Northern Territory Environment Protection Authority

ASSESSMENT REPORT 88

LEE POINT MASTER-PLANNED URBAN DEVELOPMENT
Defence Housing Australia

October 2018

Environmental impact assessment process timeline

Date	Progress stage
24/08/2015	Receipt of Notice of Intent (NOI)
18/01/2016	NT EPA decision - Environmental Impact Statement (EIS)
23/04/2016	Draft Terms of Reference (ToR) released for public comment
20/05/2016	Final ToR issued to proponent
18/11/2017	Draft EIS released for public comment for 12 weeks
8/02/2018	NT EPA direction to prepare EIS Supplement
3/08/2018	EIS Supplement received
30/10/2018	Assessment Report issued

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30 October 2018

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Abbreviations and glossary

Advisory bodies	Agencies having administrative responsibilities in respect of the proposed action
DENR	Department of Environment and Natural Resources
Draft EIS	Draft Environmental Impact Statement
DCA	Development Consent Authority
EA Act	*Environmental Assessment Act*
EAAP	Environmental Assessment Administrative Procedures
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
Environment	All aspects of the surroundings of man including the physical, biological, economic, cultural and social aspects (Section 3 of the *Environmental Assessment Act*)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
ESD	Ecologically Sustainable Development
Minister for Environment	Australian Minister for the Environment
NOI	Notice of Intent
NT EPA	Northern Territory Environment Protection Authority
Responsible Minister	Northern Territory Minister for Infrastructure, Planning and Logistics
The Minister	Northern Territory Minister for Environment and Natural Resources
The Proposal	Lee Point Master-planned Urban Development
The Proponent	Defence Housing Australia
The Supplement	Supplement to the Draft EIS
the/this Report	Assessment Report 88, for the Lee Point Master-planned Urban Development
TPWC Act	*Territory Parks and Wildlife Conservation Act*

Summary and recommendations

Environmental impact assessment (EIA) is a process for identifying potential environmental impacts and risks of a proposed action, evaluating the significance of those impacts and risks and determining appropriate avoidance, minimisation/mitigation measures to reduce those potential impacts and risks to acceptable levels.

This Assessment Report (the Report) evaluates the environmental impacts and risks associated with the Lee Point Master-planned Urban Development (the Proposal) proposed by Defence Housing Australia (the Proponent). This Report marks the end of the assessment process by the Northern Territory Environment Protection Authority (NT EPA).

This Report is provided to the Northern Territory Minister for Environment and Natural Resources (the Minister) who must provide the report to the Minister for Infrastructure, Planning and Logistics (the Responsible Minister) to be taken into account in decisions made by the Territory Government. This Report is not intended to provide an environmental approval.

The Proposal is located approximately 14 km north-east of Darwin on the northern edge of residential suburbs Muirhead and Lyons. The Proposal would provide for a range of residential types, tourist and commercial components as well as community services (including a primary school) and open space areas. The Proposal would be constructed over a period of approximately seven years.

The NT EPA has assessed the Proposal at the level of an Environmental Impact Statement (EIS) under the *Environmental Assessment Act* (EA Act).

The NT EPA initially identified that assessment was required due to potentially significant environmental impacts and risks to:

- listed threatened and migratory species
- the Casuarina Coastal Reserve
- cultural heritage
- land and water from erosion and sedimentation
- future residents from biting insects.

In making this Report, the NT EPA had regard to information provided by the Proponent (Draft EIS and Supplement, collectively referred to as the EIS), public submissions on the Draft EIS, advice from specialists within the NT Government, and relevant guidelines and standards.

The NT EPA assessed the Proposal against the NT EPA's key environmental factors and objectives for Social, economic and cultural surroundings, Human health and Terrestrial flora and fauna.

The NT EPA identified that the key potential impacts which relate to the social and cultural values onsite and in the adjacent Casuarina Coastal Reserve, including the Reserve's iconic value for turtle nesting and migratory shorebirds and the community's expectations for their tropical lifestyle and amenity. The avoidance and mitigations proposed by the Proponent are considered adequate for ensuring natural values of Casuarina Coastal Reserve continue to be available for visitors.

The NT EPA identified a potential conflict of siting an urban development near an existing wastewater treatment facility, with potential for offensive odours to impact on future resident's lifestyle and amenity. Similarly, potential health impacts to residents from proximity to breeding habitat for biting insects is also of concern. The NT EPA has recommended that future residents of the potentially affected lots are to be notified through a Caution Notice (or similar) on the property titles.

The NT EPA considers that the Proposal is likely to have a significant residual impact to the endangered black-footed tree-rat that may extend beyond the Proposal boundary. The Proponent's commitment to provide offsets to compensate for the significant residual impacts will need to contribute to the conservation of the species, and the NT EPA recommends that the offsets are considered and approved by the Department of Environment and Natural Resources in consultation with the Federal Department of Environment and Energy.

The NT EPA has carefully considered all these issues and has recommended that the development could proceed if all the NT EPA's recommendations are implemented. The NT EPA emphasises that the environmental commitments, safeguards and recommendations detailed in the EIS, this Assessment Report and in the final management plans, must be implemented to deliver acceptable environmental outcomes. Furthermore, the Proponent would be required to monitor the performance of proposed mitigation and management measures. The results of the monitoring program should be used to further refine and ensure that key environmental values are adequately protected.

The NT EPA makes 15 recommendations as an outcome of the EIA of the Proposal. These recommendations are for the Proponent and decision makers to consider in future approval processes and for the execution of the Proposal.

List of recommendations

Recommendation 1

The Proponent shall ensure that the Lee Point Master-planned Urban Development is implemented in accordance with all environmental commitments and safeguards:

- **identified in the EIS for the Lee Point Master-planned Urban Development (Draft Environmental Impact Statement and Supplement)**
- **recommended in this Assessment Report 88**
- **to the satisfaction of the relevant regulator.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent. In addition all the NT EPA recommendations should be implemented and where there is conflict between the EIS commitments and the NT EPA recommendations the latter will take precedence.

Recommendation 2

The Proponent should provide written notice to the Northern Territory Environment Protection Authority and the Responsible Minister if it alters the Lee Point Master-planned Urban Development and/or commitments, safeguards or mitigation measures described in the Environmental Impact Statement in such a manner that the environmental significance of the action may change, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

Recommendation 3

That approvals for the proposal should include a condition that requires the Proponent to develop and implement a monitoring program to quantify impacts from the Proposal on local shorebirds. The program is to be designed in consultation with Flora and Fauna Division, Department of Environment Natural Resources, and Wildlife and Heritage Division, Department of Tourism and Culture Parks, and implemented before commencement of construction activities. Results and annual updates from the program should be made publicly available on the internet.

Recommendation 4

That development applications for development stages adjacent to Casuarina Coastal Reserve (Stages 2, 3, 4 and 5 shown on Figures 2 and 3) should include details of how the Western Australian Guideline for Protecting Marine Turtles from Light Impacts (WA EPA, 2010) have been incorporated.

Recommendation 5

That development approvals for the Proposal should include conditions that require Western Australian Guideline for Protecting Marine Turtles from Light Impacts (WA EPA, 2010) to be adequately incorporated.

Recommendation 6

That approvals for each development stage of the Proposal should include conditions that require the dust, noise and vibration management plans in the Construction Environmental Management Plan to be developed in consultation with community stakeholders and include processes for:

- **communicating anticipated impacts to occupants**
- **reporting of, and responding to, complaints**
- **identifying unexpected and unacceptable impacts to occupants and amending construction practices as appropriate.**

The Construction Environmental Management Plan should be developed and implemented prior to construction commencing, be made publicly available on the websites of the Proponent, the construction company and relevant authorities, and include scope for regular reviews and updates including the schedule for construction stages.

Recommendation 7

That construction of the Proposal should comply with the *Northern Territory Environment Protection Authority Noise Guidelines for Development Sites*, and the *Northern Territory Environment Protection Authority Noise Management Framework Guideline*.

Recommendation 8

That prior to issuing of titles, the Proponent should ensure that a Caution Notice (or similar as agreed with the responsible authority under the Planning Act) is lodged with the Registrar General under Section 34 of the Titles Act for all lots within a 1.7 km buffer from the Leanyer Sanderson Wastewater Treatment Facility.

The Caution Notice (or similar) is to notify potential developers and landholder/s that the lot:

- **occurs within the identified odour buffer for the Leanyer Sanderson Wastewater Treatment Plant**
- **may be subject to occasional odours associated with the operation of the Leanyer Sanderson Wastewater Treatment Plant.**

Recommendation 9

That development approvals for the Proposal should have conditions that ensure stormwater discharges from the development terminate at a daily flushed tidal area or frontal beachline and are constructed to the satisfaction of the Medical Entomology Unit, NT Department of Health, on behalf of the final drain maintenance authority. All discharge drains, including the end point of the drains, should be excised as separate lots and appropriately zoned to allow the drain owner to carry out expedient maintenance.

Recommendation 10

That development approvals for the Proposal should have conditions that require stormwater treatment structures, including potential detention storage

and water features or lakes, to be designed and constructed to be free from potential mosquito breeding sites to the satisfaction of the Medical Entomology Unit, NT Department of Health, on behalf of the final maintenance authority.

Recommendation 11

That approvals for the Proposal should require a minimum 50 m open wind buffer between the western edge of the 2CRU residential and commercial area and the monsoon forest boundary (or edge of the escarpment if this is closer). The wind buffer should only be planted with tall-growing, long-lived, hardy native trees, with a suggested mature tree crown coverage of approximately 10%.

Recommendation 12

That the Responsible Minister should include a condition on future Development Permit(s) requiring that the Proponent ensure any lots in Muirhead North within the biting insect buffer, as shown in Figure 4:

- **have a minimum area of 4000 m^2**
- **cannot ever be subdivided.**

Recommendation 13

That prior to issuing of titles, the Proponent should ensure that a Caution Notice is lodged with the Registrar General under Section 34 of the *Titles Act* (or similar as agreed with the responsible authority under the *Planning Act*) for all lots located within the identified biting insect buffer (in consideration of Recommendation 12 above).

Each Caution Notice (or similar) should indicate the following:

- **that the lot occurs within the biting insect buffer**
- **that the lot is subject to seasonal mosquito and biting midge pest problems arising from the adjacent mangroves of Buffalo Creek and tidal marshes and mangroves in Leanyer Swamp.**

Recommendation 14

That approvals for the Proposal should require that the Proponent demonstrate consultation with, and support by, Flora and Fauna Division of the Department of Environment and Natural Resources, in relation to any offset or offset management plan required by the Australian Government with respect to the significant residual impact to the black-footed tree-rat (*Mesembriomys gouldii gouldii*).

Recommendation 15

That approvals for Muirhead North should provide adequate protection for the monsoon rainforest patch and habitat for the black-footed tree-rat. In particular, it is recommended that any approval require:

- **a vegetated buffer of at least 25 m around the monsoon rainforest patch in Muirhead North**

- **the retention of native vegetation in the 'Drainage/Conservation Area' (Figure 4), excluding the 1.85 ha 'Detention Storage'**
- **rezoning the retained area of native vegetation as CN conservation under the NT Planning Scheme.**

1 Introduction

1.1 Purpose of this report

Defence Housing Australia (the Proponent) proposes the Lee Point Master-planned Urban Development (the Proposal) comprising land clearing, earthworks and excavation for the purpose of creating land suitable for residential housing, tourism/commercial infrastructure and community facilities, including internal and connecting roads and utilities.

The Proposal has been assessed by the Northern Territory Environment Protection Authority (NT EPA) at the level of an Environmental Impact Statement (EIS) under the *Environmental Assessment Act* (EA Act). The NT EPA has prepared this Assessment Report (this Report) in accordance with section 7(2)(g) of the EA Act and clause 14(3) of the Environmental Assessment Administrative Procedures (EAAP).

The purpose of this Report is to ensure that matters with the potential to affect the environment to a significant extent are fully examined and reported. This Report is provided to the Northern Territory Minister for Environment and Natural Resources (the Minister), who must provide it to the Minister for Infrastructure, Planning and Logistics who is primarily responsible for authorising the Proposal under the *Planning Act* (the Responsible Minister).

This Report it is not intended to provide an environmental approval although it will guide the decisions and conditions of approvals, authorisations and other matters.

1.2 Scope of the assessment

The NT EPA assessed the potentially significant environmental impacts and risks associated with the Proposal in accordance with the NT EPA's factors and objectives and requirements under the EA Act. The matters relating to the environment that the NT EPA considered necessary to be dealt with in the EIS for the Proposal were identified in the Terms of Reference (NT EPA, 2016), which were developed in accordance with clauses 8(3) to 8(6) of the EAAP.

Based on the Notice of Intent, the NT EPA identified the following potential environmental impacts and risks that contributed to the decision to assess the Proposal at the level of an EIS:

- potential impact to listed threatened species and migratory shorebirds
- potential impact to the Casuarina Coastal Reserve due to weeds, fire and pest species
- potential impact to cultural heritage items
- potential for ongoing impact associated with erosion and sedimentation
- land-use conflict and health risks associated with the development being in close proximity to biting insect breeding sites.

1.3 Information before the NT EPA

In making this Report, the NT EPA had regard to:

- the Notice of Intent (NOI)

- the Terms of Reference (ToR)
- the Draft EIS
- the Supplement to the Draft EIS
- comments from NT Government agencies on the Draft ToR, Draft EIS and Supplement to the EIS
- comments from the public on the draft ToR and the Draft EIS
- a site visit conducted by NT EPA members with the Proponent
- updated maps of the masterplan provided 16 October 2018
- technical and other reports which are noted in the References (Chapter 7).

1.4 Approval and regulatory framework

The Proposal will require approval and regulation by the NT Government and the Australian Government. The framework for approval and regulation of the Proposal is provided at Chapter 8 of the EIS and is summarised below, with an emphasis on the obligations and requirements of the NT Government.

The NT EPA provides this Report to the Minister. The Minister is required to provide a copy of this Report to the Responsible Minister, together with any written comments made by the Minister in relation to this Report. If the Minister makes a comment in relation to this Report, the Minister must comply with reporting obligations to the NT EPA, under section 8B of the EA Act.

1.4.1 Primary approval

The Responsible Minister, taking into consideration this Report, will decide whether to approve the Proposal under the *Planning Act* and if so, the conditions that may be applied. The *Planning Act* is the primary legislation for approving urban development proposals in the Northern Territory.

Section 8A(2) of the EA Act requires the Responsible Minister to give the NT EPA notice of the decision as soon as practicable, but within seven days, after making the decision. Alternatively, if the decision by the Responsible Minister is contrary to this Report, the Responsible Minister must comply with reporting obligations to the NT EPA and the Legislative Assembly in accordance with section 8A(3) of the EA Act.

The making of this Report and providing it to the Minister marks the completion of the examination of the EIS by the NT EPA. The EIS and supporting documents can be viewed on the NT EPA website at: https://ntepa.nt.gov.au/environmental-assessments/register/lee-point-master-planned-urban-development.

1.4.2 Environment Protection and Biodiversity Conservation Act 1999

The Proposal (EPBC 2015/7591 – Lee Point Master-planned Urban Development) is a controlled action and requires assessment and approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) before it can proceed. The delegate for the then Australian Minister for the Environment decided that the Proposal would be assessed at the level of Public Environment Report (PER). The bilateral agreement does not apply as the Proponent is a Commonwealth entity. The Proposal is being assessed separately by the NT EPA and Australian Government, however the assessment processes under the EA Act and EPBC Act have been aligned to reduce duplication. The Australian Minister for

the Environment and Energy will consider the PER and decide whether to approve the Proposal under the EPBC Act.

2 The Proposal

2.1 Proponent

The Proponent is Defence Housing Australia (ABN: 72 968 504 934), a Commonwealth Government business that provides housing for Department of Defence members and their families. Defence Housing Australia (the Proponent) stated that it has previously developed properties in the Australian Capital Territory, Queensland and the Northern Territory.

The Proponent stated that it has not been subject to any proceedings under Commonwealth, State or Territory law with respect to the protection of the environment or the conservation and sustainable use of natural resources.

2.2 Proposal description

2.2.1 Location

The Proposal is located adjacent to the northern suburbs of Darwin, approximately 14 km north-north-east of the Darwin central business district (Figure **1**). The surrounding land uses include undeveloped land and Lee Point to the north, Commonwealth land and Buffalo Creek to the east, residential suburbs and Royal Darwin Hospital to the south, and Casuarina Coastal Reserve (including Casuarina Beach) to the west.

The Proposal area includes two properties (2 Control and Reporting Unit (2CRU) and Muirhead North). 2CRU (Lot 4873) is approximately 81 ha and is currently vacant Commonwealth land to the west of Lee Point Road. Muirhead North (Lot 9370) is approximately 51 ha and comprises vacant Crown Land to the east of Lee Point Road (Figure 1).

2.2.2 Proposal components

The Proposal is a master-planned urban development (Figure 2) to provide:

- residential housing options for an estimated 3000 residents comprising a mix of ground-level dwellings, rural residential lots and apartments
- tourist, recreation and commercial components including approximately 200 to 300 room tourist accommodation and commercial and retail businesses
- services, community purpose and open space:
  - one primary school and community centre
  - internal road network, connecting to Lee Point Road
  - pedestrian and bicycle paths
  - essential infrastructure, expanding existing electrical, reticulated water, reticulated sewerage (no septic proposed)
  - stormwater management and detention basins

- esplanade parkland developed along the western boundary of the site adjoining the Casuarina Coastal Reserve, including pedestrian/cycle trails
- active recreation reserve (2.46 ha) developed adjacent to the school site/community centre on the eastern side of Lee Point Road. The reserve would incorporate the Konfrontasi military heritage site and include sports facilities (such as an AFL/cricket oval)
- conservation area (11.24 ha) incorporating a 0.88 ha rainforest patch in Muirhead North
- park and open space area (2.57 ha) incorporating the 'Bunkers' in 2CRU.

2.2.3 Construction

Construction of the Proposal will be undertaken in seven stages (refer Figure 2 for staging sequence). Clearing and civil works would be the first aspect of the Proposal to commence for each stage, with buildings and other facilities for that stage constructed subsequently. The total clearing footprint of the Proposal is 110 ha. Clearing would be staged in line with construction staging.

The Proposal would proceed with the aim of releasing one stage each year, with a total estimated construction timeframe of seven years. The staging and timing of each part of the Proposal would be subject to planning approvals and commercial assessment of the property demand.

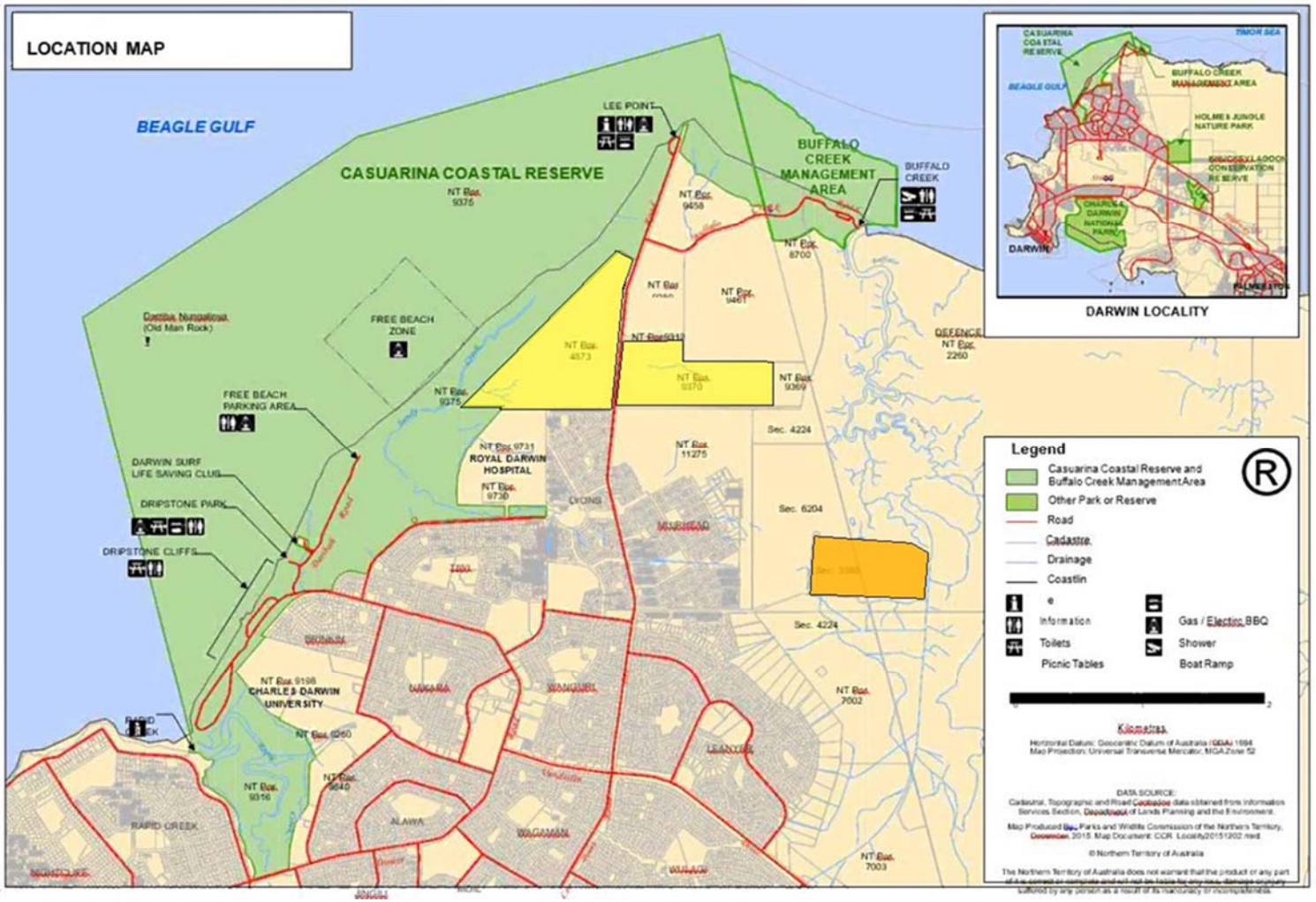

Figure 1. Map of the location of the Proposal (yellow) in relation to the Casuarina Coastal Reserve (green) and the Leanyer Sanderson Wastewater Treatment Plant (orange). Note: the suburb of Muirhead is currently being developed to the southern boundary of the Proposal.

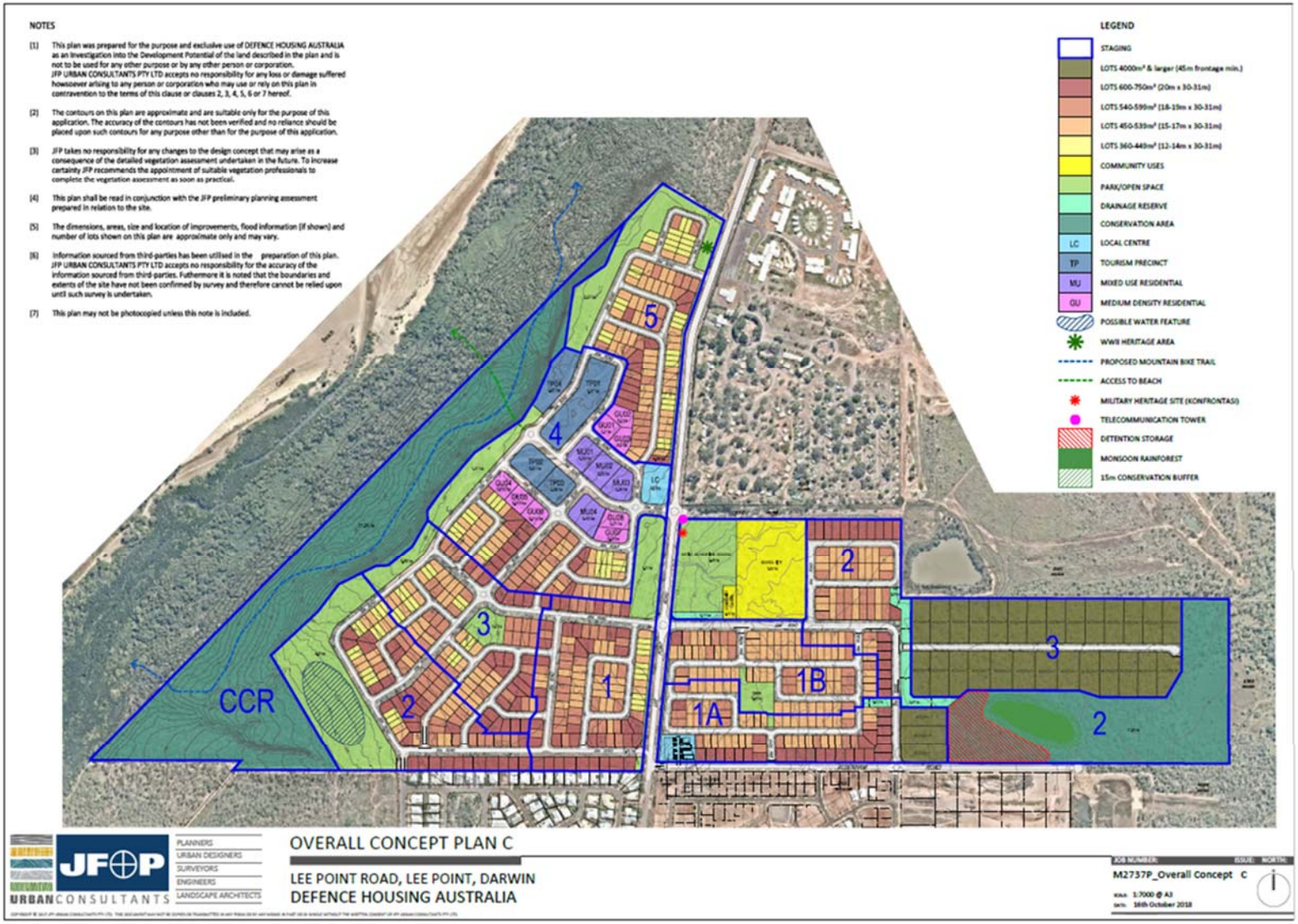

Figure 2. Overall Lee Point Master-planned Urban Development Concept Plan (provided by the Proponent - 16 October 2018)

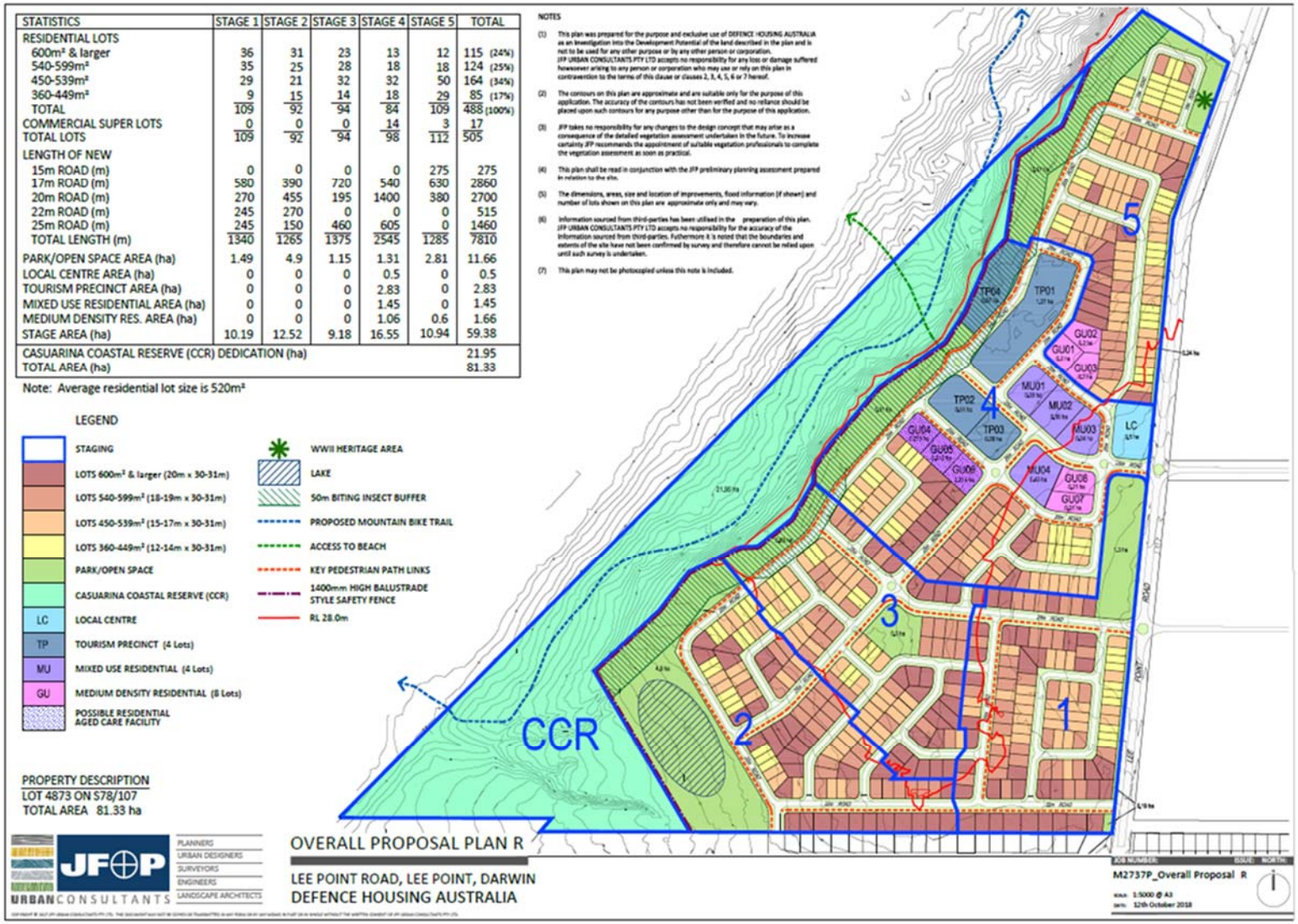

Figure 3. Overall 2CRU Plan (provided by the Proponent - 16 October 2018)

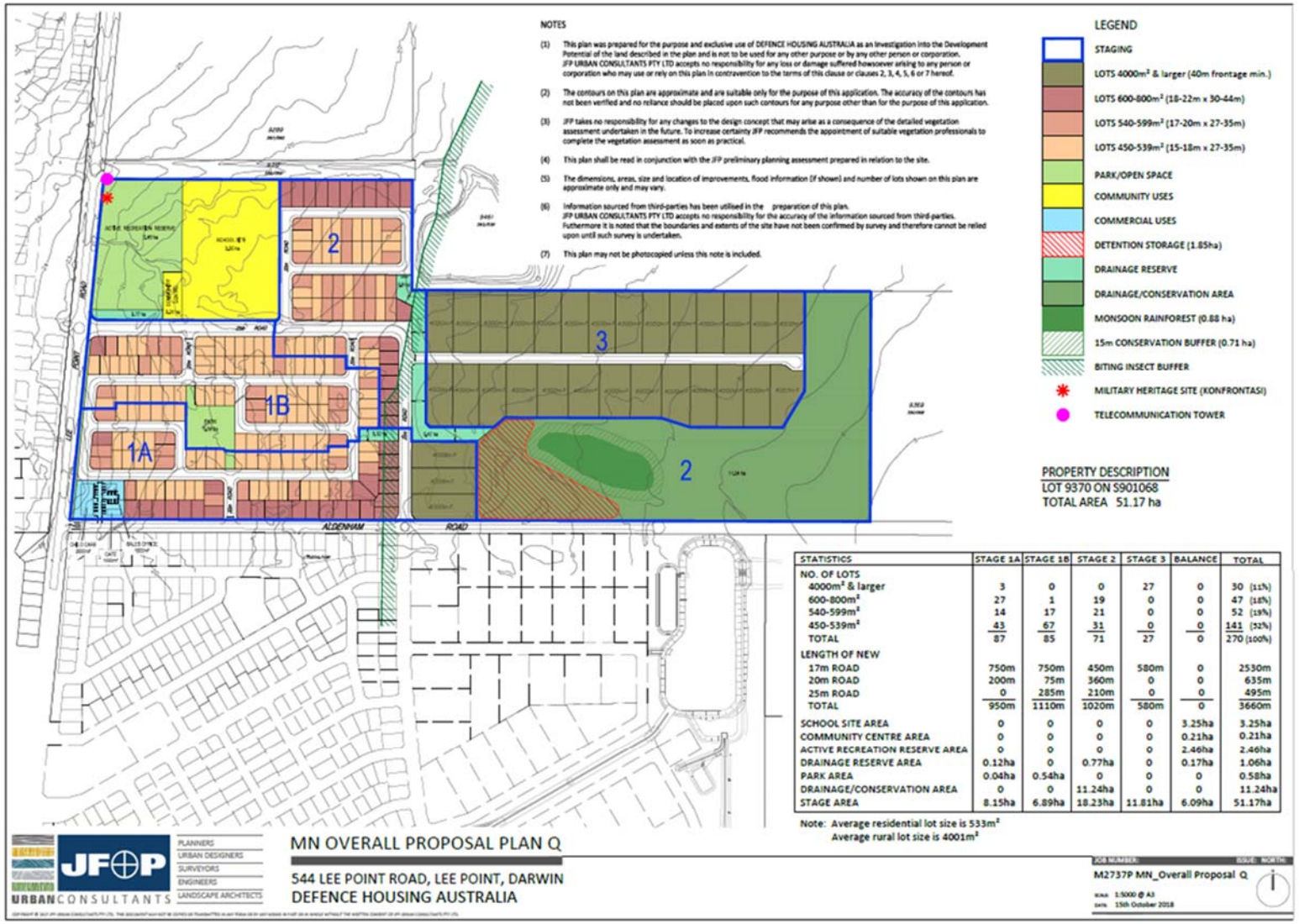

Figure 4. Overall Muirhead North Plan (provided by the Proponent - 16 October 2018)

3 Consultation

The Draft EIS was made available for public comment for 12 weeks, from 18 November 2017 to 1 February 2018. A total of 25 submissions were received. These included 10 from NT Government agencies and 15 from members of the public.

All submissions were forwarded to the Proponent. The issues raised in the submissions and the Proponent's responses were detailed in the Supplement (Ecology and Heritage Partners Pty Ltd, 2018).

The Proponent reported a range of additional consultation activities with stakeholders including:

- two workshops with relevant government agencies and service authorities to inform and seek feedback on the masterplan
- one community infrastructure workshop with identified stakeholders, to identify community and social infrastructure requirements
- one community workshop to seek feedback from the local community
- consultation with representatives of the Larrakia people
- consultation with the Department of Tourism and Culture (Parks, Wildlife and Heritage Division).

3.1 Consultation by the NT EPA

The NT EPA consulted with NT Government agencies during the development of this Report. In making this Report, the NT EPA had particular regard to whether the Proponent adequately addressed the potentially significant environmental impacts and risks raised in comments by the public and NT Government agencies.

The NT EPA has considered all environmental issues raised by the community and stakeholders in making this Report.

3.2 Public submissions

Fifteen submissions from members of the public were received. Frequent comments (raised in in at least 40% of submissions) related to:

- impacts to threatened fauna (yellow-spotted or floodplain monitor and black-footed tree rat) and migratory birds
- impacts to biodiversity from cats and dogs
- impacts from pollutants entering Buffalo Creek and Sandy Creek
- the need for additional housing in the Darwin suburbs.

Other comments (raised by up to 40% of public respondents) are listed below, in descending order of frequency:

- visual impact and amenity (particularly related to Casuarina Coastal Reserve)
- traffic congestion, vehicle speeds and pedestrian and cycle paths
- impacts to existing schools and the need for new facilities

- energy efficiency and climate change
- impacts to biodiversity from removal of vegetation in general, including impacts to monsoon rainforest from altered hydrology, removal of cycads and spread of weeds
- impacts from sea level rise and subsequent inundation of low lying land and coastal areas
- impacts to sawfish (threatened fauna)
- impacts from odour
- changes to flows in Sandy Creek
- impacts to human health from mosquitoes
- the adequacy of consultation
- erosion and sedimentation.

The Proponent provided responses to the issues raised in the public submissions in the Supplement.

The NT EPA considers that consultation by the Proponent has been appropriate for the purposes of EIA, which occurs early in the development of proposals. The NT EPA notes that the Proposal will require further public consultation under the *Planning Act*, with the requirement for a Development Permit for each stage of the Proposal. The NT EPA has made recommendations to ensure future development applications address a range of issues raised in this Report.

4 Key environmental factors

Having regard to the NOI, the EIS, and comments from the public and NT Government agencies during the EIS review, the NT EPA assessed the Proposal for potential impacts on the NT EPA's factors (NT EPA, 2018). The NT EPA identified three key environmental factors that may be significantly impacted by the Proposal (Table 1).

Table 1. Key environmental factors

Theme	Key Environmental Factor
People and communities	1. Social, economic and cultural surroundings
	2. Human health
Land	3. Terrestrial flora and fauna

The NT EPA has considered the importance of other environmental factors during the course of its assessment. Those factors that were not identified as key environmental factors, or that were adequately addressed through consideration of the above factors, are summarised at Appendix 2 of this Report.

The key environmental factors are discussed in Section 5 of this Report. The description of each factor shows why it is relevant and how it would be affected by the Proposal. The assessment of each environmental factor concludes with a judgement by the NT EPA whether or not the Proposal can meet the NT EPA's environmental objective for each factor, with implementation of recommended management measures where required.

5 Assessment of environmental factors

This section evaluates the Proposal and presents the views of the NT EPA on the environmental acceptability of the Proposal. The environmental acceptability of this Proposal was considered with regard to the principles of Ecologically Sustainably Development (ESD), through analysis of:

- the Proposal (particularly components or activities that are likely to significantly impact the environment)
- the existing environment (particularly environmental values and sensitivities)
- the potential environmental impacts and risks of the Proposal and the evaluation of the significance of those impacts and risks
- the proposed avoidance or minimisation/mitigation measures to reduce potential impacts and risks to acceptable levels and to meet NT EPA objectives.

The NT EPA also had regard to the principles of ESD articulated in the Intergovernmental Agreement on the Environment (Australian Government, 1992):

- the precautionary principle
- the principle of intergenerational equity
- conservation of biological diversity and ecological integrity
- improved valuation, pricing and incentive mechanisms such as the "polluter pays" principle.

The NT EPA has summarised its consideration of ESD in Appendix 3.

Conclusions and recommendations made in this Report are derived from consultation on the EIS with advisory bodies, the NT EPA's examination of the EIS (comprising the Draft EIS and the Supplement), and responses from the Proponent to comments received during the EIS exhibition period. Recommendations are made in this Report to add, emphasise or clarify any commitments made by the Proponent, where the proposed avoidance or minimisation/mitigation measures are considered insufficient, or where a safeguard or intervention is deemed particularly important.

In this Report, the recommendations (in **bold**) are preceded by text that identifies issues and undertakings associated with the Proposal. For this reason, the recommendations should not be considered or read in isolation.

The NT EPA acknowledges that detailed design, construction and operational plans for the Proposal have not been finalised. Minor changes are expected in the design and specifications of the Proposal following the conclusion of the EIA process. It will be necessary for approval mechanisms to accommodate subsequent changes to the environmental safeguards described in the EIS and recommendations in this Report.

If the Proponent is able to demonstrate that any changes are unlikely to significantly increase potential impacts on the environment, an adequate level of environmental protection could be achieved by modifying the conditions of relevant statutory approvals governing the Proposal. Otherwise, further environmental assessment may be required.

Recommendation 1

The Proponent shall ensure that the Lee Point Master-planned Urban Development is implemented in accordance with all environmental commitments and safeguards:

- **identified in the EIS for the Lee Point Master-planned Urban Development (Draft Environmental Impact Statement and Supplement)**
- **recommended in this Assessment Report 88**
- **to the satisfaction of the relevant regulator.**

The Northern Territory Environment Protection Authority considers that all safeguards and mitigation measures outlined in the Environmental Impact Statement are binding commitments made by the Proponent. In addition all the NT EPA recommendations should be implemented and where there is conflict between the EIS commitments and the NT EPA recommendations the latter will take precedence.

Recommendation 2

The Proponent should provide written notice to the Northern Territory Environment Protection Authority and the Responsible Minister if it alters the Lee Point Master-planned Urban Development and/or commitments, safeguards or mitigation measures described in the Environmental Impact Statement in such a manner that the environmental significance of the action may change, in accordance with clause 14A of the Environmental Assessment Administrative Procedures.

The remainder of this section identifies and discusses environmental factors and potential impacts and risks to values underlying those factors. The assessment is based on likely significance of impacts and risks, and the Proponent's investigations, studies and commitments to identify, avoid, mitigate, monitor and manage the potentially significant impacts and risks.

For each key environmental factor, the NT EPA assessed whether or not the Proposal is likely to meet the NT EPA's defined environmental objective.

5.1 Social, economic and cultural surroundings

5.1.1 NT EPA objective

To protect the rich social, economic, cultural and heritage values of the Northern Territory.

5.1.2 Environmental values

The NT EPA has identified the following social, economic and cultural values that are relevant to the Proposal:

- the ‘iconic’ status of Casuarina Coastal Reserve relating to recreational and educational experiences, particularly interactions with shorebirds and nesting turtles
- environmental surrounds facilitating the tropical lifestyle and amenity of residents and visitors
- historic and cultural heritage places and items within the Proposal site.

Recreation, education and iconic experiences associated with natural values of Casuarina Coastal Reserve

Users of the Casuarina Coastal Reserve expect to be able to experience, and continue experiencing into the future, the reserve’s natural values for recreation, education and cultural reasons.

The Proposal is immediately adjacent to Casuarina Coastal Reserve (the reserve) which is used by the public for exercise, walking dogs, bushwalking, mountain biking, beach and water activities, picnics, educational programs (such as turtle hatchling releases) and recreational birdwatching. The reserve receives over 935 000 visits annually, with the majority of visitors being local (Parks and Wildlife Commission of the Northern Territory, 2016). Public submissions confirm that the reserve is important to people.

The reserve is a site of national importance as migratory shorebird habitat and is listed as one of the ‘Best 100 Bird Watching Sites in Australia’ (Taylor, 2013). The reserve’s conservation values for migratory birds are discussed below in Section 5.3.

The reserve provides nesting habitat for three marine turtle species, the olive ridley turtle, the flatback turtle and the green turtle. Monitoring programs indicate Casuarina Beach is a low density nesting site compared to other sites in the NT. However, the significance of turtle nesting at Casuarina Beach is largely derived from the education value and that this is the only beach in Australia to have turtle nesting occurring so close to a major city (Chatto & Baker, 2008). The connection to turtle nesting is strongly valued by the community leading to locals’ views of a unique and ‘iconic’ Darwin experience.

Tropical lifestyle

The tropical climate of Darwin is conducive to an outdoor lifestyle that is valued by residents and visitors to Darwin. This is expressed in the design of tropical homes, featuring open ventilation and natural cooling principles using prevailing breezes and the rapid dispersal of heat. Particular importance is placed on outdoor living areas including verandas, gardens and shaded areas to facilitate a tropical lifestyle.

Residents are likely to have an expectation that the property they occupy allows for outdoor living and enjoyment of the tropical lifestyle, including good air quality.

Heritage and Aboriginal sacred sites

Users of the Casuarina Coastal Reserve expect retention of cultural values for spiritual, educational and tourism purposes. This expectation is supported in public submissions received on the Draft EIS, the Casuarina Coastal Reserve Management Plan and comments from NTG agencies.

Larrakia people are the traditional owners of the Proposal site and currently run cultural tours in the Lee Point area. The Casuarina Coastal Reserve area is

significant for the Larrakia people. Dariba Nunggalinya, or Old Man Rock, is a significant protector ancestor in Larrakia dreamtime. Dariba Nunggalinya is located in the sea approximately 3 km south west of the western extent of the Proposal and can be seen at low tide.

Three species of tree occurring in the project and/or adjacent Casuarina Coastal Reserve - mature Milkwood (*Alstonia actinophylla*), Paperback (*Melaleuca*) and Cycad (*Cycas armstrongii*) - have been identified as having particular cultural significance.

Aboriginal stone scatters are located within the 2CRU portion of the Proposal. No Aboriginal heritage items were identified in Muirhead North.

Items associated with former military conflicts and use of the site by the military are present within the Proposal site. From the 1950s the 2CRU portion of the site was used as a radar and receiving station by the Department of Defence (Defence). By the 1960s, the site had numerous buildings associated with the strengthening of defensive forces during the Konfrontasi conflict.

The site is no longer used as a Defence facility. The northern section of the 2CRU site contains the remains of a missile launching facility and an explosives store referred to as 'the Bunkers'. Remnants of cruciform anti-aircraft battery sites are located in the centre of the 2CRU site.

There is a defensive gun pit surrounded by 44 gallon drums associated with the Konfrontasi period (referred to as the Konfrontasi cruciform), located in Muirhead North adjacent to Lee Point Road (the red asterisk in Figure 2). The remaining structures within the Proposal site are considered to have heritage significance as rare examples of a poorly known conflict period, however they are in poor condition (Crassweller, 2010). The sites are not protected under the *Heritage Act* nor listed on the Commonwealth Heritage List, National Heritage List or inscribed as a World Heritage Place.

5.1.3 Potential impacts

The potential impacts to natural values of the Casuarina Coastal Reserve that may impact on social values, as a result or the Proposal, relate to:

- reduction or loss of recreational activities and enjoyment relating to the presence of rare migratory shorebirds. The potential reduction or cessation of feeding and roosting by shorebirds may occur from increased anthropogenic disturbance or intrusion (including increased presence of dogs and cats)
- reduction or loss of recreational enjoyment and an educational program associated with marine turtle nesting. The potential reduction or cessation of turtles nest at Casuarina Beach may result from increased anthropogenic disturbance, including light pollution from development disrupting turtle nesting.

The potential impacts to values that support a tropical lifestyle include:

- nuisance levels of dust, noise and vibration over a prolonged period during construction, depending on staging, proximity and type of works,.
- exposure to odour emissions due to siting of residences, schools and other land uses within the NT EPA's land use separation distance from existing wastewater treatment facilities.

The potential impacts to cultural heritage include removing the following items within 2CRU:

- remnants of military facilities including Konfrontasi Cruciform anti-aircraft gun position and missile facility which are in poor condition
- scattered Aboriginal stone artefacts.

The proposed new access path (from the main street of 2CRU to Casuarina Beach), and mountain bike trail (within the proposed 2CRU conservation area), have the potential to impact culturally significant trees within the identified area of Aboriginal cultural significance.

The NT EPA acknowledges the potential economic contribution of the Proposal to the Northern Territory, including $350 million to the local economy, provision of temporary full-time employment for up to 964 employees in the construction industry, a further 117 full-time and part time in the hospitality industry and 40 employees in education positions.

5.1.4 NT EPA assessment

Natural Values of the Casuarina Coastal Reserve – migratory shorebirds

The Proposal will increase the number of visitors to the Casuarina Coastal Reserve by an estimated 18 149 each year. This increase is very small (2%) compared to the current, almost one million, visitors each year to the reserve. However, the NT EPA acknowledges the Proposal has the potential to compound anthropogenic influences (including presence of dogs and cats) on the natural values that are important to people, including the natural values that support recreation and educational experiences.

The Proponent, in consultation with the Parks, Wildlife and Heritage Division of the Department of Tourism and Culture (DTC), has recognised potential impacts of uncontrolled intrusion into sensitive locations by designing a new designated beach access point which will avoid disturbance of migratory shorebirds by directing pedestrian traffic away from the known shorebird roosting site. By avoiding or minimising disturbance to birds, it is expected that visitor enjoyment, including birdwatching, can be maintained.

The Proponent has committed to facilitating educational experiences by funding installation of signage at four existing access points to Casuarina Beach as well as the new access point from 2CRU. The signage would include educational material about the significance of the reserve for shorebirds, their migration, key threats and measures for avoiding disturbance (such as keeping dogs on leashes in certain zones to avoid impacts to birds).

The NT EPA considers that the signage will enhance public interest and awareness about the significance of the reserve for birds. Educational signage about shorebirds and the need to minimise disturbance are an effective management tool and have been shown to decrease disturbance rates to shorebirds (Burger 2004 cited in EIS Appendix N). The NT EPA recommends that interpretive signage should also include information to educate the community on the threat to wildlife posed by cats.

The Proponent has committed to providing financial support for a shorebird monitoring program which could be conducted by local bird-watching groups and local residents and visitors. The aim of the program is to quantify potential impacts from the Proposal on the shorebirds. The monitoring program would run for five years

and allow visitors to actively participate in a bird monitoring program and contribute to understanding the significant values of the reserve.

The NT EPA supports the proposed avoidance and mitigation measures to maintain natural values of the reserve for social benefit. The measures proposed by the Proponent are supported by the Parks, Wildlife and Heritage Division and would contribute to the education and ongoing enjoyment of the reserve for birdwatchers and visitors. In addition, the NT EPA makes the following recommendation:

Recommendation 3

That approvals for the proposal should include a condition that requires the Proponent to develop and implement a monitoring program to quantify impacts from the Proposal on local shorebirds. The program is to be designed in consultation with Flora and Fauna Division, Department of Environment Natural Resources, and Wildlife and Heritage Division, Department of Tourism and Culture Parks, and implemented before commencement of construction activities. Results and annual updates from the program should be made publicly available on the internet.

Natural Values of the Casuarina Coastal Reserve – turtle nesting and hatchling release

The NT EPA acknowledges that Casuarina Beach is not a significant turtle nesting site and therefore is unlikely to provide significant conservation value. However, the reserve is iconic as it contains the only turtle nesting beach within a major Australian city. The Casuarina Coastal Reserve has a significant role in educating the public about the conservation of marine turtles and provides visitors with the experience of being involved in the release of hatchling turtles.

In order to protect the iconic status of the reserve and ensure it continues to contribute to people's education about marine turtles, the potential impacts and risks to nesting turtles along Casuarina Beach should be avoided and/or mitigated. The introduction of night time light sources from the development of land adjacent to nesting beaches was identified as a potential impact. The WA EPA guidelines (WA EPA, 2010) refer to instances where light pollution has been demonstrated to disorientate nesting female turtles and hatchlings trying to return to the water.

The Proponent has considered the impacts and risks to nesting turtles and proposes that lighting on buildings above the fourth storey, (taller than vegetation within the Casuarina Coastal Reserve and conservation area), will be designed and installed to avoid light spill on Casuarina Beach, and in accordance with the Western Australian Guideline for Protecting Marine Turtles from Light Impacts (WA EPA, 2010). The NT EPA supports the commitment by the Proponent to adopt measures to avoid lighting impacts on nesting turtles and hatchlings. While Casuarina Beach is protected from urban light sources to some extent by its fringing monsoon rainforest, the proposed development is situated on the top of the escarpment and visibility will be greater offshore, potentially influencing the approach by turtles. Given this, there is potential for lighting from the development to result in some glow on the horizon and for light spill into the reserve. In recognition of the potential for light glow to affect approaching marine turtles, the NT EPA makes the following recommendations:

Recommendation 4

That development applications for development stages adjacent to Casuarina Coastal Reserve (Stages 2, 3, 4 and 5 shown on Figures 2 and 3) should

include details of how the Western Australian Guideline for Protecting Marine Turtles from Light Impacts (WA EPA, 2010) have been incorporated.

Recommendation 5

That development approvals for the Proposal should include conditions that require Western Australian Guideline for Protecting Marine Turtles from Light Impacts (WA EPA, 2010) to be adequately incorporated.

Tropical lifestyle

Residents of Darwin place high importance on outdoor living and recreation in the tropical climate. The design of tropical housing in Darwin typically reflects this type of living with a focus on outdoor areas and natural cooling using sea breezes and prevailing winds. The enjoyment of outdoor living requires high quality air, in particular air that is free from nuisance levels of dust and odour and amenity that is free from nuisance noise and vibration.

Noise, vibration and dust

Proposed construction activities have the potential to generate noise and vibration, predominantly from operation of machinery, and dust from exposed surfaces. This can limit elements of the tropical lifestyle of nearby residents, resulting in occupants avoiding exposure by moving indoor, closing windows and doors and blocking seasonal breezes and natural cooling.

The NT EPA acknowledges that potential generation and exposure of noise and dust correlate to the type of activity, seasonal conditions, and proximity to works. The Proponent has committed to implement and manage a Construction Environmental Management Plan (CEMP) including an erosion and sediment control plan (ESCP) and a noise management sub-plan.

The construction schedule for the Proposal is to complete one of the seven stages per year, over a 7 to 9 month period per stage, predominantly in the Dry season. The Proponent's schedule is dependent on property demand. If construction delays are protracted, occupants may be subject to a prolonged exposure to dust over the medium to long term, which may impact on the enjoyment of the Territory lifestyle.

The NT EPA supports the commitment by the Proponent to avoid and minimise potential impacts to air quality and from noise and vibration emissions. In addition, the NT EPA recommends the following:

Recommendation 6

That approvals for each development stage of the Proposal should include conditions that require the dust, noise and vibration management plans in the Construction Environmental Management Plan to be developed in consultation with community stakeholders and include processes for:

- **communicating anticipated impacts to occupants**
- **reporting of, and responding to, complaints**
- **identifying unexpected and unacceptable impacts to occupants and amending construction practices as appropriate.**

The Construction Environmental Management Plan should be developed and implemented prior to construction commencing, be made publicly available on

the websites of the Proponent, the construction company and relevant authorities, and include scope for regular reviews and updates including the schedule for construction stages.

Recommendation 7

That construction of the Proposal should comply with the *Northern Territory Environment Protection Authority Noise Guidelines for Development Sites*, and the *Northern Territory Environment Protection Authority Noise Management Framework Guideline*.

Odour

There are two existing wastewater treatment facilities within the Lee Point region. A small, privately owned and managed, facultative pond wastewater treatment facility is located within the Lee Point Caravan Park north east of the Proposal. It has a capacity of 1250 equivalent population (EP). Applying the formula in the NT EPA Guideline: Recommended Land Use Separation Distances (NT EPA, 2017), the separation distance for the caravan park facility is 350 m. As this facility is located approximately 980 m from the closest boundary of the Proposal it is not considered to be a potential constraint on the Proposal.

The Leanyer Sanderson Wastewater Treatment Plant (LSWTP), which is owned and managed by the Power and Water Corporation (PWC), is located approximately 1.2 km from the south-eastern corner of the Proposal. The LSWTP was constructed in 1972 and uses facultative lagoons to treat effluent from approximately 50 000 EP in the northern suburbs of Darwin. The LSWTP comprises twelve ponds extending 800 m east-west and 400 m north-south, covering an area of 32 ha. According to PWC, the LSWTP has a maximum capacity of 71 500 EP, which implies that it has significant additional capacity.

The proposed increase in wastewater to the LSWTP from the Proposal was a concern for 40% of submitters, who reported or cited potential instances of unacceptable odour from the LSWTP. Community concern about odour from the LSWTP is reflected in data collected by the NT EPA in its role of regulating pollution and waste, with approximately 80 odour complaints being made to the NT EPA in recent years. Ninety percent of complaints in the NT EPA complaints database are within 1.7 km of the ponds (Figure 5), primarily in the suburbs of Leanyer and Muirhead. A majority of these complaints are from September 2017 and are associated with inlet operations and de-stratification of ponds (de-stratification occurs when there are significant reductions in air temperature leading to turnover of layers within the pond, resulting in odorous material rising to the surface). The complaints to EPA often identified that odours were significantly worse than previous levels experienced by the complainant. It is noted that, due to the large volume of complaints in a short period and, often, a delay between the incident and the report, many of these complaints to NT EPA could not be rigorously verified.

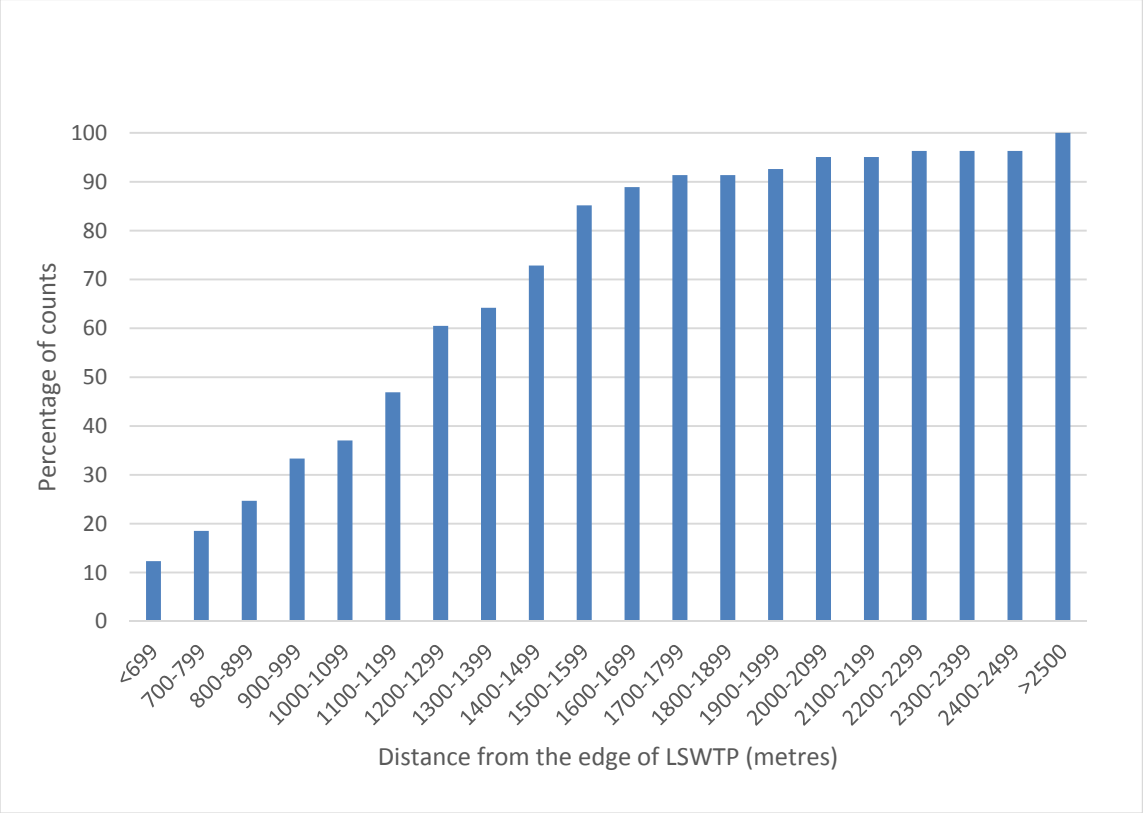

Figure 5 Cumulative counts of odour complaints received under the *Waste Management and Pollution Control Act* versus distance from the edge of LSWTP.

The NT EPA is aware that complaints from the community regarding odour from LSWTP have also been lodged with the City of Darwin, PWC, and local electorate offices and Members of Parliament. Details of these complaints are not available to the NT EPA and are therefore not considered in this assessment.

Based on the complaints received by the NT EPA, it is apparent that the LSWTP in its current operating mode is a constraint on future nearby development. Exposure to odours affects sensitive receptors in residential areas, particularly during events when conditions cause higher than usual odour levels (for example, the presence of an inversion and light winds). Impacts include a loss of amenity and in extreme cases may result in nausea. Another potential impact in Darwin is the inability to enjoy the tropical lifestyle and outdoor living. Some residents living within 1.7 km of the ponds have reported issues (to the Pollution Hotline) with sleeping, particularly when odour emissions are offensive.

The Proponent provided results of a field odour survey (The Odour Unit; EIS Appendix J) carried out on six days from Thursday 23 February to Tuesday 28 February 2018. On three days, the winds blew odour in the opposite direction to the survey points, and on three days there was heavy rain. A downwind odour plume was tracked on one day only, with weak to distinct pond odour being detected on the plant boundary, and light odour detected 500 m away at the edge of Muirhead. This report concluded that odour impacts on Muirhead North and 2CRU would be negligible and in all likelihood nil. The NT EPA considers that this report cannot be considered to reliably predict the annual pattern of odour plumes around the LSWTP, due to the limited field sampling, and therefore the report's conclusion is not supported.

The Odour Unit report also referred to an earlier odour dispersion modelling report by GHD (2015) which found that the risk of odour impacts beyond about 500 m was low. While the NT EPA considers the odour modelling in the GHD report to be informative, the modelled outputs do not accurately reflect the numerous odour complaints reported to the NT EPA, at distances to at least 1.7 km from the LSWTP.

The PWC has a developed a Continuous Improvement Program[1] to improve the performance of the LSWTP and recent works include desludging of the Sanderson Primary Pond and upgrade of inlet works, with a stated intention to trial other odour reduction techniques including surface aeration. The NT EPA acknowledges that these actions may reduce the risk of odour but also notes that it is very unusual for wastewater treatment facility servicing 50 000 EP to be based on a facultative lagoon system. Based on national 'good practice', a transition to less odorous treatment methods such as aerated lagoons is highly desirable, and would significantly reduce the radial distance of significant odour risk.

The NT EPA Guideline: Recommended Land Use Separation Distances (NT EPA, 2017) lists formulae for the nominal separation distance for facultative pond plants and also for treatment plants using other systems. For the stated maximum capacity of 71 500 EP for the LWSTP, the separation distance for facultative ponds is 2.6 km (Figure 6). The NT EPA notes, however, that the formula used in the Guideline was not intended to apply to such a large EP, and is probably an overestimate. Although not included in the NT EPA Guideline, the separation distance for an aerobic pond system, based on the EPA Victoria guidelines (EPA Victoria, 2013), would be 1.3 km. For other types of treatment, the separation distance could be reduced to as little as 440 m.

On the basis of available evidence, which includes taking into account the NT and Victorian Guidelines on separation distances and the available odour complaint data, the NT EPA considers that there is a risk of intermittent odour at nuisance levels at distances up to 1.7 km from the LWSTP as it is currently operating, and this 'odour buffer' should be applied during the assessment of this Proposal. With further improvement to the operation of LWSTP, including increased aeration, it is likely that this odour buffer could be reduced to 1.3 km.

The NT EPA notes that separation distance should not be applied retrospectively (NT EPA, 2017). As stated in the guideline, it '*cannot be applied to existing interfaces between current activities and sensitive land uses where those sensitive land uses are located within land that would be part of the separation distance. In these circumstances the NT EPA manages potential impacts under existing authorisations and general environmental duty provisions within the WMPC Act'.* However, in preparing this assessment, the NT EPA acknowledges two important factors. Firstly that this is a proposed expansion of a new residential development into the odour buffer zone of a sewage treatment plant and, secondly, the current sewage treatment plant cannot be considered as current good practice technology for this level of population. The NT EPA is of the view that it must consider the potential for people occupying this new residential area to be adversely affected by odour from the LSWTP, particularly in light of the potential for an increase in odour issues arising from an increased load at the LSWTP from the development of the Proposal as well as continued growth in the northern suburbs.

[1]https://www.powerwater.com.au/networks_and_infrastructure/water_services/water_and_waste_water_treatment/leanyer_sanderson_waste_stabilisation_ponds

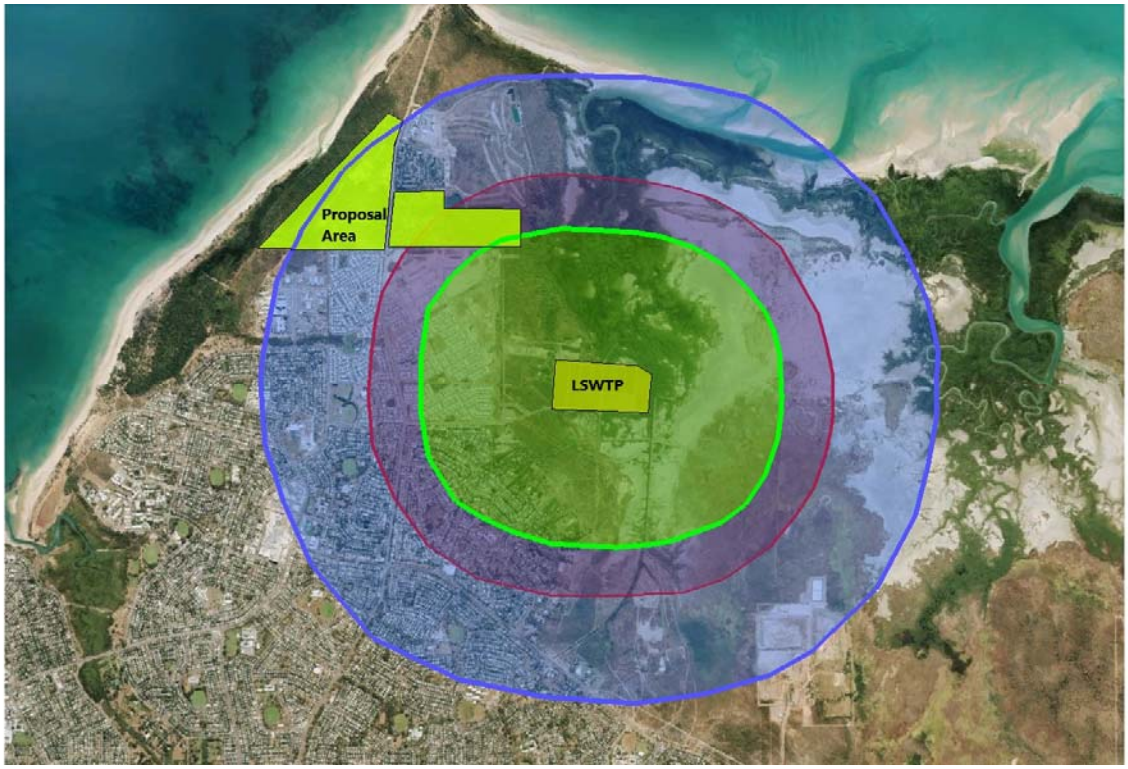

Figure 6. Separation distance calculations and recommended odour buffer around LSWTP. The EPA Victoria aerobic calculation is 1.33 km (green). NT EPA separation distance calculation for facultative ponds is 2.6 km (blue). The NT EPA's recommended odour buffer for the Proposal is 1.7 km (red).

The NT EPA considers all components of the Proposal that are located greater than 1.7 km from the LSWTP can proceed with a low risk of potential future odour nuisance.

There is a potential for land-use conflict within the 1.7 km odour buffer, which includes the proposed rural residential lots and a small proportion of the urban housing lots within Muirhead North. The NT EPA took a number of factors into consideration in determining an appropriate, proportionate response to this issue, including the precautionary principle, the 'agent of change' principle, and the level of uncertainty in determining the odour buffer radius.

As the emissions from the LSWTP are an existing concern and outside the Proponent's control, the NT EPA considers that it would be appropriate for future residents within the 1.7 km odour buffer to be informed that receptors/residents may be impacted by odour from the LSWTP.

Recommendation 8

That prior to issuing of titles, the Proponent should ensure that a Caution Notice (or similar as agreed with the responsible authority under the *Planning Act*) is lodged with the Registrar General under Section 34 of the *Titles Act* for all lots within a 1.7 km buffer from the Leanyer Sanderson Wastewater Treatment Facility.

The Caution Notice (or similar) is to notify potential developers and landholder/s that the lot:

- **occurs within the identified odour buffer for the Leanyer Sanderson Wastewater Treatment Plant**
- **may be subject to occasional odours associated with the operation of the Leanyer Sanderson Wastewater Treatment Plant.**

After completion of upgrade works to the LSWTP, there may be an opportunity to revise the odour buffer and therefore the need for the Caution Notice. This is to be determined following consultation with the Power and Water Corporation, Department of Infrastructure, Planning and Logistics, and Department of Environment and Natural Resources.

Heritage and Aboriginal sacred sites

The Proponent has obtained an AAPA Authority Certificate (C2018/060) under the *Northern Territory Aboriginal Sacred Sites Act.* Provided the Proponent complies with the AAPA Authority Certificate and accompanying letter, with a commitment to avoid clearing and disturbing culturally significant trees within the nominated area of cultural significance, the NT EPA is satisfied that the potential impacts and risks to sacred sites have been adequately addressed.

The Proponent acknowledges the military history of the site and has committed to preserving important heritage items where possible. The 'Bunkers' would be retained and incorporated into the Proposal within park or open space (Figure 2). The Konfrontasi cruciform in the north-west corner of Muirhead North would also be retained. To ensure the retained heritage places continue to be protected, the Proponent proposes a Cultural Heritage Management Plan.

In addition to preserving the heritage items, the Proponent has committed to working with the Parks, Wildlife and Heritage Division of DTC, to develop signage and interpretation material for both sites.

The NT EPA considers that the retention of the two heritage sites will allow development of the Proposal while maintaining people's connection with historic values of the area. The installation of signage and the associated interpretative material will contribute to furthering public awareness and understanding of a poorly known period in Australia's military history.

The stone scatters identified within 2CRU would be removed for each stage of the Proposal, resulting in the associated loss of cultural heritage values. Pre-clearance surveys would be undertaken by the Larrakia Development Corporation to identify the scatters and any new archaeological material. The Proponent has committed to obtaining all relevant approvals under the *Heritage Act* prior to removing Aboriginal heritage items.

The NT EPA supports the Proponent's commitments. Provided the Proponent complies with permit requirements under the *Heritage Act* and the AAPA Authority Certificate and accompany letter under the *Northern Territory Aboriginal Sacred Sites Act*, the NT EPA is satisfied that the potential impacts and risks to cultural heritage have been adequately addressed.

5.1.5 Summary and conclusion

The NT EPA has considered the potential impacts and risks on social and cultural heritage values. The NT EPA considers that, with implementation of the measures proposed by the Proponent and the recommendations described above, the NT EPA objective for social, economic and cultural surroundings is likely to be met.

5.2 Human health

5.2.1 NT EPA objective

Ensure that the risks to human health are identified, understood and adequately avoided and/or mitigated.

5.2.2 Environmental values

Darwin's housing stock, particularly in Darwin's northern suburbs, is seasonally impacted by biting insects. The most common biting insects with potential to spread diseases, and hence impact human health, are mosquitoes and midges.

In a report prepared for the Proponent, the Medical Entomology Unit, Department of Health identified that the northern salt marsh mosquito (*Aedes vigilax*) and the common banded mosquito (*Culex annulirostris*) are present across the Proposal area. Both species are vectors for disease transmission, particularly Ross River virus and Barmah Forest Virus. *Culex annulirostris* is also known to transmit Murray Valley encephalitis virus and Kunjin virus. Other mosquito species that do not transmit disease are also likely to be present (Medical Entomology, 2016).

Two species of pest biting midges (*Culicoides ornatus* and *Culicoides* sp. *subimmaculatus*) were found to be seasonally present at the Proposal area (Medical Entomology, 2016). Biting midges do not transmit disease, however bites may cause local swelling, irritation/discomfort and, potentially, secondary bacterial infection. The Medical Entomology Unit identified the following significant biting insect breeding areas that have the potential to affect the Proposal area:

- the Leanyer swamp, stretching east from the mangrove margin of Buffalo Creek, is a major potential breeding area for *A. vigilax* and *Cx. annulirostris*
- swamps to the east of Leanyer swamp, as far away as the Howard River are a potential minor source of *A. vigilax* due to its very long flight range
- depressions in upper tidal mangrove creeks in Casuarina Coastal Reserve provide breeding habitat for *A. vigilax*
- interdunal and monsoon rainforest depressions from the mouth of Buffalo Creek to Dripstone Cliffs provide very productive breeding habitat for *A. vigilax*
- the mangroves and tidal tributaries of Buffalo Creek are major biting midge breeding areas
- Sandy Creek is likely to be a moderate biting midge breeding area.

Residents and visitors to the proposed future suburb expect to reside and occupy the location with a high level of security for their health and wellbeing. Residents are likely to have an expectation that the property that they occupy allows for outdoor living and enjoyment of the tropical lifestyle.

5.2.3 Potential impacts

The potential impacts to human health, as a result or the Proposal, relate to:

- creation of additional mosquito breeding habitat, particularly inadequately designed stormwater and downstream infrastructure

- exposure of occupants and visitors to pest mosquitoes and biting midges that have the potential to increase the rate of infections of mosquito-borne diseases, or cause irritation and discomfort.

5.2.4 NT EPA assessment

Creation of new biting insect breeding habitat

Poorly designed and constructed stormwater drainage was identified by the Medical Entomology Unit as being a significant contributor to historic mosquito breeding problems in Darwin (Medical Entomology, 2016). Further, the Medical Entomology Unit identifies that the greatest potential for creating new mosquito breeding areas is associated with the selection of inadequate drain discharge points.

The creation of new mosquito breeding habitat would likely increase mosquito problems for future residents of the proposed development as well as existing residents in adjacent suburbs. The Proponent has noted this as a risk and has committed to ensuring all stormwater management infrastructure is designed and constructed consistent with the relevant Northern Territory Guidelines (Medical Entomology, 2017). The Proponent has committed to implementing the measures identified by the Medical Entomology Unit (Medical Entomology, 2016) including a commitment to construct appropriate drainage outfalls and a commitment to remediate historic erosion issues that have been attributed to increased mosquito breeding in Casuarina Coastal Reserve. The NT EPA supports these actions and makes the following recommendations:

Recommendation 9

That development approvals for the Proposal should have conditions that ensure stormwater discharges from the development terminate at a daily flushed tidal area or frontal beachline and are constructed to the satisfaction of the Medical Entomology Unit, NT Department of Health, on behalf of the final drain maintenance authority. All discharge drains, including the end point of the drains, should be excised as separate lots and appropriately zoned to allow the drain owner to carry out expedient maintenance.

Recommendation 10

That development approvals for the Proposal should have conditions that require stormwater treatment structures, including potential detention storage and water features or lakes, to be designed and constructed to be free from potential mosquito breeding sites to the satisfaction of the Medical Entomology Unit, NT Department of Health, on behalf of the final maintenance authority.

Proximity to existing biting insect breeding habitat

The human population occupying the proposed future development area has the potential to be impacted by mosquito-borne diseases, due to the proximity of mosquito breeding habitat. Surveys of the Proposal site found that mosquito numbers were seasonally high across both 2CRU and Muirhead North.

The Department of Health *Guidelines for Preventing Biting Insect Problems for Urban Residential Developments or Subdivisions in the Top End of the NT* (updated Dec 2017), state that there should be no urban residential development within 1.6 km of large uncontrolled areas of mosquito and midge breeding sites, unless specific medical entomology investigations are carried out and these investigations reveal

urban residential development is suitable. The guidelines consider that incorporating a rural residential buffer between major sources of biting insects and the urban component of a subdivision will generally allow the 1.6 km urban residential buffer to be relaxed to 1 km. The guidelines do not prohibit rural blocks closer to mosquito or midge breeding areas, but specify increasingly large block sizes closer to the source boundary.

The risk of mosquito-borne diseases on the human population as a result of the Proposal was assessed by the Medical Entomology Unit in its report prepared for the Proponent (Medical Entomology, 2016). The report made recommendations for a range of controls for the design of the Proposal, including:

- a 1 km separation distance between the landward mangrove margin of Buffalo Creek and urban residential areas (refer to the biting insect buffer demarcated in Figure 4)
- preventing the creation of new breeding areas (particularly when constructing stormwater infrastructure)
- creating barriers or buffers between breeding areas and densely populated residential areas (see specifications below)
- chemical control of larval mosquitoes when significant numbers are anticipated.

Leanyer Swamp, Buffalo Creek and portions of Casuarina Coastal Reserve are currently targeted for aerial mosquito control, particularly when numbers of mosquitoes reach significant numbers and the risk of mosquito-borne disease risk is high (Medical Entomology, 2016). In advice to the NT EPA, Department of Health confirmed that there was a helicopter spray program to control mosquitoes in tidal swamps from the edge of Buffalo Creek to Shoal Bay Receiving Station, and that this control allowed the 1.6 km buffer to be reduced to 1 km for the proposal. This advice also noted that, while the suburb of Leanyer approaches to within approximately 500 m of Leanyer Swamp (where significant mosquito control measures are implemented), a similar 500 m buffer could not be considered for the Proposal due to the additional issue of biting midge problems arising from Buffalo Creek. Unlike for mosquitoes, there are currently no effective controls for biting midge breeding sites.

In advice to the NT EPA, the Department of Health recommended formalising an open-wind buffer between the monsoon forest east of the Casuarina Coastal Reserve and the western development margin. The intent of the buffer is to provide a break in mosquito and biting midge harbourage and breeding habitat between developed areas and the adjacent monsoon forest. The open buffer should have a mature tree canopy of less than 10% crown cover and may include roads, footpaths or mown grass. The NT EPA supports this approach, subject to maintaining the integrity of the coastal monsoon vine forest.

Recommendation 11

That approvals for the Proposal should require a minimum 50 m open wind buffer between the western edge of the 2CRU residential and commercial area and the monsoon forest boundary (or edge of the escarpment if this is closer). The wind buffer should only be planted with tall-growing, long-lived, hardy native trees, with a suggested mature tree crown coverage of approximately 10%.

Portions of the Muirhead North site are less than 1 km from biting insect breeding habitats at Buffalo Creek and Leanyer Swamp, requiring the Proponent to implement a buffer to reduce the dispersal of biting insects through the Proposal. This buffer is in the form of a cleared drainage reserve (approximately 100-150 m wide) and larger rural lots (with reticulated sewerage) along the eastern boundary of Muirhead North. These lots would be of an area of approximately 4000 m^2 and are intended to disrupt the dispersal of biting insects into the Proposal. The NT EPA notes that the Department of Health has confirmed it supports this approach. Larger lots within the 1 km buffer also result in lower population density, reducing the risk of disease at the population level.

The NT EPA supports the adoption of larger rural lots on the eastern margin of the Proposal, to provide a buffer to reduce the dispersal of biting insects into urban and residential areas. The NT EPA recommends the following conditions:

Recommendation 12

That the Responsible Minister should include a condition on future Development Permit(s) requiring that the Proponent ensure any lots in Muirhead North within the biting insect buffer, as shown in Figure 4:

- **have a minimum area of 4000 m^2**
- **cannot ever be subdivided.**

Future occupants of rural lots within the 1 km biting insect buffer are likely to be impacted by biting insects to a greater extent than other residents. The NT Department of Health advised the NT EPA that there are a range of recommended management options to control biting insects, including:

- designing and constructing dwellings that are less accessible to biting insects, for example, elevated houses with insect screens fitted
- use of residual insecticides
- personal protection by individuals.

These would be the responsibility of individual property owners or occupants.

To ensure future occupants of rural lots within the 1 km buffer are aware that they may be exposed to seasonally high numbers of biting insects, the NT EPA recommends that the following condition:

Recommendation 13

That prior to issuing of titles, the Proponent should ensure that a Caution Notice is lodged with the Registrar General under Section 34 of the *Titles Act* (or similar as agreed with the responsible authority under the *Planning Act*) for all lots located within the identified biting insect buffer (in consideration of Recommendation 12 above).

Each Caution Notice (or similar) should indicate the following:

- **that the lot occurs within the biting insect buffer**
- **that the lot is subject to seasonal mosquito and biting midge pest problems arising from the adjacent mangroves of Buffalo Creek and tidal marshes and mangroves in Leanyer Swamp.**

The Medical Entomology Unit reported that the implementation of the recommended controls and buffers would likely result in peak season mosquito numbers experienced in the Proposal area (outside the buffer zone) being similar to other mosquito-affected suburbs such as Muirhead, Leanyer and Karama (Medical Entomology, 2016).

The NT EPA notes that, as the population in the region increases, it will be important that control effort is maintained at a level commensurate with disease risk.

5.2.5 Summary and conclusion

The NT EPA has considered the potential impacts and risks from biting insects on future residents of the Proposal site. The Proponent has followed the key recommendations of the Medical Entomology Unit, and the NT Department of Health has confirmed to the NT EPA the acceptability of these measures in relation to biting insects. While it is acknowledged that the risks to public health from biting insects cannot be fully avoided, the measures proposed would reduce exposure and potential health impacts to occupants and visitors.

The NT EPA considers that, with implementation of the measures proposed by the Proponent and the recommendations described above, the NT EPA objective for human health is likely to be met.

5.3 Terrestrial flora and fauna

5.3.1 NT EPA objective:

Protect the NT's flora and fauna so that biological diversity and ecological integrity are maintained.

5.3.2 Environmental values

Vegetation surveys of the Muirhead North portion of the Proposal site identified seven relatively common vegetation types and one significant and sensitive vegetation type (monsoon rainforest, which includes monsoon vine thicket, or coastal vine thicket). Surveys of the 2CRU site identified four vegetation types including a large patch of monsoon rainforest along the western boundary of the site. The vegetation types and their distribution and extent are summarised in chapter 7 of the EIS.

The area of monsoon rainforest (20.6 ha) along the western boundary of 2CRU is part of a larger stand (52.76 ha) associated with the Lee Point escarpment. The DENR advised that the monsoon rainforest associated with Casuarina Coastal Reserve is of significant conservation value due to its large size. In addition, because of the proximity to Darwin, this patch has value to the community for recreational and educational activities, and supporting natural processes that are highly valued by the community (addressed in section 5.1). The monsoon rainforest in Muirhead North is significantly smaller (0.88 ha) and considered by DENR to be of 'moderate' conservation significance, as one of a network of monsoon rainforest patches in the Darwin area.

While the Proposal site does not provide habitat for migratory shorebirds, two significant areas for shorebirds are located within the nearby Casuarina Coastal Reserve. Darwin Harbour, including Casuarina Beach, is known to provide foraging and roosting habitat for at least 25 species of migratory shorebirds (Lilleyman, 2016). Migratory shorebirds are protected under the EPBC Act, and several species are also listed as threatened species under the EPBC Act and TWPC Act (Table 2).

Table 2 Threatened migratory shorebird species present in Darwin Harbour

Shorebird	EPBC Act	TWPC Act
lesser sand plover	Endangered	Vulnerable
greater sand plover	Vulnerable	Vulnerable
bar-tailed godwit (northern Siberian)	Critically endangered	Vulnerable
bar-tailed godwit (western Alaskan)	Vulnerable	Vulnerable
eastern curlew	Critically endangered	Vulnerable
Asian dowitcher	-	Vulnerable
great knot	Critically endangered	Vulnerable
red knot	Endangered	Vulnerable
curlew sandpiper	Critically endangered	Vulnerable

Within Casuarina Coastal Reserve, Buffalo Creek at Lee Point (1.4 km northeast of the Proposal site) meets all the criteria (Commonwealth of Australia, 2017) for a nationally important habitat for migratory shorebirds, while Sandy Creek (347 m northwest of the Proposal) meets two of the criteria (Lilleyman, 2016). Both sites support internationally significant numbers[2] of some species.

The coastal area between Rapid Creek and Buffalo Creek is managed under the Casuarina Coastal Reserve Management Plan (Parks and Wildlife Commission of the Northern Territory, 2016). No dogs are allowed between Lee Point and Buffalo Creek (an area approximately 1.7 km long), and dogs must be kept on leads within 100 m on either side of Sandy Creek, to protect migratory shorebirds.

At Sandy Creek, the main area used by roosting shorebirds occurs on the western side of the creek in casuarina trees/mangrove vegetation. Foraging occurs seasonally on the tidal flats along Casuarina Beach (Lilleyman, 2016).

A population of the yellow-spotted monitor (*Varanus panoptes*), which is listed as vulnerable under the TPWC Act, has been recorded as persisting in the Casuarina Coastal Reserve outside of the Proposal site. There are additional records of the species from the nearby suburbs of Brinkin, Rapid Creek and Nightcliff.

Two threatened species are confirmed to occur on the Proposal site. The Darwin cycad (*Cycas armstrongii*), listed as Vulnerable under the TPWC Act, occurs across large areas of the site in low to medium densities. The black-footed tree-rat (*Mesembriomys gouldii gouldii*) is listed as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and Vulnerable under the TPWC Act. Surveys of the Proposal site recorded black-footed tree-rat at three sites within Muirhead North, but did not record it in 2CRU (EIS Appendix M). Based on a number of criteria, areas within the Proposal were identified and mapped according to their potential habitat quality for black-footed tree-rat. The majority of higher quality habitat was in Muirhead North, but also included some areas of 2CRU (EIS Appendix M, Figure 3). There are a small number of records of black-footed tree-rat in the Lee Point area (between Charles Darwin University and Buffalo Creek) and, based on the distribution of suitable habitat in this substantially modified region, this could be considered to represent a remnant sub-population of this declining species.

[2]Considered to be greater than 1% of the flyway population of a single species (Hansen, et al., 2016).

5.3.3 Potential impacts

The potential impacts to terrestrial flora and fauna, as a result of the Proposal, include:

- degradation of the health and condition of monsoon rainforest in Casuarina Coastal Reserve, the western margin of 2CRU and one patch in Muirhead North through altered hydrology and introduction of weeds
- removal of habitat for Darwin cycad resulting in a direct loss of individual plants
- reduction of the value of roosting habitat for migratory birds in Casuarina Coastal Reserve due to increased disturbance, causing migratory birds to seek alternative roosting habitat
- removal of habitat for black-footed tree-rat within the proposal area, decreasing and fragmenting the area of available habitat, and with the potential to result in reduction or loss of the Lee Point sub-population.
- Increased risk of vehicle strike, human disturbance, or increased numbers of cane toads affecting the sub-population of yellow-spotted monitor in Casuarina Coastal Reserve.

5.3.4 NT EPA assessment

Monsoon rainforest

The Proponent has committed to avoid clearing monsoon rainforest. The largest patch of monsoon rainforest (21.8 ha) has been rezoned by the Proponent to 'Conservation' (CN zone) under the NT Planning Scheme. The Proponent proposes that this patch of rainforest (on the western boundary of 2CRU) would be transferred to the Parks, Wildlife and Heritage Division, DTC, for inclusion in the Casuarina Coastal Reserve. The NT EPA supports the retention of the 2CRU monsoon rainforest, and its transfer to the Casuarina Coastal Reserve.

The Proposal provides for a 50 m open-wind buffer, to mitigate biting insect impacts, from the edge of the retained Casuarina Coastal monsoon rainforest to the proposed urban development. The NT EPA notes that the proposed buffer is not consistent with the Northern Territory Land Clearing Guidelines 2010 (NRETAS, 2010). The Guidelines specify that a 100 m buffer of native vegetation should be retained around monsoon rainforest to protect the monsoon rainforest from degrading edge effects, particularly colonisation by weeds, impacts from urban runoff and for the maintenance of hydrology.

The NT EPA observed that the existing native vegetation at the edge of the monsoon rainforest is currently highly degraded, and does not provide the benefits expected of a native vegetation buffer. In consultation with DENR, the NT EPA has formed the view that the proposed 50 m biting insect buffer (as per Recommendation 11), providing it is maintained to exclude fire and reduce weed infestation, is likely to provide a preferable level of protection for the monsoon rainforest compared to requiring retention of an additional 50 m buffer of highly degraded native vegetation. In order to protect the values of the monsoon rainforest, it would be essential that weed spread is minimised, and that suitable ground cover is maintained to reduce runoff, erosion and sedimentation.

The revised area plan for Muirhead North includes a drainage reserve and conservation area along the eastern boundary. This drainage reserve and

conservation area includes a smaller monsoon rainforest patch which is proposed to be retained and protected within a ‘conservation area’ (11.24 ha). The ‘conservation area’ is proposed to be retained and rezoned as ‘open space’ (OS zone).

The proposed area plan includes a buffer of 15 m between the monsoon rainforest patch and adjoining rural lots. Advice from the DENR suggests that a 15 m buffer is unlikely to provide adequate protection to the rainforest patch from adjacent land uses and pressures (changes to hydrology, weeds, fire, dumping of rubbish etc.). The NT EPA considers that a minimum buffer of 25 m of retained native vegetation should be considered.

The NT EPA supports the retention and management of the monsoon rainforest in Muirhead North but notes that the proposed zoning as ‘open space’ would provide limited protection to the patch. To provide adequate protection to the monsoon rainforest patch, the NT EPA makes Recommendation 15 below to require a minimum buffer of 25 m around the monsoon rainforest and that the retained vegetation be incorporated into a larger area zoned as ‘conservation’ (CN zone) under the NT Planning Scheme.

To maintain sensitive and significant monsoon rainforest, the Proponent has prepared and will implement a Biodiversity Management Sub-plan which identifies appropriate weed hygiene and management measures. The implementation of the plan and commitment to health and condition monitoring is supported.

The ongoing management of the ‘conservation area’ within 2CRU will be outlined in a management plan which is to be prepared in consultation with relevant stakeholders (City of Darwin; Parks, Wildlife and Heritage; Casuarina Coastal Reserve Landcare Group). The Proponent has committed to managing the ‘conservation area’ until such time as the ‘conservation area’ will be handed over to Parks, Wildlife and Heritage. The NT EPA supports this approach.

Darwin cycad (*Cycas armstrongii*)

The Darwin cycad (*Cycas armstrongii*) is a locally common species with a restricted distribution. The species has been recorded from the Proposal site in low to moderate densities. Clearing for the Proposal would require the removal of 63.9 ha of occupied habitat for the species. An area with moderate densities of *C. armstrongii* is proposed to be retained within the 11.24 ha ‘conservation area’ on the Muirhead North portion of the site. The NT EPA supports the retention of cycads within an area zoned ‘conservation’ in accordance with Recommendation 15 (below).

During clearing, the Proponent may relocate some *C. armstrongii* for landscaping in the development. The NT EPA notes that the relocation and use of *C. armstrongii* for landscaping is not considered to have any conservation benefit and is not an avoidance or mitigation measure. The use of individual plants for landscaping purposes is, however, consistent with the Management Program for Cycads in the Northern Territory (Liddle, 2009).

The NT EPA acknowledges that the Proposal will contribute to the cumulative loss of *C. armstrongii* in the greater Darwin region. However, due to the small area of habitat lost compared to the total distribution of the species, the NT EPA does not consider that the loss due to the Proposal is likely to affect the conservation status of the species in the Northern Territory.

Migratory shorebirds

Darwin's population growth has contributed to an increase in visitor numbers to the Casuarina Coastal Reserve. This has contributed to increased encroachment on important roosting sites and potential disturbance of shorebirds (Lilleyman, 2016). The disturbance of migratory shorebirds during roosting and foraging activities can add pressure to populations by adversely affecting birds' ability to build energy reserves which are needed for long-distance migration flights (Lilleyman, 2016).

Two areas within Casuarina Coastal Reserve are considered to have significant populations of migratory shorebirds, with Sandy Creek being the closest to the Proposal area. The Proponent has presented a range of mitigation measures to reduce the potential impacts from human intrusion on significant migratory shorebird habitat, including locating access points to avoid roosting habitat, installing interpretative signs and supporting a shorebird monitoring program. The NT EPA considers that the proposed mitigation measures sufficiently address potential impacts to populations of migratory shorebirds from the Proposal (see section 5.1).

Black-footed tree rat (*Mesembriomys gouldii gouldii)*

The Proponent considers that the Proposal would require the clearing of 23 ha, and additional modification of 7.5 ha, of suitable habitat for the black-footed tree-rat (*Mesembriomys gouldii gouldii)*. The NT EPA observes that the Proponent used a qualitative assessment to rank potential habitat, and only higher quality habitats were considered 'suitable' in the area calculation reported above. The NT EPA notes that the inclusion of habitat ranked as 'moderate-quality' would result in the area of 'suitable' habitat being 52.37 ha. The NT EPA considers that a significantly greater spatial and temporal intensity of sampling would be required to definitively determine habitat use by tree-rats within the proposal area and, without this, a more precautionary approach to estimating the total area of habitat potentially used by tree-rats would be appropriate.

The Department of Environment and Natural Resources (DENR) advised that the removal of vegetation across the Proposal site would remove a significant proportion of the remaining woodland habitat for the species in the Lee Point area. There is a risk that removal and fragmentation of woodland habitat may reduce habitat availability to a point that the longer-term viability of the Lee-Point sub-population is compromised, and consequently the residual impact to black-footed tree-rats may extend beyond the immediate proposal footprint.

The NT EPA considers that the postulated impact from the proposal on the larger Lee Point subpopulation of black-footed tree-rat is feasible, but there is insufficient data to rigorously assess the likelihood of this outcome. On balance, the NT EPA considers that there is likely to be a residual impact on the local occurrence of black-footed tree-rat from the Proposal, but the impact on the species is not likely to sufficiently great to make this impact unacceptable. Nevertheless, the NT EPA considers that the residual impact is sufficiently significant for an offset to be appropriate, noting that this mechanism is available under the EPBC Act, rather than NT legislation.

The Proponent has committed to preparing an Offset Management Plan, which is intended to compensate for the significant residual impact, and has presented a preliminary offset proposal and calculation. While the NT EPA does not have responsibility for administering offsets, it recognises and supports the development of an appropriate offset that is based on a precautionary estimate of the residual impact. The NT EPA does not agree with the proponent that retaining a portion of current habitat on site can be considered an offset, as this is a mitigation measure and the

residual impact is present even with this mitigation in place. Similarly, the NT EPA is concerned that limiting offsets to the immediate vicinity of the Proposal does not necessarily ensure the best outcome for improving the conservation security of the species.

Any offset provided by the Proponent should directly contribute to the conservation of the black-footed tree-rat and meet the minimum requirements in the Australian Government's Offset Policy. To ensure the offset is appropriate, the NT EPA recommends that the Proponent prepare the Offset Management Plan in consultation with the Flora and Fauna Division of the Department of Environment and Natural Resources, and the Department of Environment and Energy.

Recommendation 14

That approvals for the Proposal should require that the Proponent demonstrate consultation with, and support by, Flora and Fauna Division of the Department of Environment and Natural Resources, in relation to any offset or offset management plan required by the Australian Government with respect to the significant residual impact to the black-footed tree-rat (*Mesembriomys gouldii gouldii*).

The NT EPA acknowledges that there is uncertainty about the future of habitat for the black-footed tree-rat in the eastern part of Muirhead North. The NT EPA considers that the vegetation within the area identified as 'drainage/conservation' (with the exception of the 1.85 ha area necessary for construction of stormwater infrastructure) should be retained and protected as CN under the NT Planning Scheme.

Recommendation 15

That approvals for Muirhead North should provide adequate protection for the monsoon rainforest patch and habitat for the black-footed tree-rat. In particular, it is recommended that any approval require:

- **a vegetated buffer of at least 25 m around the monsoon rainforest patch in Muirhead North**
- **the retention of native vegetation in the 'Drainage/Conservation Area' (Figure 4), excluding the 1.85 ha 'Detention Storage'**
- **rezoning the retained area of native vegetation as CN conservation under the NT Planning Scheme.**

Where works are required within the 'detention/conservation area' that have not been considered in this report, the Proponent would need to consult with the NT EPA about whether further consideration under the EA Act is required.

The NT EPA considers that the Proposal is likely to result in a significant residual impact to black-footed tree-rat and that, while this is not sufficiently large or certain to make the project unacceptable, it is appropriate that an offset be developed that directly contributes to the conservation security of the species and that meets the minimum requirements of the Australian Government's Offset Policy.

Yellow-spotted monitor (Varanus panoptes)

The main risk from the Proposal to yellow-spotted monitor would be the inadvertent creation of toad breeding habitat, which may increase toad densities in Casuarina Coastal Reserve, and therefore potentially increase lethal ingestion of the toads by

monitors. The Proponent has designed the stormwater treatment infrastructure to avoid creating areas of pooled water and biting insect habitat, and detention basins have been designed to drain within 24 hours of a rainfall event. The design of drainage infrastructure is likely to be unsuitable for toads to successfully breed and disperse into the reserve.

The NT EPA acknowledges that toads are common on the Proposal site and occur in existing urban areas adjoining the reserve.

Varanus panoptes are at risk from road-strike particularly in urban areas. The existing traffic control measures within Casuarina Coastal Reserve are considered to be adequate to limit vehicle speeds and manage additional traffic generated by the Proposal within Casuarina Coastal Reserve.

The NT EPA has assessed the potential impacts and risks to the population of *V. panoptes* within the Casuarina Coastal Reserve and considers that the design of stormwater treatment infrastructure, and existing traffic control measures, would be sufficient to minimise any additional impacts and risks to this species.

5.3.5 Summary and conclusion

The Proponent has satisfactorily addressed potential impacts to cycads, migratory shorebirds and yellow-spotted monitors. The NT EPA has assessed the potential impacts and risks to the black-footed tree-rat and considers that there is likely to be a significant residual impact to the species which can be offset. The NT EPA is therefore satisfied that the impacts of the Proposal on this species are acceptable.

The NT EPA considers that, with implementation of the measures proposed by the Proponent and the recommendations described above, the NT EPA objective for terrestrial flora and fauna is likely to be met.

6 Conclusion

In making this Report, the NT EPA had regard to the information provided by the Proponent, public submissions on the Draft EIS, advice from experts in NT Government agencies, and relevant guidelines and standards. The NT EPA assessed the Proposal against the NT EPA's objectives for the key environmental factors of Social, economic and cultural surroundings; Human health; and Terrestrial flora and fauna.

The NT EPA's assessment of the proposed Lee Point Urban-masterplan Development Project identified potentially significant environmental, social and cultural impacts and risks associated with amenity; recreational and educational activities within the Casuarina Coastal Reserve; tropical lifestyle, land use conflict and biting insects; heritage and culturally significant sites; and reduction in threatened species habitat.

The NT EPA considers that this assessment provides a sound basis for the Proposal to proceed in a manner in which environmental impacts are maintained within acceptable limits. It stresses that the environmental commitments, safeguards and recommendations detailed in the EIS, this Assessment Report and in the final management plans, must be implemented. Further, the Proponent will be required to monitor the performance of safeguards against objectives and ensure that this information informs design and management of future stages.

The NT EPA makes 15 recommendations as an outcome of the EIA of the Proposal. These recommendations are for the Proponent and decision-makers to consider in future approval processes and during the execution of the proposed action.

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Appendix 1 – Geographic coordinates

Table 3. Geographic coordinates for the Proposal

Point	Latitude	Longitude
1	-12° 20' 23	130° 53' 27”
2	-12° 20' 26	130° 53' 33”
3	-12° 20' 33	130° 53' 30”
4	-12° 20' 45	130° 53' 29”
5	-12° 20' 45	130° 53' 45”
6	-12° 20' 51	130° 53' 45”
7	-12° 20' 51	130° 54' 08”
8	-12° 21' 04	130° 54' 08”
9	-12° 21' 04	130° 52' 57”
10	-12° 21' 03	130° 52' 58”
11	-12° 21' 03	130° 52' 47”

Appendix 2 – Evaluation of other environmental factors

The NT EPA assessed the environmental impact of the Proposal in line with its environmental factors and objectives (NT EPA, 2018). The following table presents environmental factors for the Proposal which, based on current knowledge, were assessed as not significant. The NT EPA considers it unlikely that implementation of the Proposal would have a significant impact on these factors and they can be managed to meet the NT EPA's environmental objective.

Environmental factor	**Potential impacts**	**Explanation of why the factor is not a key environmental factor**
LAND		
Terrestrial Environmental Quality	Erosion and sediment movement	To manage the risks and potential impacts associated with the soil mobilisation and deposition into watercourses, the Proponent has committed to preparing stage-specific erosion and sediment control plans (ESCPs) for each stage of the development. The NT EPA acknowledges this commitment and considers that it would be appropriate for the Responsible Minister to include a condition on any Development Permit(s) requiring that the Proponent develop and implement stage specific ESCPs. The ESCPs need to be prepared by a Certified Practitioner in Erosion and Sediment Control (CPESC). Each ESCP would be prepared in accordance with the International Erosion Control Association (IECA) Best Practice Erosion and Sediment Control Guidelines 2008 (or higher standard) and include the following: • details of both temporary and permanent erosion and sediment control methods and treatments for all stages of the Proposal (pre, during and post construction) • the ESCP should be a stand-alone document which is consistent with other relevant management plans. It should, however contain all the necessary information to implement without requiring the user to refer to other plans

Environmental factor	Potential impacts	Explanation of why the factor is not a key environmental factor
		• include an over-arching strategic document outlining the principles, practices and methods to be implemented • include information on the proposed timing and staging of works, site manager contact details, maintenance and monitoring requirements, and reporting procedures. The Proponent must implement each ESCP until each stage is stable and non-polluting. This should be demonstrated through regular monitoring by a suitably qualified third party auditor, to the satisfaction of the consent authority. The NT EPA is of the opinion that the mitigation measures proposed are appropriate to reduce the potential impacts and risk to an acceptable level.
Landforms	Unlikely	The Proposal area does not contain any significant landforms that would be impacted during the construction and/or occupation of the Proposal.
WATER		
Aquatic ecosystems	Unlikely	There are aquatic ecosystems downstream from the Proposal area within Buffalo Creek and Sandy Creek. The aquatic ecosystem in Buffalo Creek is considered to be heavily impacted due to runoff from existing urban areas and discharges from the Leanyer Sanderson Wastewater Treatment Facility. Sandy Creek receives stormwater from Lyons, Tiwi and the Hospital precinct and is considered to be modified due to changes from an ephemeral system to a more permanent waterway. The proposed inclusion of stormwater treatment infrastructure into the Proposal would ensure the quality of stormwater and the hydrology (peak flows) does not adversely impact on aquatic ecosystems.
Inland water environmental quality	The channelling and accumulation of runoff and changes to the quality of stormwater being discharged from the	The Proponent prepared a Stormwater Management Plan which identifies a range of Water Sensitive Urban Design measures for managing water quality

Environmental factor	Potential impacts	Explanation of why the factor is not a key environmental factor
	Proposal area into Darwin Harbour through Sandy Creek and/or Buffalo Creek were identified as potential impacts on the beneficial use values of Darwin Harbour.	being discharged off the site. The measures are outlined in the CEMP and include gross pollutant traps, grassed swales and stormwater detention basins. Sediment could potentially be mobilised during clearing and construction activities. These would be managed through the development and implementation of stage specific ESCP's prepared by a CPESC and as per the IECA Guidelines. With the implementation of the proposed preventative measures and relevant management plans identified above, the NT EPA considers that the Proposal could be conducted in such a manner that its objective for inland water environmental quality is likely to be met.
Hydrological processes	Changes to the hydrological regime of Sandy Creek and Buffalo Creek.	Water from the development will runoff from the Proposal area into Buffalo Creek, Sandy Creek and the Casuarina Coastal Reserve. The hydrology of both Sandy and Buffalo Creeks are considered to be relatively modified due to existing suburbs and other infrastructure within the catchment. The Proposal would increase in impervious surfaces and as a result surface runoff. Stormwater from the Proposal would be managed as per a Stormwater Management Plan and stormwater infrastructure (detention basins, pollutant traps, swales). The infrastructure is designed to maintain the pre-development hydrology (peak flows). The NT EPA does not consider that Hydrological processes will be significantly impacted by this Proposal.
Marine flora and fauna	Unlikely	The NT EPA notes that there are existing potential impacts and risks to marine flora and fauna (including sawfish) along the Casuarina Beach and Buffalo Creek. The addition of 3100 new residents and a new access point to Casuarina Beach is unlikely to significantly increase interactions with sawfish. The commitment to fund new signage at access points would contribute to educating existing and future users of the reserve.

Environmental factor	Potential impacts	Explanation of why the factor is not a key environmental factor
		The social values in relation to nesting turtles along Casuarina Beach are discussed in section 5.1 of this Report. The NT EPA considers that it is unlikely that the Proposal would have a significant impact on the NT EPA's environmental objective for Marine flora and fauna.
Benthic Habitat and Communities	Unlikely	The Proposal is not located on land immediately adjacent to the coastal margin. Runoff from the site is unlikely to have a significant impact on benthic habitat and communities.
Marine Environmental Quality	Unlikely	The Proposal is unlikely to have a significant impact on the environmental values for Marine Environmental Quality.
Coastal processes	Unlikely	The Proposal is unlikely to have a significant impact on coastal processes.
AIR		
Air quality and Greenhouse Gases	Implementation of the Proposal would result in the unavoidable emission of greenhouse gases from land clearing, construction, vehicle emissions, and energy generation. Potential impacts to this factor may occur through the following: • clearing of 110 ha of vegetation • construction of built infrastructure	Air quality and greenhouse gasses was not identified as a key environmental factor for the Proposal. The NT EPA noted that: • the clearing of 110 ha of vegetation is unlikely to result in significant quantities of GHG emissions • design of the Proposal is likely to take advantage of prevailing breezes for natural cooling to reduce energy consumption • the Proponent has committed to the implementation of a Dust Management Sub-plan during construction including measures to avoid

Environmental factor	Potential impacts	Explanation of why the factor is not a key environmental factor
	• transport of building materials to and around the site • emissions generated from energy usage by households, businesses and industry	the mobilisation of dust and potential impacts on sensitive receptors. This has been assessed in section 5.1 of this Report. The NT EPA considers that it is unlikely that the Proposal would have a significant impact on Air Quality and Greenhouse Gases and can be managed to meet the NT EPA's environmental objective.

Appendix 3 – Principles of Ecologically Sustainable Development

Under the NT EPA Act, ecologically sustainable development (ESD) means *using, conserving and enhancing the community's resources so that ecological processes, on which life depends, are maintained, and the total quantity of life now and in the future can be increased.*

In December 1992, the Territory Government endorsed the 'National Strategy for Ecologically Sustainable Development' and agreed, along with all other States and Territories, to the 'Intergovernmental Agreement on the Environment' (IGAE).

The NT EPA uses the four principles contained in the IGAE to demonstrate that it has considered ESD in its assessment of the Proposal and in its fulfilment of its objectives under the NT EPA Act.

ESD Guiding principle	NT EPA assessment
1. The precautionary principle *Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.* *In application of this precautionary principle, decisions should be guided by:* *a) careful evaluation to avoid, where practicable, serious or irreversible damage to the environment; and* *b) an assessment of the risk-weighted consequences of various options.*	In considering this principle, the NT EPA notes that Social, Economic and Cultural, Terrestrial Flora and Fauna and Human Health could be significantly impacted by the Proposal. The assessment of these impacts is provided in Assessment Report 88 (this Report). The Proponent's investigations into the biological and social environment provided sufficient scientific certainty to assess the potential impacts and risks and outline measures to avoid/minimise those impacts and risks. The NT EPA made further recommendations for the Proponent to implement, in line with the precautionary principle, in order to avoid and minimise impacts to social amenity and human health. These recommendations included provisions for informing future residents of potential land use conflicts and minimising the risks. Where there was uncertainty about potential future land conflict (odour), the NT EPA considered the available modelling, complaints data and relevant policy guidance and adopted a precautionary approach using appropriate land use planning tools. From its assessment of the Proposal, the NT EPA identified there is a threat of serious or irreversible damage but concluded that those threats could be

ESD Guiding principle	NT EPA assessment
	managed through the Proponent's commitments and the inclusion of the NT EPA's recommendations as conditions on future Development Permits.
2. The principle of intergenerational equity *The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for the benefit of future generations*.	The NT EPA has considered the principle of intergenerational equity in assessing this Proposal. The design of the Proposal has considered the environmental values of the site and identified suitable avoidance measures in order to retain the identified values within the site and the adjacent Casuarina Coastal Reserve for future generations.
3. The principle of the conservation of biological diversity and ecological integrity *Conservation of biological diversity and ecological integrity should be a fundamental consideration*.	In considering this principle, the NT EPA notes that the Proposal would result in impacts to terrestrial flora and fauna. In assessing this Proposal, the NT EPA has considered these impacts and risks and taken into consideration measures proposed by the proponent to avoid and minimise impacts to the affected environmental factor. From its assessment of this Proposal, the NT EPA has concluded that the measures proposed are adequate to avoid significant impacts to significant and sensitive vegetation types. A residual significant impact is likely for the black-footed tree-rat. Those significant residual impacts could be adequately compensated through a suitable environmental offset.
4. Principles relating to improved valuation, pricing and incentive mechanisms *a) Environmental factors should be included in the valuation of assets and services.* *b) The polluter pays principles – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.* *c) The users of goods and services should pay prices based on the full life-cycle costs of providing goods and services, including the use*	In considering this principle, the NT EPA notes that the Proponent would take responsibility for preventing, managing and mitigating waste and pollution during clearing and construction of the Proposal. Once the site is constructed and occupied, the responsibility for preventing, managing and mitigating waste and pollution would become the responsibility of individual landholders. The NT EPA has had regard to this principle during the assessment of the proposal.

ESD Guiding principle	NT EPA assessment
of natural resources and assets and the ultimate disposal of any waste. *d) Environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and responses to environmental problems.*	