions pathways (carbon dioxide)[94]

To limit global warming to 1.5°C with no or limited overshoot, the IPCC states, requires:

> … rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems (high confidence). These systems transitions are unprecedented in terms of scale, but not necessarily in terms of speed, and imply deep emissions reductions in all sectors, a wide portfolio of mitigation options and a significant upscaling of investments in those options.[95]

Current global commitments insufficient to meet Paris goals

As noted above, prior to COP26 countries were encouraged to update their respective 'nationally determined contributions' (NDCs) to ensure no overshoot of 1.5°C warming. In a revised report of the UNFCCC Secretariat in October 2021, the latest NDCs to 2030 were considered in the context of the goal of limiting warming to 1.5°C:

> The total global GHG emission level in 2030, taking into account implementation of all the latest NDCs, is expected to be 15.9 per cent above the 2010 level. According to the SR1.5

[94] IPCC, Summary for Policymakers in Special Report on Global Warming of 1.5°C, 2018, Figure SPM.3a.
[95] Ibid, para C.2.

> to be consistent with global emission pathways with no or limited overshoot of the 1.5 °C goal, global net anthropogenic CO2 emissions need to decline by about 45 per cent from the 2010 level by 2030, reaching net zero around 2050. For limiting global warming to below 2 °C, CO2 emissions need to decrease by about 25 per cent from the 2010 level by 2030 and reach net zero around 2070.[96]

Noting that current NDCs would result in an increase in emissions above 2010 levels by 2030, the report noted that this:

> … implies an urgent need for either a significant increase in the level of ambition of NDCs between now and 2030 or a significant overachievement of the latest NDCs, or a combination of both, in order to attain cost-optimal emission levels suggested in many of the scenarios considered by the IPCC for keeping warming well below 2 °C or limiting it to 1.5°C.[97]

From the above, and consistent with our advice on earlier appeals, it is apparent that to limit global warming to well below 2°C and pursuing 1.5°C, steep reductions in emissions are required this decade. Indeed, the latest IPCC advice quoted by the EPA suggests that only rapid reductions in emissions this decade will likely keep global warming to below 1.5°C, with intermediate and higher emissions scenarios predicted to fail to meet the Paris agreement goal of not exceeding 2°C global warming, with increases of between 2.1°C and 5.7°C the likely range.

Southwest Western Australia faces significant climate risks

The EPA acknowledged that there is an established link between GHG emissions and the risk of climate change and that climate change will impact on Western Australia's environment and environmental values.[98]

In analysis by the Department of Primary Industries and Regional Development (DPIRD), rainfall in the southwest of Western Australia is expected to decline by up to 15 per cent in a medium emissions scenario up to 35 per cent in a high emission scenario by 2090, with streamflow decline of 24 per cent by 2030, and 45 per cent and 64 per cent for intermediate- and high-emission scenarios in 2090.[99]

In relation to drought, DPIRD advised:

> The number of dry days is likely to increase over all of WA. Agricultural drought months (defined as a month of extremely low soil moisture) are projected to increase by up to 20% over most of Australia by 2030 and up to 80% in the south-west by 2070. The projected duration and frequency of droughts in the south-west increased for all emission scenarios, with a high level of confidence in these projections.
>
> One study found that there is greater than 66% probability that drought will affect twice as much of southern WA and/or twice as often by 2030.
>
> Drought can be expected to continue to be an occasional feature of the Kimberley climate, but there is low confidence in projections of how the frequency or duration may change.[100]

We find the EPA was correct to link increases in GHGe (including from this proposal) with potential impacts to Western Australia's environment.

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[96] UNFCCC Secretariat, Nationally determined contributions under the Paris Agreement - Revised synthesis report, 25 October 2021, para 13 (https://unfccc.int/sites/default/files/resource/cma2021_08r01_E.pdf)
[97] Ibid, para 15.
[98] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 24.
[99] DPIRD, Climate projections for Western Australia, 15 April 2021 https://www.agric.wa.gov.au/climate-change/climate-projections-western-australia
[100] Ibid.

Best available technology for power generation

The peer review commissioned by the EPA found that while the use of combined cycle gas turbines was consistent with BAT, the claimed 52 per cent power efficiency 'appears to be below the efficiency stated for BAT [of] 53-58.5% net electrical efficiency':[101]

> Benchmarking with the LCP BAT Conclusions implies a need to improve the net electrical efficiency from 52% to within the 53—58.5% range. A key impact on the operating efficiency is the operating ambient temperature. The design case is for 32°C in the Burrup. The BAT Conclusions are referenced to ISO conditions (i.e. performance at 15°C), and the proponent has stated that at 15°C the Burrup CCGT would achieve a net electrical efficiency of approximately 55%.[102]

It is taken from the above that the peer review accepted the proponent's advice in respect to the effect of ambient conditions on efficiency. In any event, noting the GHGMP is required to be approved by the CEO (and can be reviewed at any time), it is anticipated that that process provides a mechanism by which the electrical efficiency of the plant can be verified for compliance with BAT and therefore ensure it reflects lowest possible emissions.

Native vegetation, methane and renewable energy appropriately considered by EPA

We consider that the EPA's assessment appropriately considered issues raised in appeals about native vegetation, methane emissions and renewable energy.

In relation to the appellant who questioned the effect of clearing approximately 73 hectares of native vegetation to accommodate the proposal, the EPA advised that it:

> … considers that from a GHG perspective, the loss of carbon sequestration due to clearing of 73.05 ha of vegetation for the proposal is not so significant as to require conditioning. The vegetation types that will be cleared and their densities within the disturbance footprint naturally limit the potential for significant quantities of CO_2 to be sequestered.[103]

We agree with the EPA that the nature of the vegetation within the development area is unlikely to be a significant store of carbon and therefore it was unnecessary for the EPA to consider the global warming potential of the clearing as part of the assessment.

While the clearing in this case is not considered significant from a GHGe perspective, the EPA's GHGe Guideline specifically acknowledges clearing of native vegetation as being relevant to assessments.[104]

In relation to methane, the EPA advised that this is not a valid consideration for this assessment because the proposal will not emit methane directly into the atmosphere during normal operations. In any event, the EPA noted that the use of a 100 year global warming potential equivalent value for methane is consistent with Commonwealth's 'National Greenhouse Accounts Factors – Australian National Greenhouse Account, October 2020.'[105] We consider the EPA's position in this regard is justified.

Finally in respect to renewable energy, the EPA advised that while decision makers under section 45 of the EP Act can consider the broader social and economic consequences of requiring alternate energy source such as green energy, the EPA stated it is constrained to

[101] Ramboll, Ammonia and Urea Production Technology for the Perdaman Urea Project, 19 May 2021, page 8.
[102] Ibid.
[103] EPA, Response to Appeal 034/21, 3 November 2021, page 14.
[104] EPA, Environmental Factor Guideline: Greenhouse Gas Emissions, April 2020, page 3.
[105] EPA, Response to Appeal 034/21, 3 November 2021, page 14.

only consider the proposal that is referred to it for assessment.[106] We accept the EPA's position on its role, and discuss the role of decision makers further below.

Residual emissions will need to be met by significant reductions elsewhere

The need for reductions to counter approving increases in emissions from the current proposal appears to be accepted by the EPA:

> … the State Government will now **determine whether the residual emissions from the proposal are acceptable** and/or aligned with current policy settings after taking into account the many other sources of GHG emissions and reduction opportunities in the State, many of which are outside the EPA's scope (e.g. existing emissions sources).[107] (emphasis added)

This advice, and the EPA's advice that 'it would be inconsistent with the EPA's statutory role and responsibilities if it was only permitted to assess proposals against the objective of having no impact on the environment',[108] are taken to reflect the EPA's position that it is for the DMAs to make those determinations under section 45 of the EP Act.

The EPA's position is in similar terms to its responses to previous appeals. In our consideration of those appeals, we concluded that the question for the Minister was whether:

> … the EPA's assessment was based on inadequate information, and in particular, whether [the EPA] ought to have had regard to how the new emissions from the proposal fit within a carbon budget or warming scenario reflected in (for example) the IPCC 1.5 Report.[109]

While the application of a carbon budget is not a prominent issue in the current appeals, it is considered that if the Minister accepts the EPA's view as to its role, the question remains for the Minister and other decision makers under section 45 as to how any increase in emissions as a result of this proposal are countered by reductions elsewhere.

In relation to the potential for this proposal to exacerbate GHGe through other proposals (such as the Scarborough proposal of Woodside Energy Ltd), the EPA noted that it is not able to consider the implications of recommending the approval of this proposal on other current and future proposals in the region as that is not within the scope of its assessment. We concur with this view, though note these broader implications are likely encompassed within the EPA's view that decision makers can consider other sources of GHGe in the State.

Noting the EPA is currently reviewing its GHG Guidance, it may be appropriate for it to consider including additional guidance such that the decision makers under section 45 have objective information on the implications of approving new sources of emissions and how such increases could be countered by other reductions or mitigations elsewhere in the economy.

Net zero emissions for life of proposal is open to decision makers

The EPA has advised that the process under section 45 of the EP Act provides an opportunity for the decision makers to consider 'the consequences of requiring the proponent to achieve net zero emissions over its life-time.'[110]

In previous appeals, we found that achieving carbon neutrality over the life of a proposal appears to be contemplated by the GHG Guideline:

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[106] EPA, Response to Appeal 034/21, 3 November 2021, page 14.
[107] Ibid.
[108] Ibid, page 13.
[109] Appeals Convenor, Report to the Minister for Environment, Pilbara Energy Generation Project, January 2021, page 17.
[110] EPA, Response to Appeal 034/21, 3 November 2021, page 14.

> The EPA may request information on any considered and proposed mitigations that demonstrate that all reasonable and practicable measures have been applied at each step of the mitigation hierarchy, including:
> …
> - Offsetting emissions (carbon offsets) through the implementation of a GHG emissions offset package to offset some **or all** residual emissions.[111] (emphasis added)

That is, the GHG Guideline leaves open to the EPA (and decision-makers generally) the question as to whether all GHG emissions from a proposal that cannot be avoided should be offset.

In the PEG appeal, we observed:

> The apparent inconsistency between the EPA's conclusion that the residual greenhouse gas emissions are not significant but that the acceptability of the emissions will be determined by decision makers under section 45 is understood to reflect the EPA's position (discussed elsewhere in this report) that its role is limited to looking at the impacts of this proposal in isolation, and that it is difficult, if not impossible, to make a direct link between a single proposal's emissions and the environmental impacts associated with climate change in WA.[112]

While in the present case the EPA has not cited the direct link between a single proposal's emissions and the environmental impacts associated with climate change, it is taken to be implied by the consistency with the previous assessments.

We concluded on that aspect of the appeals for the PEG proposal:

> The EPA's advice that the (environmental) acceptability of the emissions is a matter for decision makers is framed by its finding about the significance of the proposal as an individual point source.
>
> From this, it is considered that while the EPA has not recommended conditions requiring the proposal to be net zero from commencement, that is part of the role of the decision makers under section 45. [113]

It follows from the above that the EPA considers that the acceptability of the GHGe from this proposal is a matter for the decision makers under section 45 of the EP Act. This report, and the EPA's Report 1705, provide guidance on the current state of knowledge of global warming, and that rapid and steep reductions in emissions are required this decade to limit warming to 1.5°C. In that regard, the EPA has stated that it is for decision makers to consider whether applying a condition requiring net zero emissions over the life of the proposal is required in this case.

Short of requiring net zero lifetime emissions, decision makers could also consider the acceptability of the trajectory reflected in the EPA's report and may (for example) consider more ambitious trajectories as part of weighing the broader considerations reflected in the EPA's advice. In that regard, the EPA has recommended that the GHGMP be reviewed and submitted to the CEO before commencement of ground disturbing activities, and which is to 'be consistent with the achievement of the Net GHG Emissions limits in condition 3-1 … (or **achievement of emission reductions beyond those required by those emission limits**)'[114] (emphasis added). This text appears to contemplate that more ambitious reductions are contemplated. This is reflected in the EPA's advice that:

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[111] Appeals Convenor, Report to the Minister for Environment, Pilbara Energy Generation Project, January 2021, page 37, citing EPA, Environmental Factor Guideline: Greenhouse Gas Emissions, April 2020, page 5.
[112] Appeals Convenor, Report to the Minister for Environment, Pilbara Energy Generation Project, January 2021, page 38.
[113] Ibid.
[114] Recommended condition 3-3(1).

> … the science and policy of GHG emissions and climate change are rapidly evolving … [and] the GHG condition framework is expected to be able to be responsive to such evolution, particularly by enabling reviews of the GHGMP to reflect any significant changes (e.g. if there are material changes to relevant State, Commonwealth or international GHG science or policy). The EPA also notes that the Minister has the ability to direct the EPA to inquire into Ministerial Statement conditions (including GHG conditions) at any time.[115]

As noted by the EPA, recommended condition 3-4 provides for the review of the GHGMP at any time on the direction of the CEO.

Noting the above, we consider that the limits specified in condition 3-1 reflect the maximum permitted net emissions from the premises, and that there are mechanisms available to modify these limits over time, either through review of the GHGMP or review of conditions under (for example), section 45 of the EP Act.

3.3 Human health

Impacts of emissions from the proposal on human health was raised by two appellants. The concerns related to cumulative impacts within the Karratha area generally and the effect of urea dust specifically.

On the health risks generally, we find the EPA appropriately considered relevant standards and guidelines in finding that the proposal was consistent with its objectives for air quality.

While particulate matter in the airshed may exceed health standards on some occasions, we accept the EPA's advice that the proposal alone is a minor contributor to these emissions.

On urea dust specifically, we also accept the EPA's advice that the occupational standard raised by one appellant is not applicable to public receptors, but that in any event, it is unlikely to be exceeded given existing modelling of particulate levels at sensitive receptors outside the facility.

We also note that additional data in relation to ammonia emissions in the airshed is under investigation by DWER, and that revised airshed modelling is expected in February 2022. It is understood this modelling will include consideration of ammonia emissions against published health guidance. Advice from DWER during the appeal investigation was that it will ensure that health guidelines for ammonia are met into the future.

The proposal will produce emissions that will affect air quality

Report 1705 sets out the air emissions from the proposal in detail, but in summary, the EPA identified the emissions as follows:

- oxides of nitrogen (NO_x) as nitrogen dioxide (NO_2)
- sulfur dioxide (SO_2)
- ammonia (NH_3)
- volatile organic compounds (VOCs) as a precursor for ozone (O_3)
- particulate matter as PM_{10} (particulates 10 micrometers (µg) or less in diameter), and $PM_{2.5}$ (particulates 2.5 µg or less in diameter).[116]

EPA finds proposal's contribution to airshed 'relatively minor'

The EPA assessed the potential impacts of the proposal on human health at residential premises in Dampier and Karratha and at recreational and cultural sites such as Hearson

[115] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 27.
[116] Ibid, page 5.

Cove and Deep Gorge. The EPA compared 'baseline conditions', 'standard operating conditions' (including the proposal's operation) and a potential future 'worst case' modelling scenario including the continuation of all existing facilities together with background emissions and potential future proposals.

The predicted cumulative air emission ground level concentrations (GLCs) due to the proposed urea plant and other existing industrial sources within the Murujuga airshed were compared against the applicable criteria in the National Environment Protection (Ambient Air Quality) Measure (NEPM) New South Wales Environment Protection Authority (NSW EPA) Approved Methods for the Modelling and Assessment of Air Pollutants in NSW.[117] Except for predicted annual average PM_{10} and $PM_{2.5}$ particulate (dust) GLCs at Deep Gorge and Hearson Cove, all other predicted air emission GLCs were below the applicable NEPM/health criteria.

High level of particulates due to natural sources

Although there are predicted exceedances of the annual NEPM criteria for PM_{10} and $PM_{2.5}$ particulates at Deep Gorge and Hearson Cove, the EPA noted that this was predominantly due to high natural background dust sources rather than industry.

Modelled particulate levels are shown in Table 4.

Table 4 – Modelled particulate levels

	Parameter	Criteria (µg/m³)	Baseline (µg/m³)				With proposal operating at standard conditions (µg/m³)			
			Dampier	Karratha	Deep Gorge	Hearson Cove	Dampier	Karratha	Deep Gorge	Hearson Cove
PM_{10}	Max 24-hour	50	34.5	34.1	34.4	34.3	34.6	34.4	39.2	39.6
	Annual	25	23.7	23.8	23.8	23.8	23.8	23.9	25.5	25.8
$PM_{2.5}$	Max 24-hour	25	15.3	14.5	14.9	15	15.2	14.7	16	15.9
	Annual	8	7.9	7.9	8	8	8	7.9	8.6	8.7

According to the Ramboll's 2021 study of the air emission in the Murujuga Airshed, 66-73% of annual average PM_{10} concentrations are attributable to background (non-industrial) sources.[118] Events such as bushfires and windstorms are understood to contribute to high background particulate matter, as well as dust from iron-ore stockpiles and ship loading in neighbouring ports of Dampier and Cape Lambert. [119]

In response to the appeals, the EPA noted:

> … that the proposal's predicted contribution to the air shed is relatively minor. The proponent's air quality modelling indicates that when particulate emissions (i.e. urea dust) from the proposed urea plant are considered in isolation and under normal operating

[117] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 5.
[118] Ramboll, Study of the Cumulative Impacts of Air Emissions in the Murujuga Airshed, July 2021, page 6'
[119] Cardno, Environmental Review Document, 2021, page 142

> conditions, the predicted maximum 24-hour PM_{10} particulate (i.e. urea dust only) GLCs at Dampier, Karratha, Deep Gorge, and Hearson Cove range between 1 and 8 µg/m³ which is well below the applicable NEPM standard of 50 µg/m³.
>
> The EPA also notes that the predicted annual average PM_{10} particulate (i.e. urea dust only) GLCs at Dampier, Karratha, Deep Gorge and Hearson Cove range between 0.1 and 2 µg/m³ which is well below the applicable NEPM standard of 25 µg/m³.

Table 5 sets out the PM emissions attributable to proposal-only at Dampier, Karratha, Deep Gorge and Hearson Cove during normal operations (and non-routine operations for 24 hour standard).

Table 5 – Comparison of Perdaman-only PM_{10} and $PM_{2.5}$ emissions[120]

Paramater	NEPM Standard	Type of operations	Dampier	Karratha	Hearson Cove	Deep Gorge
PM_{10} 24-hr	50	Normal	1.4	1.6	7.5	6.7
		Non-routine	1.8	2.1	10.3	9.4
PM_{10} annual	25	Normal only	0.14	0.13	2.06	1.82
$PM_{2.5}$ 24-hr	25	Normal	0.4	0.4	1.9	1.7
		Non-routine	0.4	0.5	2.6	2.3
$PM_{2.5}$ annual	8	Normal only	0	0	0.5	0.4

This shows that for non-routine operations, 24 hour average proposal-only PM_{10} emissions are predicted to be 10.3 µg/m³ at Hearson Cove, which is over 20 per cent of the NEPM standard. For $PM_{2.5}$, the 24 hour average proposal-only emissions are predicted to be 2.6 µg/m³ at Hearson Cove, which is over 10 per cent of the current NEPM standard and 13 per cent of the 2025 standard.

In relation to the changes to NEPM for $PM_{2.5}$ that will take effect in 2025, the EPA:

> … advises that the predicted annual average $PM_{2.5}$ GLCs at Dampier, Karratha, Hearson Cove, and Deep Gorge (Ngajarli) will exceed the future proposed NEPM standard of 7 µg/m³ in 2025 (NEPC 2019). This is primarily due to high background dust levels from natural sources (Ramboll 2021a). The predicted additional contribution to annual average $PM_{2.5}$ GLCs from the proposal at the above-mentioned sensitive receptor locations is between zero and 10% of the proposed 2025 NEPM standard.[121]

From the foregoing, it is considered that the proposal-only emissions are predicted to be well below NEPM standards, although for the 24-hour standard during non-routine operations, PM_{10} and $PM_{2.5}$ are higher than indicated by the EPA. Despite this, the EPA's approach is considered to be valid, and that it was therefore satisfactory for it to conclude that the proposal is a relatively small contributor to total PM emissions.

Urea workplace standards not applicable to residential or recreational exposure

The workplace exposure level recommended by the American Industrial Hygiene Foundation (AHIF) cited by one appellant of 10 mg/m³ (i.e. 10,000 µg/m³) over an 8-hour averaging period relates to the potential health impacts of urea to workers within industrial facilities rather than members of the public in residential premises or at recreational locations. As a

[120] Data from Tables E-1 and E-2 of Appendix D of Cardno, Environmental Review Document, 26 March 2020.
[121] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 14.

result the EPA considered it has limited relevance to its assessment of potential impacts to human health from this proposal.

In any event, the EPA noted that the highest predicted maximum 24-hour urea dust GLC on the Burrup Peninsula of about 10 µg/m^3 (i.e. 0.01 mg/m3) is identified within the premises boundary. While a 24 hour average, the EPA said this is 1,000 times less than the AIHF's recommended maximum 8-hour average limit for urea exposure. The EPA considers that the predicted maximum 24-hour urea dust GLCs at Dampier, Karratha, Deep Gorge and Hearson Cove are significantly less in comparison to the AIHF's recommended maximum 8-hour average limit for urea exposure.

Ammonia emission data under review

Late in the appeal investigation, we received advice from DWER that emissions data from Yara Pilbara Fertiliser Pty Ltd Ammonia Plant may not have been accurately reflected in the airshed modelling commissioned by DWER.

While the implications of this issue are not yet available (revised modelling is not expected to be provided to DWER until February 2022), DWER advised that irrespective of the outcome of revised modelling, 'it will ensure that future ammonia emissions from industry on the Burrup peninsula do not result in the exceedance of published health guidelines at sensitive receptor sites'.[122] On the basis of this advice, and on the basis that the proposal's contribution to ammonia emissions would be well below the human health guideline for ammonia, the Chair of the EPA also confirmed that the outcomes of Report 1705 would not change.[123]

Noting that ammonia emissions are also raised on appeal in respect to rock art, we noted under that ground of appeal that it was open to the Minister to remit the proposal to the EPA for reconsideration of impacts once the new modelling is complete. This is equally applicable to human health. However, given both the EPA and DWER advice cited above, it is also open to the Minister to consider there is sufficient information available to properly inform a final decision on the proposal without further assessment.

3.4 Amenity

Broadly, appellants were concerned about the impact of the expanding industrial development on the cultural, recreational, and tourism use of the surrounding landscape.

Specifically, appellants raised concerns about the significant visual, light, and noise impact from the proposal. They contend that the scale of the proposal is considerable, and it will have detrimental effect on the visual amenity of the area.

One appellant raised concerns about the proponent's landscape and visual impact assessment.

Another appellant submitted that the increased vehicle traffic will impact amenity and the ambience of the rock art.

In summary, the investigation found that the EPA did assess the impact of the proposal on social surroundings, including the potential impact on amenity including visual amenity, noise, light and traffic. The investigation notes that following several mitigation measures, the

[122] DWER, Letter to Appeals Convenor, 7 January 2022.
[123] EPA, Letter to Appeals Convenor, 7 January 2022.

EPA considered that the residual impact is consistent with protecting social surroundings from significant harm.

The appeals investigation found that the EPA's conclusion is justified, based on the following key factors:

- the impact on viewsheds at Hearson Cove and Deep Gorge (Ngajarli) is not expected to be significant due to the landscape obscuring most of the proposal infrastructure.
- the proponent's commitments to reduce impacts on landscape and visual amenity.
- noise levels are predicted to be within relevant limits.
- the impact to traffic is expected to be less than 10%.
- the conditions recommended to manage light.

Amenity values of the Burrup are significant

The values of the Burrup Peninsular, in relation to amenity and its recreational, tourism or cultural use are discussed at length in other sections and are not in dispute. This section discusses the potential impacts to these values from the proposal under appeal.

The EPA acknowledged that the proposal is located within a culturally significant landscape with important values. Report 1705 identified that the proposal's development envelope is situated directly adjacent to a National Heritage Listed Area – with some parts of the boundary approximately 140 m from Murujuga National Park. Report 1705 lists the following significant cultural values (identified in the cultural heritage survey) which are in close proximity to the proposal (Figure 9 below):

- Deep Gorge (Ngajarli), which is located about 1.5 km east and includes rock art, a boardwalk, and interpretive signage to educate visitors about its cultural significance to the traditional owners
- the Fish Thalu Aboriginal heritage site situated in the King Bay / Hearson Cove supratidal to intertidal flat area to the north-east
- eight recorded Aboriginal Heritage Sites which are located adjacent to the development envelope
- 33 sites of cultural heritage value which are recorded within the proposal development envelope east of Burrup Road.

In summary, the EPA identified that construction and operation of the proposal could impact the following values:

- Aboriginal cultural heritage sites and rock art
- the Murujuga Cultural Landscape World Heritage listing
- recreational and cultural activities due to increased cumulative noise levels at locations such as Hearson Cove and Deep Gorge (Ngajarli)
- visual amenity
- public safety due to increased road traffic, the re-alignment of Hearson Cove Road, and the construction of a new intersection where the road on the causeway meets Hearson Cove Road.[124]

[124] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 63.

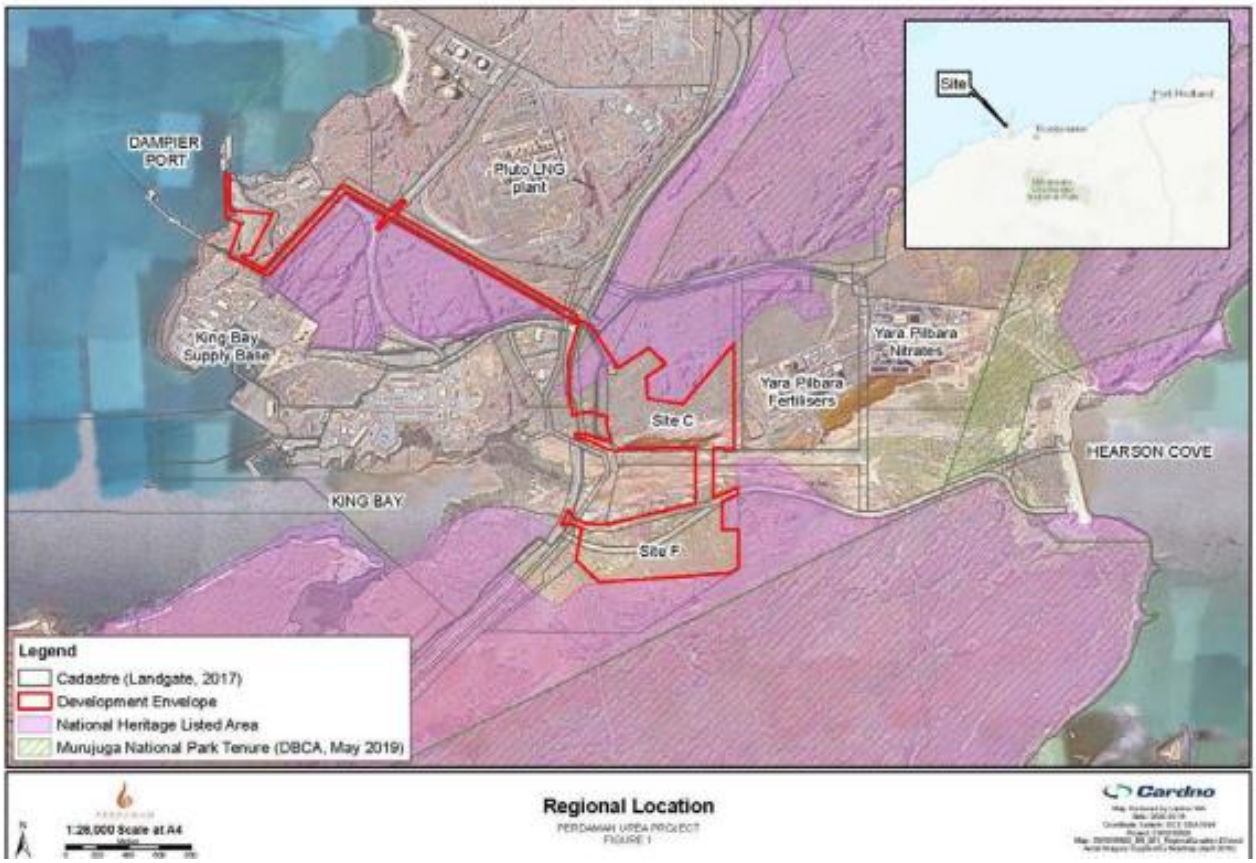

Figure 9 Proposal within the surrounding landscape including areas of cultural heritage value, and existing industrial development (Source: Cardno 2021)

The EPA assessed the impact of the proposal on amenity

The EPA identified visual amenity and the cultural values of the surrounding landscape under its assessment of Social Surroundings. The EPA's environmental objective for social surroundings is to *protect social surroundings from significant harm.*

The EPA advised that its assessment of the proposal in this regard was informed by several surveys and assessments, including a Landscape and Visual Impact Assessment (LVIA), cultural heritage surveys,[125] noise modelling and assessment,[126] and a traffic impact assessment.[127]

These are discussed in the relevant sections below.

The impact to visual amenity was considered unlikely

Report 1705 notes that the proposal will intensify the industrial development within the Burrup Strategic Industrial Area (BSIA). It identified the potential for the construction and operation of the proposal to impact visual amenity and recreational and cultural activities at locations such as Hearson Cove and Deep Gorge (Ngajarli).

[125] Cardno, Aboriginal Heritage Management Plan, Perdaman Urea Project Burrup Peninsula, Western Australia, 2020. This document has been updated to include culturally sensitive heritage information provided by MAC during consultation
[126] The noise modelling was reviewed by the DWER Environmental Noise Branch who advised that it is appropriate for the proposed project
[127] Cardno, Environmental Review Document, 26 March 2020, Section 4.9.5.5.

The EPA's assessment was informed by the LVIA commissioned by the proponent. The LVIA methodology was based on guidance published by the Western Australian Planning Commission (WAPC).[128] The document includes guidelines for siting and design for different landscape types and land uses. The LVIA was also informed by guidance published by the Australian Institute of Landscape Architects.[129]

The LVIA assessed the existing and proposed landscape and visual environment in terms of character, scenic amenity, and natural landscape and aesthetic values of the National Heritage Listed area and the Murujuga National Park.

The LVIA used a viewpoint-based approach and included consideration of the visibility, appearance and the visual impacts of the proposal as well as the sensitivity of affected areas. The LVIA defined five viewer groups and 'scenic demand' categories were allocated to each of them based on their likely 'scenic expectations'. These groups included local residents, recreational users, tourists and visitors to Murujuga National Park, traditional owners, and on-site workers and contractors. Viewpoint sensitivity was defined by the ability of a viewer or viewpoint to tolerate change without losing valued attributes.

The LVIA analysed 11 viewpoints on the Burrup Peninsula – of which six locations were identified as having low sensitivity, two with moderate sensitivity, and two that were identified as sensitive (Table 6 below).

Table 6 - The 11 viewpoints analysed in the LVIA, and their respective sensitivity (source: LVIA)

Viewpoint	Selected Viewpoints	Viewer Group (See S. 2.4.2)	Viewpoint Sensitivity
VP01	Burrup Road (>2km from site)	All	Low
VP02	Burrup Road/Hearson Road	All	Moderate
VP03	Hearson Cove Road	1, 3	Moderate
VP04	Burrup Road culvert	4	Low
VP05	Burrup Road (opposite Site C)	4	Low
VP06	Deep Gorge walking track	2, 3	Sensitive
VP07	Hearson Cove Beach BBQ area	1, 3	Sensitive
VP08, VP09	Burrup Road & King Bay industrial estate	4, 5	Low
VP10	Dampier town	5	Low
VP11	Karratha lookout	1, 5	Low

Based on the above, Burrup Road, Hearson Cove Road, Deep Gorge and Hearson Cove Beach were identified as viewpoints which have moderate to high sensitivity and will have the proposal within their viewshed. These are the locations of concern raised by the appellant.

The LVIA and the EPA acknowledge that on Burrup Road and Hearson Cove Road, the proposal (along with existing industry) will dominate the views of an approaching vehicle, and that the proposal will impact the visual amenity at these viewpoints (Figure 10 and 11).

[128] WAPC, Visual Landscape Planning in Western Australia: A Manual for Evaluation Assessment, Siting and Design, 2007.
[129] Australian Institute of Landscape Architects, Guidance Note for Landscape and Visual Assessment, 2018.

Figure 10 Comparison of the existing view from Burrup Road VP02 (top) and the view of the proposed development from the same viewpoint (bottom)[130]

Figure 11 Comparison of the existing view from Hearson Cove Road VP03 (top) and the view of the proposed development from the same viewpoint (bottom)[131]

However, at sensitive viewpoints (Deep Gorge VP06 and Hearson Cove Beach VP07), the proposed buildings and infrastructure will not be visible as they will be obscured by rocky terrain. At these sites only the proposed flare stack will be visible. The flare stack is understood to be permeable, reducing bulk and scale of the infrastructure. This is illustrated by Figure 12 and 13.

[130] Cardno, Landscape and Visual Impact Assessment Perdaman Urea Project, 12 March 2020, page 35.
[131] Ibid, page 36.

Figure 12 Comparison of the existing view from Deep Gorge (top, with existing LNG plant flare stack visible). The proposed view from Deep Gorge (bottom), illustrates that just the top of the proposed flare stack is visible above the rocky outcrop[132]

Figure 13 Comparison of the existing view from Hearson Cove Beach VP07 (top photo) and the proposed view from the same viewpoint (bottom photo) [133]

[132] Cardno, Landscape and Visual Impact Assessment Perdaman Urea Project, 12 March 2020, page 38.
[133] Ibid, page 39.

The findings of the LVIA were summarised by the EPA in response to this aspect of the appeals:

> … the proposal w[ill] dominate the views from Burrup Road, Hearson Cove Road, and Hearson Cove Beach. However, only the proposal's permeable flare stack will be visible from the access track to Deep Gorge as the rest of the plant and its associated infrastructure will be obscured by the rocky terrain nearby.[134]

The LVIA concluded:

> The visualisations indicate that the proposed urea Project will be seen from several viewing locations within the Burrup Peninsula, but is generally seen within the context of other existing industrial facilities…
>
> …Overall, the visual impacts on most viewpoints are already mitigated through site selection: the location is within an existing industrial area, is at low elevation with relatively low visual exposure screened by rocky terrain (generally inaccessible), dunes and mangroves screening views from offshore, at considerable distance from residential areas.[135]

The EPA advised that it also considered the proponent's commitments to reduce impacts on landscape and visual amenity which include:

- using natural-coloured materials and finishes on buildings and roofs that are non-reflective to reduce visual contrast, and
- establishing vegetative screening along the property boundary and/or along the Hearson Cove Road reserve using fast growing trees and shrubs, where practicable.

Having regard for the results of the LVIA and the avoidance measures proposed, the EPA considered that the proposal's impact on sensitive viewsheds is not expected to be significant due to the landscape obscuring most of the proposal infrastructure with views limited to rooftops and a partially visible stack structure[136] subject to the proponent's commitments and recommended conditions.

The recommended conditions require the proponent to implement the proposal to meet the objective of avoiding, where possible, and otherwise minimising direct and indirect impacts to visual and amenity impacts to social and cultural places and activities. The proponent is also required to revise its Aboriginal Heritage Management Plan to include a framework for consultation, with Traditional Owners and other relevant stakeholders, over the life of the proposal. The framework is to specify construction and operation environmental management activities relevant to cultural heritage, including visual amenity.

Finally, the EPA noted that the proponent is required to construct the proposal in accordance with applicable guidelines and legislation under the *Building Act 2011* and the *Planning and Development Act 2005.*

The EPA therefore concluded:

> … that a material impact on visual amenity is unlikely, provided that management and mitigation measures are complied with. Furthermore, that subject to conditions requiring avoidance and minimisation of visual amenity impacts to social and cultural places and activities, in addition to construction and operational management of visual amenity, the residual impacts of the proposal are likely to be consistent with EPA's objectives for social surroundings.

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[134] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 23.
[135] Cardno, Landscape and Visual Impact Assessment Perdaman Urea Project, 12 March 2020, page 44.
[136] EPA, Response to Appeal 034/21, 3 November 2021, page 24.

The investigation acknowledges that industrial development has the potential to significantly impact of the visual amenity of a landscape, particularly one as significant as the Burrup Peninsula. This is reflected in the LVIA, which acknowledges the potential for cumulative impacts to affect World Heritage listing:

> Although the cumulative effect of industrial development may impact on the longer term aspirations for the World Heritage listing of the Burrup Peninsula with respect to its aesthetic values (criterion vii), the proposed Project is generally outside of the NHL areas, and the existing industry is already likely to affect the ability of the Peninsula to meet this criteria.[137]

Notwithstanding the visual impacts of the proposal, the EPA accepted that the visibility of the proposal will be minimal at sensitive viewpoints. We also accept that the existing regional context is relevant, as the proposal is within the Burrup Strategic Industrial Area, an area zoned as 'Strategic Industry' in the City of Karratha's Town Planning Scheme, and explicitly reserved for the purposes of industrial infrastructure and development. We therefore consider that the EPA's conclusions regarding the impacts to visual amenity were justified.

It is noted, however, that as the EPA advised with respect to GHGe, a decision on whether or not to approve the proposal is ultimately a matter for the decision makers under section 45 of the EP Act. It is expected that process will include consideration of the impacts of the proposal as a whole, including visual impacts.

Predicted noise impacts comply with relevant standards

The EPA advised that it assessed the noise impacts to cultural heritage values from the proposal, which was based on a noise assessment commissioned by the proponent.

The noise assessment predicted noise at sensitive receptor locations including Hearson Cove and Deep Gorge (Ngajarli) in addition to the eastern boundary of Site C and the industrial area bounded by Burrup Road, King Bay Road, and Griffin Road.

Additional modelling to predict noise levels at Yatha and Fish Thalu Aboriginal heritage sites and the National Heritage Listed area located within Site F was undertaken during the assessment process.

The noise assessment found that operational noise from the proposal will result in cumulative residual impacts to the sensitive receptor locations. However, noise levels under 'worst case' meteorological conditions were predicted to comply with the relevant criteria in the *Environmental Protection (Noise) Regulations 1997* (EP Noise Regulations) at the locations (table 7 below).

Table 7 – Assigned levels under the Noise Regulations, compared to modelled worst case predicted noise levels at receptors (adapted from Environmental Noise Assessment)

Receptor	Assigned level L_{A10} (dB)	'Worst-case' predicted noise level L_{A10} (dB)
Hearson Cove	45	40
Deep Gorge	60	42
Yara plant boundary	65	64
West industrial estate	65	59

[137] Cardno, Landscape and Visual Impact Assessment Perdaman Urea Project, 12 March 2020, page 47.

Report 1705 states that the proponent has prepared a Noise Management Protocol as part of its Project Environmental Management Plan. The Noise Management Protocol includes the following management and mitigation actions to minimise impacts from noise:

- operating noise, vibration, and potential mitigation measures, such as sound absorption devices, will be specified when selecting equipment for the proposal
- equipment will be fitted with appropriate noise reduction devices to ensure compliance with project and regulatory requirements
- mobile equipment will be regularly inspected, maintained, and replaced so that noise levels are minimised during the life of the equipment.

In response to this ground of appeal the EPA acknowledged the cumulative noise impact from the industrial area, and concluded:

> … that the increase to cumulative noise levels attributed to the proposal, is not likely to be a material impact to noise levels at sensitive locations, and that with the application of recommended conditions in addition to the existing regulatory framework for noise management, the proposal's residual impact is likely to be consistent with the EPA's objective for this factor.[138]

Based on the results of the noise modelling assessment, we consider that the EPA's conclusion regarding noise is justified.

Conditions have been recommended to manage night glow

Report 1705 identified that the proposal's lighting has the potential to impact on the experience of night visits at Deep Gorge (Ngajarli) and Hearson Cove from an increase of night glow.

The EPA acknowledged that it was unable to assess the specific potential impact of night glow on the surrounding environment due to the absence of detailed information.[139]

The LVIA confirms that the night-time environment was not modelled as part of the assessment as lighting design had not yet been confirmed. The LVIA does identify that there is already significant night glow in and around the existing industrial area of the BSIA and the port, as well as along highways and towns of Karratha and Dampier. The LVIA states that:

> … lighting at night and movement of vehicles will not be unduly dissimilar to the existing light sources and movement of vehicles along Burrup Road and Dampier Highway, servicing the industrial areas of the BSIA and the Port.[140]

As a result of the potential impact and lack of information, the EPA recommended the following conditions to manage light impacts:

- Condition 10-1 requires the proponent to implement the proposal such that it meets the environmental objective of avoiding, where possible, and otherwise using best practice technology and risk-based management actions to minimise nightglow and light overspill from the proposal so that the environmental values of amenity at sensitive locations (including, but not limited to, Hearson Cove and Deep Gorge) are protected.
- Condition 10-2 requires the proponent to prepare and implement a Lighting Management Plan in consultation with MAC which:

[138] EPA, Response to Appeal 034/21, 3 November 2021, pages 24-25.
[139] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 70.
[140] Cardno, Landscape and Visual Impact Assessment Perdaman Urea Project, 12 March 2020, page 43.

- specifies the best practice technology and risk-based management actions that will be implemented to demonstrate compliance with the objective specified in Condition 10-1;
- specifies measurable management target(s) to determine the effectiveness of the best practice technology and risk-based management actions; and
- specifies monitoring to measure the effectiveness of best practice technology and management actions against management targets.

The EPA also noted that the proponent has proposed to use lighting in accordance with AS 4282-1997: Control of Obtrusive Effects from Outdoor Lighting Guidelines.

The EPA concluded that the recommended management and mitigation measures outlined in the recommended conditions (and particularly in Condition 10) will result in:

- the residual impact on social surroundings from lighting being not likely to be a material impact, and
- the proposal being implemented in a manner that is likely to be consistent with the EPA's objective for this factor.

Based on the above, the appeals investigation agrees with the EPA's recommended conditions to manage night glow.

Changes to traffic were adequately assessed by EPA

The EPA identified that the proposal has the potential to impact on recreational activities and public safety due to increased road traffic and the potential disruption caused by the construction and operation of the proposal.

The Traffic Impact Assessment (TIA) identified four roads within the vicinity of the proposal (Figure 14), with Burrup Road as a primary distributor connecting the industrial areas of Burrup to Dampier Highway, Hearson Cove Road providing access to Hearson's Cove, and King Bay Road and Mof Road as access roads connecting jetties and industrial areas to Burrup Road.

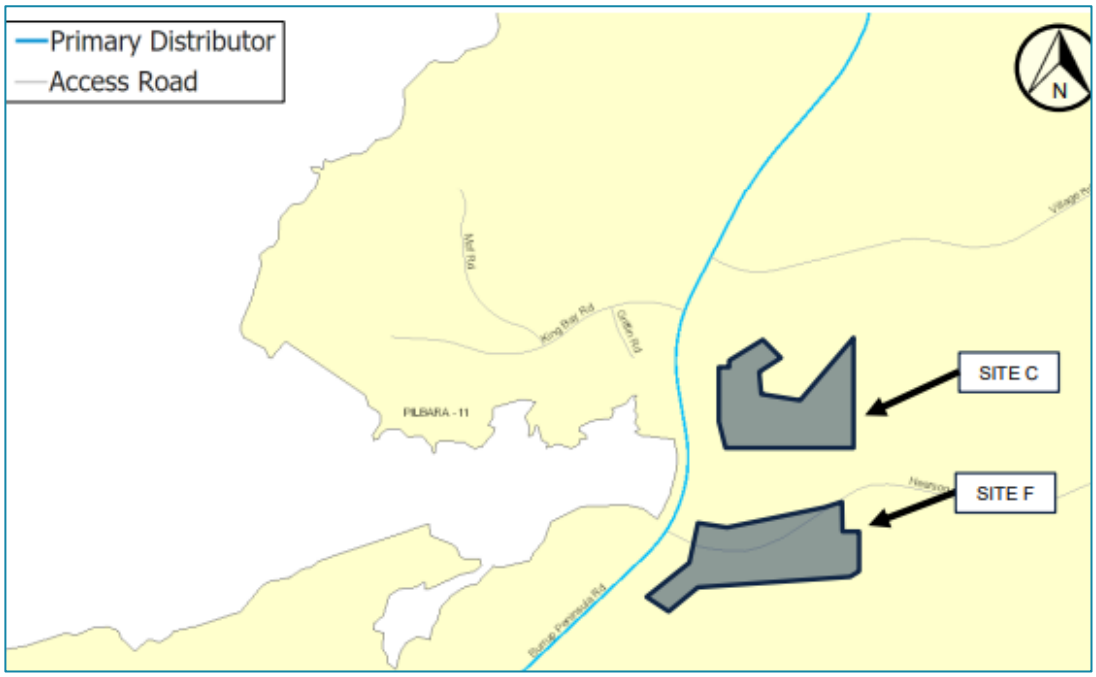

Figure 14 Road network in the vicinity of the proposal[141]

[141] Cardno, Traffic Impact Assessment Perdaman Urea Project, 28 August 2019, Figure 2-1.

The proposal includes access arrangements from Burrup Road to Site C, access to Site F from a realigned Hearson Cove Road and a causeway connecting Site C and F. The TIA states that once Hearson Cove Road is realigned, the existing intersection of Burrup Road and Hearson Cove Road will be closed.

Existing traffic volumes on Burrup Road were sourced from Main Roads, and in 2017/18 averaged 2,600 daily vehicles.

Changes to traffic are expected as a result of the proposal, including during the following periods:

- Construction phase – which will involve an influx of traffic from construction workers, truck deliveries and materials transportation. Approximately 1,500 construction staff are expected at the peak of the construction phase.
- Operation phase – this refers to day-to-day operations when the site is completed and fully operational. The traffic generated primarily comprises employees with an estimated 200 employees living and working within the region.

The TIA found that during operations, vehicle movements (two-way trips) will be 200 vehicles in the morning and the same in the afternoon (that is, 400 movements per day). Based on average daily traffic recorded on Burrup Road north of Hearson Cove Road in 2017/18 of 2,600 vehicles, the proposal will add over 15 per cent to vehicle movements. This is higher than identified by the EPA,[142] but not significantly so.

Modelling undertaken in the TIA also demonstrated that the intersections and access ways surrounding the proposal will operate at an acceptable level of service with low traffic volumes and negligible queuing.

In addition, the proponent has committed to the following measures to reduce traffic impacts:

- employ a shuttle bus service to transport site construction workers to site to reduce traffic associated with the construction of the proposal
- employ traffic management personnel to safely control the movement of heavy transport vehicles at the intersection of the causeway and Hearson Cove Road during construction to facilitate the movement of large modules and heavy materials on slow moving vehicles and avoid impacts to traffic on Burrup Road
- install a gatehouse and boom gates at the causeway and Site F entry points on Hearson Cove Road to prevent unauthorised access.

The EPA advised that it considers that the realignment of Hearson Cove Road will not affect access to Deep Gorge (Ngajarli) or Hearson Cove. The EPA considers that the overall change to traffic from the proposal is minor.

The EPA also noted that the proponent is required to obtain a development approval from the City of Karratha under the *Planning and Development (Local Planning Schemes) Regulations 2015*. This will ensure that construction is undertaken in accordance with applicable guidelines and legislation.

Having regard for the results of the TIA and the measures committed to by the proponent, we consider that the overall change to traffic from the proposal is not so significant that it will impact on access, recreational activities or amenity of the surrounding area.

[142] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 69.

3.5 Direct impacts to heritage sites

Broadly, seven appellants raised concerns about the significant Aboriginal heritage in the region and contend that the EPA did not apply adequate weight or value to this in its assessment of the proposal.

Specifically, several appellants raised concerns about the disturbance and relocation of registered Aboriginal heritage sites for the construction of the proposal.

One appellant submitted that there was no mitigation plan to prevent the destruction of these sites.

Another appellant suggested that the relocation of these sites amounts to their destruction, as they have deep spiritual links to place and location.

Several appellants also raised concerns that the proposal will impact the values for which Murujuga is nominated for World Heritage listing. The EPA's consideration of World Heritage listing is briefing discussed in Other Matters, however the impacts to the cultural values are covered in this section and previously in 3.1.

In summary, the EPA assessed impacts to Aboriginal heritage and determined that there was potential for direct and indirect impacts resulting from the proposal (impacts to rock art from air emissions are discussed in Section 3.1).

The EPA considered that provided appropriate management measures were applied, the proposal could be implemented while protecting cultural values from significant harm. This conclusion was based on the proponent's commitment to reduce its impacts by avoiding the majority of heritage sites (30 of 33 sites avoided), and the proponent's agreement with MAC to disturb the remaining three sites.

The EPA has recommended the proponent's Aboriginal Heritage Management Plan be revised in consultation with MAC and Department of Planning Lands and Heritage to include a framework for ongoing impact minimisation, consultation with Traditional Owners, and facilitation of connection and access, throughout the lifetime of the proposal. The proponent must not commence ground disturbing activities until this is approved by the EPA.

The direct disturbance to these sites will also be the subject to a section 18 consent under the *Aboriginal Heritage Act 1972* (or as otherwise applies under the *Aboriginal Cultural Heritage Act 2021)*.

Based on the key considerations summarised above, we consider that the EPA's finding is reasonable. Further explanation follows.

There is significant Aboriginal heritage on the Burrup Peninsula

The proposal is located within a National Heritage Listed place, which covers the Burrup Peninsula and the Dampier Archipelago (Figure 15). As outlined in Section 3.1 of this report, the Burrup Peninsula and Murujuga is home to one of the largest, densest, and most diverse collections of carved rock art in the world. There are thought to be over a million recorded petroglyths, created by Aboriginal people over 40 thousand years.[143]

[143] Murujuga Aboriginal Corporation (MAC) (2021) https://www.murujuga.org.au/about/about-murujuga/

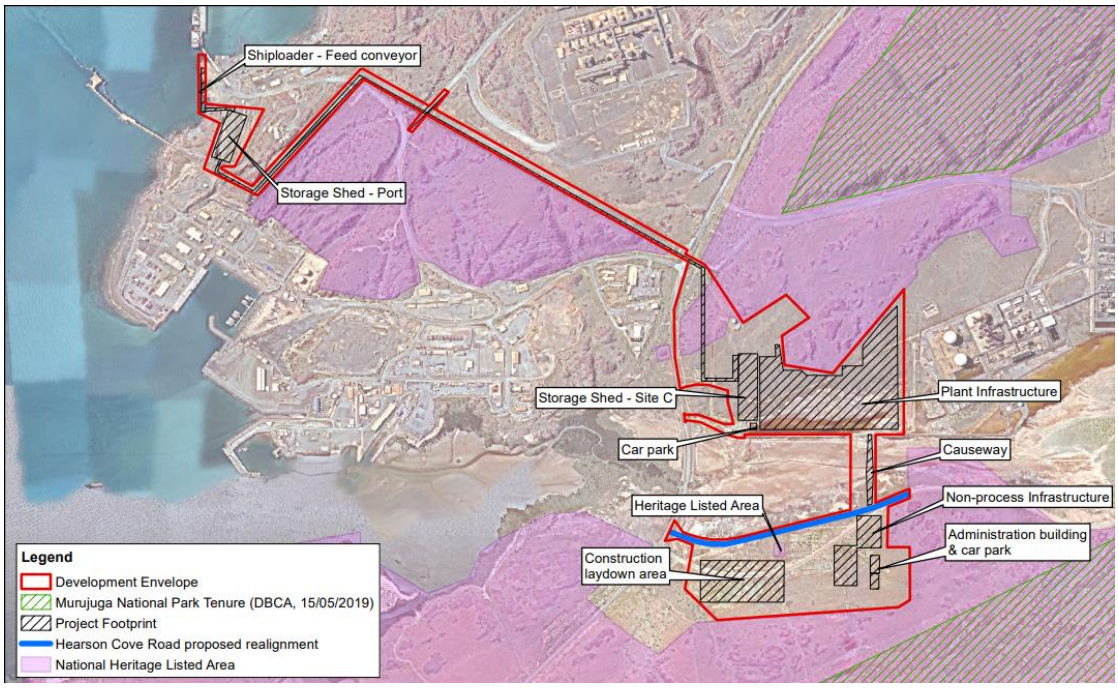

Figure 15 Location of the development envelope within the context of Murujuga, including the National Heritage Area (Source: Cardno 2020). Note that the location of specific Aboriginal heritage sites identified in surveys has not been released to the public.

Within this context of significant heritage value, the proposal's development envelope is 106.7 ha. This includes 34.4 ha at Site C, 34 ha at Site F, 3.6 ha for a causeway between Sites C and F, and an access road linking Burrup Road to Site C (1.5 ha). Approximately 300 m of the conveyor route passes through the National Heritage listed place. Direct physical disturbance to Aboriginal heritage sites is therefore a potential outcome of development on the Burrup Peninsula, including this proposal. For the purposes of this proposal, Aboriginal heritage sites are defined in accordance with the *Aboriginal Heritage Act* as:

- any place of importance and significance where persons of Aboriginal descent have, or appear to have, left any object, natural or artificial, used for, or made or adapted for use for, any purpose connected with the traditional cultural life of the Aboriginal people, past or present
- any sacred, ritual or ceremonial site, which is of importance and special significance to persons of Aboriginal descent
- any place which, in the opinion of the Committee, is or was associated with the Aboriginal people and which is of historical, anthropological, archaeological or ethnographical interest and should be preserved because of its importance and significance to the cultural heritage of the State
- any place where objects to which this Act applies are traditionally stored, or to which, under the provisions of this Act, such objects have been taken or removed.

The EPA assessed cultural values and heritage

As discussed in 3.4, the EPA considered the cultural values of the location in its assessment of Social Surroundings.

The EPA advised that its assessment of Aboriginal heritage was informed by the cultural heritage surveys of Site C and F undertaken in 2019, coordinated by Department of Jobs,

Tourism, Science, and Innovation (JTSI).[144] The surveys found there was significant values within and adjacent to the development envelope, as well as within the surrounding landscape of the Burrup Peninsular. The surveys also identified specific sites of cultural heritage value within the proposal's development envelope.

In consultation with MAC, additional sites were added to the survey's list, including sites within the development envelope comprising midden/artefact assemblages, engravings and artifact scatters. The investigation understands that as this included culturally sensitive information, the location of these sites has not been made public.

The EPA advised that it also considered the proponent's Aboriginal Heritage Management Plan (Version D, 19 March 2020) in its assessment.

The proposal will avoid most heritage sites

In total, 33 sites of cultural heritage value were recorded within the proposed development envelope, including engravings located within Site F which is a National Heritage Listed Place and considered a matter of national environmental significance under the EPBC Act.

The proponent has designed the proposal to avoid impacts to most of the identified Aboriginal heritage sites and cultural values in the development envelope. 30 out of 33 identified sites east of Burrup Road will be avoided by the following measures:

- Reducing the size of the development envelope to avoid direct impacts to the Yatha Aboriginal heritage site
- Altering the location of the access road linking Site C to Burrup Road to avoid Aboriginal Heritage Site ID 9597
- Altering the route and elevating sections of the urea product conveyor to avoid direct impacts to all known Aboriginal heritage sites within Site C, with exception of three sites (Site ID 18615, 19239 and 19874)
- avoiding four Aboriginal Heritage Sites (Site ID 9439, 26008, 9296, and MAC 004) situated within Site F by adjusting the project footprint to avoid cultural heritage values
- Excising the National Heritage Listed Area (Site ID 9439) located within Site F from the disturbance footprint and providing a traditional owner access corridor to allow permanent access to the area from Hearson Cove Road.[145]

Following these minimisation measures we understand that three heritage sites could not be avoided - ID 18615, 19239 and 19874 within Site C.

MAC has agreed to relocation of remining sites

As discussed above, MAC, representing the custodians of Murujuga, provided information in the identification of Aboriginal heritage sites within the development envelope, and participated in the cultural heritage surveys. The EPA advised that representatives of MAC informed the assessment of impacts and the proposed relocation of registered Aboriginal heritage sites.

The EPA advised that the proponent has agreement from MAC to relocate the three registered Aboriginal heritage sites. The proponent's AHMP states:

> A collaborative approach has been undertaken with MAC representatives to understand the location and significance of the sites in question and to shape the layout and design of the

[144] Confidential report, coordinated by JTSI and conducted in late 2019
[145] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 63.

> plant and construction facilities to minimise impacts. Perdaman project representatives have met numerous times with Traditional Custodians in this regard.[146]

Similarly, the EPA advised that the proponent has the agreement of MAC to salvage and relocate these 3 remaining sites:

> The EPA notes that the proposed impact has been subject to significant consultation with MAC who have agreed to the disturbance and are continuing to undertake consultation with the proponent to facilitate consent to disturb these sites under Section 18 of the AHA and will discuss potential salvage requirements with MAC.[147]

The EPA recommends conditions to further protect heritage sites

Having regard for the residual impact to cultural heritage sites, the EPA has recommended several conditions be imposed. Condition 9-1 has the following objectives:

- to avoid, where possible, and otherwise minimise direct and indirect impacts to social, cultural, heritage, and archaeological values within and surrounding the development envelope
- allow ongoing Traditional Owner and Custodian access to enable traditional activities and connection to culturally significant areas within and surrounding the development envelope
- allow Traditional Owner and Custodian access to the development envelope following decommissioning of the proposal
- avoid, where possible, and otherwise minimise direct and indirect impacts to visual and amenity impacts to social and cultural places and activities.

The following conditions were recommended to ensure the objectives are achieved:

- recommended condition 9-2(1) requires that the proponent in consultation with the MAC and the Department of Planning, Lands and Heritage revise the Aboriginal Heritage Management Plan, at least six months prior to ground disturbing activities, to ensure cultural heritage objectives specified in 9-1 are met
- recommended conditions 9-2(2)-(4) requires the proponent to revise the Aboriginal Heritage Management Plan to include a framework for consulting with Traditional Owners and other relevant stakeholders throughout the life of the proposal (the conditions also specify consultation issues are to include construction and operation environmental management activities relevant to cultural heritage, including and not limited to, noise, construction emissions, air quality, traffic management and visual amenity and including the provision of traditional owner observers)
- recommended condition 9-2(5) requires the proponent to revise the Aboriginal Heritage Management Plan to specify risk-based management actions that will be implemented to demonstrate compliance with the objectives specified in condition 9-1
- recommended conditions 9-2(6) and (7) requires the proponent to revise the Aboriginal Heritage Management Plan to specify measurable management targets to determine the effectiveness of the risk-based management actions and monitoring to measure the effectiveness of the management actions against the management targets
- recommended conditions 9-2 (8) and (9) requires the proponent to revise the Aboriginal Heritage Management Plan to specify the process for revising management actions and the format and timing for compliance assessment reporting

[146] Perdaman, Aboriginal Heritage Management Plan Perdaman Urea Project, April 2021, page 4.
[147] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 67.

- Recommended condition 9-3 specifies that the proponent must not commence ground disturbing activities until the CEO has confirmed in writing that the plan submitted under condition 9-2 satisfies the requirements of condition 9-2.

The proponent is required to obtain consent under *Aboriginal Heritage Act*

Finally, the EPA noted that there is a requirement for the proponent to obtain consent under section 18 of the *Aboriginal Heritage Act* to disturb the remaining three heritage sites.

The investigations notes that at the time of publication of Report 1705, the *Aboriginal Heritage Act* was the relevant legislation in this regard. Since then, the *Aboriginal Cultural Heritage Act 2021* has come into effect. Transitional arrangements apply to the new Act which the proponent will need to consider separately to the requirements of the EP Act.

3.6 Clearing of native vegetation

One appellant submitted that a large footprint is proposed to be cleared for construction of the proposal and raised concerns about the impact on existing rare flora and fauna habitat. The appellant contended that the area has not been surveyed adequately.

We find that the EPA considered the impact of the clearing, including the adequacy of the surveys, and concluded that the proposed clearing is significant. We understand that in this way, the EPA's assessment acknowledged the values identified in the appeal.

Due to the residual risk to fauna habitat, the existence of a priority ecological community (PEC), and the uncertainty around direct and indirect impacts to conservation significant short-rage endemic (SRE) species, the EPA recommended several conditions to protect terrestrial fauna, flora and vegetation including a contribution to the Pilbara Offsets Fund. Provided these measures are implemented, the EPA considered that the environmental outcome is likely to be consistent with its environmental objectives.

Based on the available evidence, we consider the EPA's assessment was adequate. The investigation's findings are detailed below.

There are significant vegetation, flora, and fauna habitat values on the Burrup Peninsula

The proposal is located within the Pilbara Interim Biogeographical Region (IBRA) and the Roebourne IBRA sub-region. Only 3.45% of the Roebourne IBRA is currently reserved for conservation. According to DBCA's description of the Roebourne sub-region, the Burrup Peninsula provides high habitat diversity for plants, and displays high species diversity for Camaenid landsnails, and human disturbance through mining and industrial emissions are known threatening processes.[148]

The biological survey report describes the landscape:

> Large outcrops and ranges of fractured red / brown rock and spinifex-covered scree slopes dominate the landscape of the Burrup Peninsula. The land is elevated from the typically low and flat coastal plains of the West Pilbara. Numerous gorges, creeks and drainage lines cutting across the landscape provide heterogeneity in the topography and the vegetation communities it supports. The landscape is distinctive in its appearance and is restricted to the Burrup Peninsula, some nearby islands and adjacent mainland.[149]

[148] https://www.dpaw.wa.gov.au/images/documents/about/science/projects/waaudit/pilbara04_p581-594.pdf
[149] Animal Plant Mineral (2019) Pre- and post-wet season biological survey, Perdaman Urea Project, Burrup Peninsula

The Burrup Peninsula lies within the Fortescue Botanical District, which is part of the biogeographical region known as the Eremaean Botanical Province.

The Burrup Peninsula rock pool communities Priority Ecological Community (PEC) (Priority 1) and Burrup Peninsula rock pile community PEC (Priority 1) are located on the Burrup Peninsula. No Threatened Ecological Communities (TEC) listed under the EPBC Act or the BC Act are known to occur on the Burrup Peninsula.

The location of the proposal also represents four main types of fauna habitat - Rocky Outcrops, Hummock Grasslands on Mid-slopes, Samphire Shrublands / Saltplains, and Drainage Lines. The known extents of each of these habitat types on the Burrup Peninsula are as follows:

- Rocky Outcrops – 2335.74 ha
- Hummock Grasslands on Mid-slope – 3704.13 ha
- Samphire Shrublands / Saltplains – 803.02 ha
- Drainage Lines – 579.3 ha.[150]

No flora species listed as threatened under the EPBC Act are known to occur on the Burrup Peninsula, or within 100 km of the study area for the proposal. No flora species listed as threatened under the *Biodiversity Conservation Act 2016* (BC Act) have been recorded on the Burrup Peninsula.[151]

Numerous conservation significant terrestrial fauna species are known to occur in the region, including migratory birds and bat species, as well as northern quoll and the Pilbara olive python that potentially exist in the region.

Clearing for the proposal will impact these values

Report 1705 states that the proposal will clear 73.05 ha of native vegetation within the development envelope of 106.7 ha. Figure 2 illustrates the disturbance footprint, which includes:

- Site C: clearing of up to 31.1 ha
- Site F: clearing of up to 32.54 ha
- Causeway: clearing of up to 1.36 ha
- Access Road linking Burrup Road to Site C: clearing of up to 1.45 ha.

Regarding flora, vegetation and fauna habitat, the EPA identified the following potential impacts from construction and operation of the proposal:

- clearing of 73.05 ha of vegetation within the development envelope during construction will directly impact on flora and vegetation values
- habitat disturbance and fragmentation of fauna habitats as a result of construction
- introduction and/or spread of weeds, altered fire regimes and altered surface water and groundwater flow regimes
- impacts from NO_2 and SO_2 emissions from the urea plant.

EPA assessed the impact of the clearing

The EPA identified both Flora and Vegetation, and Terrestrial Fauna as key environmental factors in its assessment of the proposal.

[150] Cardno, Environmental Review Document, 26 March 2020, page 119.
[151] Animal Plant Mineral (2019) Pre- and post-wet season biological survey, Perdaman Urea Project, Burrup Peninsula

In response to the appeal, the EPA noted that it:

> … considered the various types of vegetation and fauna habitat that are present within the development envelope and the proposal's disturbance footprint as well as the conservation significant fauna species that are likely to be found within these habitats. The EPA compared the area of clearing within each habitat type to the known extents of these habitats on the Burrup Peninsula. The EPA also noted the proponent's proposed management measures to avoid and minimise potential impacts to fauna.[152]

Report 1705 describes the flora and fauna surveys undertaken by the proponent (biological surveys)[153] used to inform the EPA assessment. The proponent commissioned 2 flora and vegetation surveys and 2 fauna surveys, undertaken in different seasons. A pre-wet season survey was conducted in November 2018 and a post-wet season survey which was conducted in March 2019. The survey area covered Sites C and F, the area between the 2 sites, the site access easements, and the section of the proposed product conveyor route east of Burrup Road.

The EPA advised that the flora and vegetation surveys were consistent with the *Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessme*nt.

The proponent's fauna surveys included an initial level 1 fauna survey prior to the wet season of 2018/19 and a level 2 survey conducted immediately after that wet season. A full bird census, camera trapping, spotlight surveys, and bat surveys were carried out in both surveys, while a full terrestrial fauna trapping survey was conducted in the post-wet season survey. Targeted searches in rock piles and along drainage lines for short-range endemics (SRE) such as Camaenid land snails was included in the 2019 terrestrial fauna survey. The EPA advised that in its view, the SRE surveys did not meet the requirements of the EPA's *Technical Guidance - Sampling of short-range endemic invertebrate fauna.* However, we understand that the proponent has committed to undertake further detailed SRE surveys of the potential rockpile communities within the project development footprint prior to construction activities, and the EPA considered this uncertainty in its application of an offset requirement (see below for further discussion).

EPA identified the values impacted

There are four main fauna habitats recorded within the development envelope. These habitats are Rocky Outcrops, Hummock Grasslands on Mid-slopes, Samphire Shrublands/ Saltplains, and Drainage Lines. The Burrup Peninsula rock pile community PEC (Priority 1) was recorded in 26 locations within the development envelope (see Figures 16 and 17).

The biological surveys recorded 63 bird, 7 non-volant mammal, 8 bat, 27 reptile and 1 amphibian species during two surveys. Within this assemblage, one Threatened fauna species, the Ghost Bat (*M. gigas*), one Priority 4 species, the Northern Coastal Free-tailed Bat (*M. cobourgianus*), and 26 listed bird species were recorded.[154]

[152] EPA, Response to Appeal 034/21, 3 November 2021, page 31.
[153] Animal Plant Mineral, Pre- and post-wet season biological survey, Perdaman Urea Project, 2019.
[154] Ibid.

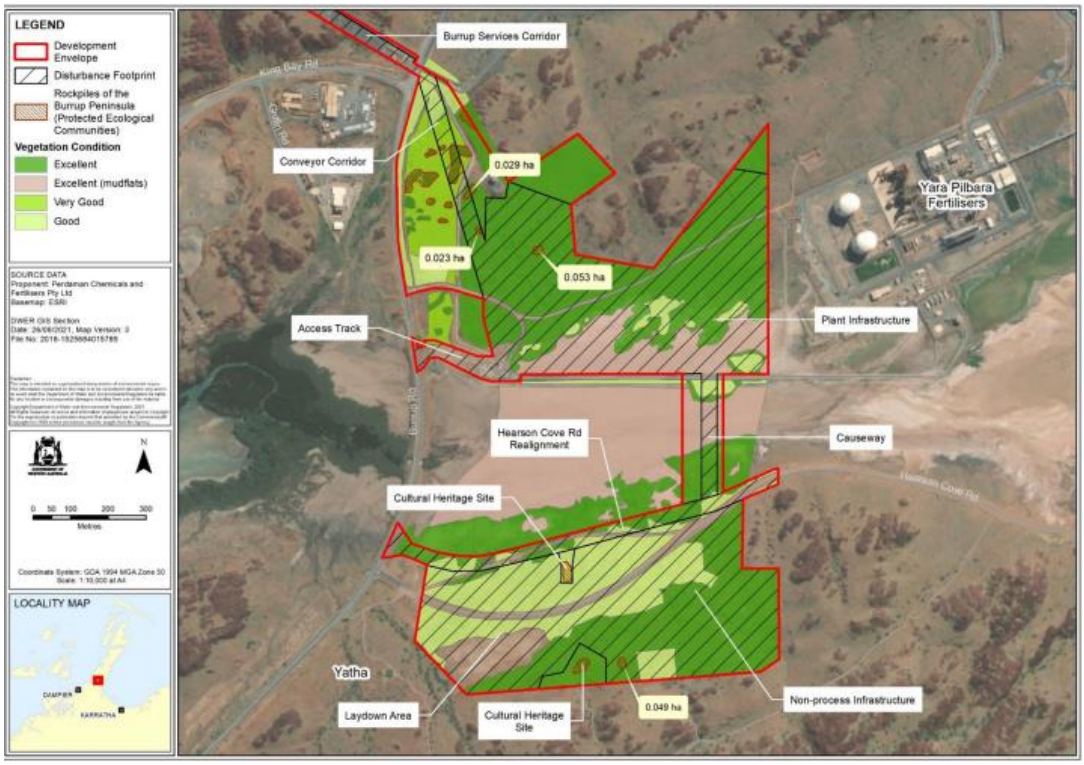

Figure 16 Vegetation quality and threatened communities

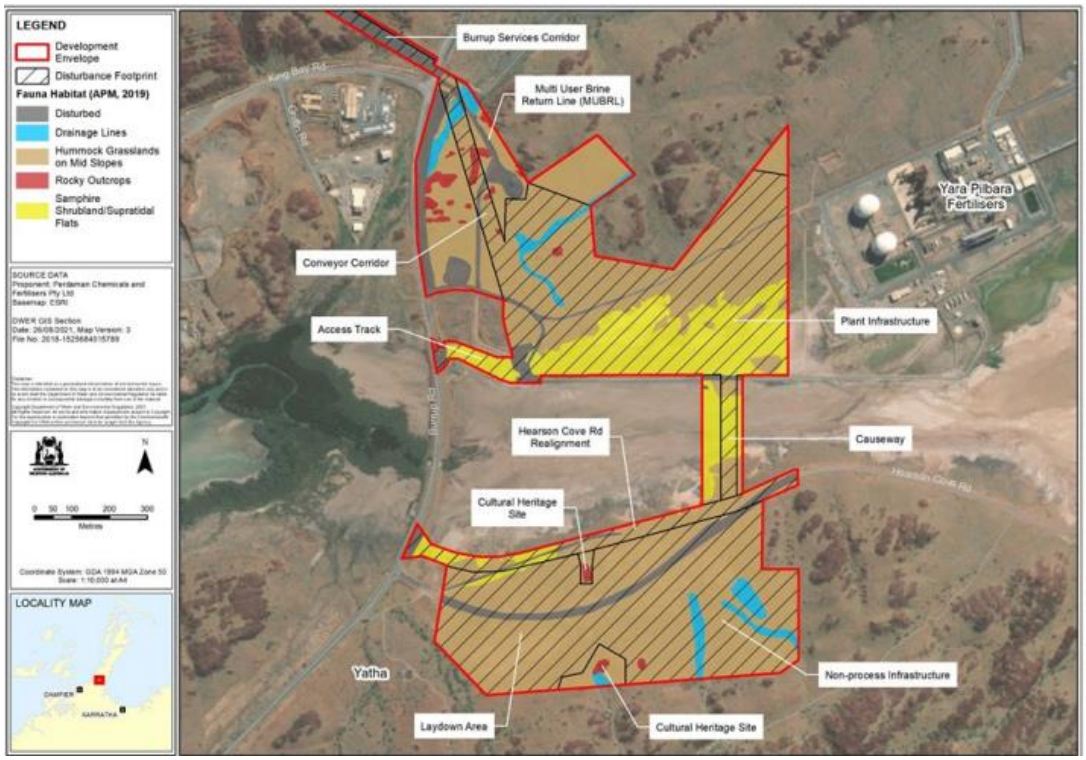

Figure 17 Fauna habitat mapping

The proposal will involve clearing within the development envelope of up to 73 ha, of which 64 ha is in 'Good to Excellent' condition foraging and roosting habitat for fauna species listed under the EPBC Act and the BC Act (Figure 17 above). This includes:

- 0.16 ha of the Priority 1 PEC - Burrup Peninsula Rock Pile community in 'Good to Excellent' condition, providing habitat for the northern quoll and the Pilbara olive python
- 49.17 ha of Hummock Grasslands on Mid-slopes in 'Good to Excellent' condition and 3.02 ha in 'Poor to Completely Degraded' condition providing habitat for the northern quoll and the Pilbara olive python
- 11.97 ha of Samphire Shrublands / Supratidal Flats in 'Good to Excellent' condition and 0.94 ha in 'Completely Degraded' condition providing habitat for migratory and marine bird species
- 2.7 ha of Drainage Lines in 'Good to Excellent' condition providing habitat for the ghost bat
- direct impacts on 21 potentially locally significant vegetation communities, including 2 flora species of conservation significance; a Priority 3 and a Priority 4.

The surveys recorded 2 flora species of conservation significance -*Terminalia supranitifolia* (Priority 3) and *Rhynchosia bungarensis* (Priority 4) within the study area and the development envelope.

The proposal will avoid and minimise most of the impact

The EPA acknowledges, and we agree, that there is vegetation and fauna habitat values within the broader area and within the development envelope, and that the proposal has the potential to impact on these values. However, as the EPA notes, the proponent has designed the proposal to avoid significant vegetation and key fauna habitat through its configuration of the development envelope and the disturbance footprint. These avoidance and minimisation measures are set out in proponent's Native Vegetation and Clearing Management Protocol, which details clearing limitations and measures that will be implemented, primarily during the construction phase, to minimise damage to native vegetation.

Specifically, the proposal will minimise impacts to PECs and conservation significant flora through footprint design, and has identified and demarcated the extent of PECs and the presence of Priority flora and avoided them where possible to form the boundaries of clearing areas as exclusion zones. In addition, the proposal will:

- avoid sites where Priority 3 individuals and Priority 4 flora species were recorded
- select a road re-alignment option which avoids high quality vegetation located in the vicinity of the southern perimeter of Site F
- vegetation clearing, grubbing and earthworks during high winds (>40 km/h) will be avoided
- avoid rocky outcrops, drainage lines, and high-quality vegetation located adjacent to the southern boundary of Site F
- use an elevated causeway with large culverts to cross the tidal flats rather than reclaiming areas of tidal flats
- locating a significant portion of the urea product conveyor within the existing East West Service Corridor which has already been cleared.[155]

The proponent has also prepared a Fauna Management Plan [156] and a Threatened Species Management Plan, which include the following management and mitigation actions to minimise potential impacts on terrestrial fauna habitat:

[155] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 30
[156] Cardno (2021) Fauna Management Plan, Perdaman Urea Project Burrup Peninsula, Western Australia Version PCF 1, 25 January 2021.

- keeping clearing of vegetation to the minimum necessary for safe and efficient construction and operation and undertaking it progressively to minimise the pressure on the carrying capacity of the native vegetation surrounding the site
- undertaking inspections and fauna capture, removal and relocation of native fauna from all habitat / microhabitats prior to clearing
- rehabilitating fauna habitat at the end of the life of the project
- installing drainage, erosion, and sediment pollution controls prior to the commencement of construction to minimise the potential for changes in groundwater and surface water quality to adversely affect fauna and fauna habitat
- maintaining denning habitat by avoiding disturbance to rock piles on the upper slopes of the valleys
- planning clearing to maximise the 'area to perimeter' ratio of remnant vegetation.

Having regard for the survey results, the known extents on the Burrup, and the proposed management measures, the EPA found that there is still a significant residual risk to conservation significant fauna due to habitat loss. Similarly, the EPA considered that the likely residual impacts on flora and vegetation is a significant impact that requires conditions and offsetting to ensure that it is likely to be consistent with the EPA objective for flora and vegetation.

The impact of the clearing can be counterbalanced

EPA's recommended conditions relevant to this ground of appeal are:

- Condition 1 – which limits the proposal extent, including the development envelope and footprint
- Condition 4 – related to Flora and vegetation, including limiting the clearing of PEC, and avoiding all direct impacts to native vegetation
- Condition 5 – related to Terrestrial fauna, including limiting clearing of habitat types, avoiding impacts to SRE fauna, minimise impacts to northern quoll, Pilbara olive python, and ghost bats within the development envelope
- Condition 11 – Offsets (see below).

We consider that conditions 1, 4 and 5 will ensure that the impact of clearing is minimised as far as possible. However, as the EPA found that there is still some potential residual impact to habitat that needs to be counterbalanced, condition 11 requires the proponent to provide a financial contribution to the Pilbara Environmental Offsets Fund (PEOF) as follows:

> The proponent shall contribute funds to the Pilbara Environmental Offsets Fund, (for the implementation of offset projects preferably located in Murujuga) calculated pursuant to condition 11-2, to counterbalance the significant residual impacts to:
>
> (1) 'Good' to 'Excellent' condition native vegetation, including foraging and dispersal habitat for the Pilbara olive python, northern quoll, ghost bat and EPBC Act listed migratory/marine bird habitat; and
>
> (2) Priority 1 PEC – Burrup Peninsula rock pile community, which is also critical habitat for the Pilbara olive python and northern quoll.

The EPA advised that it considers that the residual impact can be counterbalanced in a way that is consistent with the WA Environmental Offsets Guidelines and with other decisions in the Pilbara region based on:

- the remaining quality and quantity of habitat types in the local area and region, and
- the relatively small areas of impact from the proposal when compared to known extents.

We note that the extent of clearing of the represented fauna habitats are relatively small, compared to the known extent on the Burrup Peninsula, as follows:

- Rocky Outcrops – 0.007 %
- Hummock Grasslands on Mid-slope – 1.3 %
- Samphire Shrublands / Saltplains – 1.5 %
- Drainage Lines – 0.47 %

We understand that this was the basis for the EPA's conclusion that residual impacts on fauna habitat could be counterbalanced through the application of an offset condition.

Condition 11-3 sets out the financial contribution to the PEOF for clearing of the 2 types of vegetation (rate per hectare), being the highest applicable rate for the relevant type of vegetation:

- **$826** AUD (excluding GST) per hectare of 'Good to Excellent' condition native vegetation, including foraging and dispersal habitat for the Pilbara olive python, northern quoll, ghost bat and EPBC Act listed Migratory/marine bird habitat, cleared for the proposal within the Roebourne IBRA subregion within that financial year; and
- $**1,653** AUD (excluding GST) per hectare of Priority 1 PEC – Burrup Peninsula rock pile community, which is also critical habitat for the Pilbara olive python and northern quoll (rocky outcrop), cleared for the proposal within the Roebourne IBRA subregion within that financial year.

Table 4 Financial contribution set out in the EPA's recommended conditions related to the vegetation types

Financial contribution	Vegetation type	Area (ha)
$826 AUD +GST	PEC	0.16
$1,653 AUD +GST	'Good to Excellent' native vegetation	64

The investigation notes that the PEOF sets a base and higher rate for most IBRA sub-regions in the Pilbara. The PEOF describes how rates are determined, based on the level of biodiversity protection in the region, and cumulative impacts to environmental values, including high quality vegetation and the conservation of significant-species habitat:

> A base rate applies for impacts to native vegetation in good to excellent condition, which may include impacts to fauna habitat.
>
> A higher rate may apply for impacts to some types of specialised environmental values, including but not limited to impacts on:
>
> - riparian vegetation
> - Threatened or Priority Ecological Communities
> - important vegetation types
> - specialised fauna habitat.[157]

The higher rate per hectare for clearing of the Burrup Peninsula rock pile PEC ($1653) is in line with higher rate for clearing in the Roebourne IBRA sub-region, set by the PEOF.[158]

As the PEOF does not set a base rate for Roebourne, it appears the EPA has applied the base rate for the Hamersley region for the contribution per hectare of 'Good to Excellent'

[157] https://www.wa.gov.au/service/environment/business-and-community-assistance/program-pilbara-environmental-offsets-fund
[158] Ibid.

native vegetation cleared for the proposal. As Hamersley's higher rate is equivalent to Roebourne's this is considered a valid substitute if the lower rate was applied.

The investigation notes that the proponent's Environmental Offsets Report (March 2021) states that it will apply the higher rate to the entire 64 ha:

> the Project Proponent proposes the provision of an environmental offset at a rate of $1,653/ha for the following activities:
>
> - clearing of conservation significant vegetation including Priority Flora and PECs,
> - fauna habitat potentially utilised by EPBC Act listed species, and
> - clearing of rest of the vegetation in Good to Excellent condition.[159]

We also note that the proposal is still being assessed as a Control Action under the EPBC Act, and that the Commonwealth may be considering offset requirements under that Act.

Finally, the EPA has recommended the proponent be required to provide a financial contribution to the PEOF, for implementation of offset projects preferably located in Murujuga. We note that the while the ERD does not provide any detail on offsets proposed, MAC has requested that any development within Murujuga implement locally based offset projects. Based on the findings of the investigation, we consider that the EPA's recommended conditions in this regard are adequate, and we support the implementation of biological offsets within the Murujuga region as far as practical.

[159] Cardno (2021) Environmental Offsets Report, page 9

4 Other matters

Cumulative impact of industry in Murujuga

An appellant submitted that an Environmental Protection Policy (EPP) or similar be established to manage the cumulative effects on sea, country, and airshed of Murujuga to manage the unique environmental assets; and the EPP should state that there must be no additional industries adjacent to the Burrup area and require that all polluting industries are removed from this area.

The EPA advised that Report 1705 provided other advice to the Minister in relation to Murujuga (See Section 6 on page 90). In the other advice, the EPA recognises that there is a potential for industry and other activities located within Murujuga to impact on the Murujuga marine, terrestrial and airshed environments, and further that these issues are beyond the control of any one proponent or agency. The EPA noted the existing legal arrangements and legislation in place to manage and protect the Murujuga Landscape (See Section 6, pages 90-91) and further noted that the MRAS and MRAMP are currently being implemented.

The EPA advised that to support the existing measures to manage impacts to Murujuga, there is a need for the State Government to establish an overarching and strategic environmental management framework, such as an Environmental Protection Policy (EPP) under Part III of the EP Act or other relevant policy and guidance instruments, to strategically manage the potential for cumulative effects on the sea, country and airshed of Murujuga (See Section 6 on page 91).

As above, the EPA further advised in Report 1705 that it considers that an overarching strategic approach to managing the Murujuga sea, country and airshed would provide a mechanism for protecting the marine and air environment and cultural values (including ethnographic values) from cumulative effects.

Alternatives

Two appellants raised concerns about the location of the proposal and contend that the proposed urea plant should have been located elsewhere, or specifically, within the Maitland Strategic Industrial Area (SIA).

One appellant contends that it is not necessary to use methane in the production of urea.

In response, the EPA advised that it is required to assess proposals which are referred to it, in the location in which they are proposed. This means it is out of the EPA's scope to assess alterative locations for the proposal, or the proposed use of methane in the production process.

Notwithstanding, Report 1705 includes the proponent's consideration of alternative locations for the proposal, including:

- Ashburton North SIA
- Maitland SIA
- Shotts Industrial Park, Collie.

Report 1705 states:

> The Ashburton North SIA was discounted by the proponent due to lack of an adequate gas supply and local port facilities for exporting urea, and the need for approvals and significant capital expenditure for seawater supply and brine disposal.
>
> The Maitland SIA was discounted by the proponent due to the lack of existing infrastructure, the significant amount of clearing that would be required within National Heritage Listed

> (NHL) areas on either West Intercourse Island or the mainland for infrastructure corridors and port facilities, as well as potential impacts to Matters of National Environmental Significance (MNES).
>
> The Shotts Industrial Park in Collie option was determined by the proponent not to be feasible due to the absence of readily accessible natural gas, a long-term commercially viable coal supply for the proposal as an alternative source of energy, a seawater circulation system, as well as the need to use water from Wellington Dam.[160]

In respect of the location of future activities on Burrup Peninsula, the EPA noted that future activities and development located on the Burrup Peninsula should assess compatibility with the protection of the key values of Murujuga and its surrounds. The EPA further advised that, as it has done with past and the current proposal, it will scrutinise future activities and future proposals which are referred to it against their potential impacts upon key values of significance.

Notwithstanding this, the EPA also noted:

> The EPA considers that the values of the sea and land environments of Murujuga and its surrounds are unique environmental assets of global significance that require a cautious approach. The EPA notes that future activities and developments should assess compatibility with the protection of values within Murujuga and its surrounds. The EPA considers that there is an opportunity to strengthen the protection of Murujuga through avoidance of activities and development proposals that could use alternative locations, for example, the Maitland Industrial Estate.[161]

On alternatives to urea production, the EPA advised that it assesses proposals which are referred to it in the form in which they are referred.

World heritage nomination

The EPA's consideration of the impact to cultural heritage values – both direct (relocation of heritage sites) and indirect (impacts to rock art from air emissions) are discussed previously in this report.

Appellants also raised concerns about the World Heritage nomination of Murujuga, and the proposal's potential impact on this listing. Appellants contend that the EPA did not consider this, the EPA's decision is contrary to the WA Government's commitment to protect and preserve Murujuga and to promote the World Heritage listing, and industrial development on the Burrup will jeopardise the potential listing.

In response to these concerns, the EPA advised that it recognises the World Heritage nomination for the Murujuga Cultural Landscape and the diverse collection of rock art.

The EPA considered the cultural values of the Murujuga Cultural Landscape that are likely to be relevant during the World Heritage listing assessment process in its assessment within the air quality, social surroundings and holistic assessment.

The EPA advised:

> … the World Heritage nomination/listing is however an independent process. That process does not require the EPA to delay its assessment pending the World Heritage nomination outcome, or determine the outcome of the EPA's assessment process. In the meantime as the nomination process continues, the EPA remains responsible to assess the impacts of the proposal in line with its responsibilities under the EP Act. As above, this has included consideration of many similar matters to what the World Heritage nomination process will also consider, in particular the cultural values of the Murujuga Cultural Landscape.

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[160] EPA, Report and Recommendations on the Perdaman Urea Project, Report 1705, September 2021, page 4.
[161] Ibid, page viii.

> The EPA gave consideration to the matters relevant to the precautionary principle and intergenerational equity when assessing the potential risk to cultural heritage values. The EPA adopted a cautious, proportional response which will achieve the outcome of ensuring that the proposal does not impact on the Murujuga rock art.[162]

Conflict of interest

One appellant raised concerns about MAC, and its potential conflict of interest. The appellant contended that MAC is constrained under the Burrup and Maitland Industrial Estates Agreement (BMIEA) and by the funding agreements with Woodside and other proponents, and therefore its agreement on the relocation of heritage sites does not represent Free Prior and Informed Consent.

The appellant also suggested that MAC is not a Prescribed Body Corporate and was not established as a decision-making authority for the provision of consent for industrial development.

The EPA advised that it assessed the proposal against its objectives for social surroundings, consistent with other EPA assessments, and with the EPA framework and guidance for assessment of proposals. It is also consistent with the EP Act, which prescribes that, for the purpose of assessing proposals, the aesthetic, cultural, economic and social surroundings are relevant to the extent that they *directly* affect or are affected by *physical and biological surroundings*.

The EPA advised:

> … any process that requires the demonstration of Free, Prior and Informed Consent of Traditional Owners and custodians is a separate, independent process to the EPA's assessment. In the meantime, the EPA remains responsible to assess the impacts of the proposal in line with its responsibilities under the EP Act. This has included consideration the cultural values of the Murujuga Cultural Landscape, and consideration of cultural heritage matters which are directly affected by physical and biological surroundings.
>
> As part of its assessment, the EPA consulted with the MAC and considered its views. Following this, as a result of its assessment, the EPA recommended Ministerial conditions that ensure the MAC have an ongoing consultation role regarding management of cultural heritage. The EPA advises it believes this role is consistent with the cultural significance of rock art and MAC's role in representing the Traditional Owners of Murujuga. The EPA also advises that it believes it is unlikely that this consultation role will be undermined by the constraints which the appellants believe may exist, and that the formal consultation role may in fact tend to mitigate against some of those constraints.
>
> The EPA also advises that it did not rely on any MAC agreement, as this would be potentially inconsistent with the EPA's statutory responsibility to assess social surrounds impacts itself.
>
> Neither did the EPA recommend any ongoing decision-making role for MAC, or any future requirement for agreement with MAC, as this could potentially lead to conditions which are not legally valid. Therefore the EPA advises that it is unlikely that the EPA's assessment and recommendations were undermined by the constraints which the appellants believe may exist.[163]

Downstream fertiliser use

One appellant raised concern about the urea produced at the proposal being supplied to the domestic market. They contend that the control of potential impacts of fertilisers on waterways is inadequate.

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[162] EPA, Response to Appeal 034/21, 3 November 2021, page 20.
[163] Ibid, pages 29-30.

In response, the EPA advised:

> The location and amount of any use in WA of the urea fertiliser produced by the Perdaman Urea Project does not form part of the proposal. The EPA advises that any Part IV assessment of the potential impacts of fertiliser use on WA waterways, coastlines etc would be dependent on knowing the location and amount proposed as part of a particular proposal (or cumulative effects of more than one proposal). The EPA has therefore not assessed these potential impacts at this time. The EPA notes however that pollution from downstream fertiliser use is able to be considered by the EPA and other agencies under other regulatory and policy regimes, and may also considered by the EPA under Part IV if relevant to a particular proposal.[164]

[164] EPA, Response to Appeal 034/21, 3 November 2021, page 33.

Appendix 1 List of appellants

Janet Hummerston	034/21.001
Dianne Fruin	034/21.002
Mary Gray	034/21.003
Linda de Boulay	034/21.004
Celine Lai	034/21.005
Professor Jaynie Anderson	034/21.006
Friends of Australian Rock Art (Inc)	034/21.007
Eileen Whitehead	034/21.008
Susan M Swain	034/21.009
David Hummerston	034/21.010
Kathy Fenner	034/21.011
Dr John L Black	034/24.012
Ian Fletcher	034/21.013
Dr Janet Fletcher	034/21.014
Professor Carmen Lawrence	034/21.015
350 Boorloo Perth	034/21.016
Robert Day	034/21.017
Conservation Council of Western Australia	034/21.018
Pam Nairn	034/21.019
Pamela Fruin	034/21.020