

Statement of Effect of Use or Development Proposal

Prepared under section 46(3) of the Planning Act 1999

Clearing permit application – Stage 2 Aquaculture Development, Little Paradise

Applicant: Groote Aqua Aboriginal Corporation (GAAC)

Land: Aquaculture Lease 01 and Lease 02, Little Paradise, Groote Eylandt, Northern Territory

Prepared by: Dr. Valentin Thepot, GAAC (vthepot@grooteaqua.com.au / 0460012284)

Date: September 2026

This Statement of Effect addresses each of the matters specified in section 46(3) of the Planning Act 1999 in relation to GAAC's application for a permit to clear native vegetation under Clause 10.2 of the NT Planning Scheme 2020, in support of the Stage 2 aquaculture development at Little Paradise. Following advice from the NT Department of Lands, Planning and Environment (DLPE) that the clearing provisions of the Planning Act 1999 and Planning Scheme 2020 apply to the whole portion rather than being restricted to areas covered by an administrative lease, and that the sub-1 ha clearing exemption is accordingly unlikely to apply separately to each lease, this application now covers both the new Stage 2 clearing on Lease 02 and the existing cleared area across Lease 01 and the Lease 02 Stage 1 footprint, for certainty. It should be read alongside GAAC's Stage 2 Environment Protection Licence (EPL) supporting document, Stage 2 environmental protection approval (EPA) supporting document, and Stage 2 Environmental Management Plan (EMP), which provide the detailed technical basis for the assessments summarised below.

46(3)(a) – Compliance with the Planning Scheme

The land is unzoned under the NT Planning Scheme 2020. Under Clause 10.2, the clearing of native vegetation exceeding one hectare in aggregate on unzoned land requires consent. Consistent with DLPE's advice that this aggregate threshold applies across the whole portion rather than separately to each administrative lease, GAAC's application addresses the total clearing area relevant to the aquaculture project: approximately 4 ha of new Stage 2 clearing, together with approximately 2.3 ha of existing cleared area across Lease 01 and Lease 02 that was cleared under the previous administration of the site, for a combined total of approximately 6.3 ha. This combined area accordingly requires a development permit. Clause 10.3 sets out the performance criteria against which such an application is assessed; GAAC's proposal addresses each as follows:

- Land Clearing Guidelines: the new clearing has been planned with regard to the NT Land Clearing Guidelines, minimising the disturbance footprint and confining works to land already substantially modified by the existing Stage 1 facility; the existing cleared area is included in this application for certainty rather than as new disturbance.
- Threatened wildlife and essential habitat: the broader region may support species protected under the Territory Parks and Wildlife Conservation Act and the EPBC Act; self-assessment undertaken as part of the Stage 2 EPA supporting document concluded that significant impacts on matters of national environmental significance are unlikely, and no essential habitat has been identified within the clearing footprint.
- Sensitive or significant vegetation communities: no mangrove, rainforest, vine thicket or riparian vegetation will be cleared; the clearing footprint is confined to terrestrial vegetation typical of the broader Groote Eylandt landscape (noting the existing cleared area is already cleared and does not affect any of these communities).
- Regional biodiversity: the total clearing footprint (approximately 6.3 ha, of which approximately 2.3 ha is already cleared) is small relative to the extent of similar vegetation in the surrounding landscape, and vegetation buffers will be retained around the site perimeter and foreshore to maintain landscape connectivity.
- Necessity for the intended use: new clearing is limited to the footprint required for the eight grow-out ponds, the bioremediation pond, and associated access and service corridors; pond and infrastructure layout has been optimised to work around existing vegetation where feasible. The existing cleared area

supports GAAC's operational Stage 1 facility, accommodation, power generation, fuel storage and laydown functions.

- Water and soil suitability: the site has direct access to high-quality seawater from Bartalumba Bay via the existing intake alignment, and has a demonstrated three-year operating history under Stage 1. Excavated material will be reused to form pond bund walls, reflecting the underlying sandstone geology and reducing the extent of excavation required.
- Slope: the site falls gently from the western boundary toward the coast; construction methodology (dry-season timing, single-campaign excavation, spoil reuse) has been selected having regard to this general fall (see the Stage 2 EPA supporting document).
- Water features, waterways and wetlands: no billabongs, swamps or watercourses occur within the clearing footprint; the intake and discharge infrastructure follows an already-disturbed alignment adjacent to the existing breakwater, and vegetation buffers will be retained along the foreshore.
- Buffers and corridors: vegetation buffers will be retained around the site perimeter and along the foreshore, providing erosion control, dust suppression and a degree of habitat connectivity consistent with the surrounding landscape.
- Heritage, archaeological and sacred sites: GAAC will obtain the necessary clearance from the Aboriginal Areas Protection Authority (AAPA) prior to any new clearing, and will consult with the Anindilyakwa Land Council and Traditional Owners, consistent with the NT Aboriginal Sacred Sites Act 1989 and the Heritage Act.

No Interim Development Control Order is understood to apply to the land beyond the clearing provisions addressed above.

46(3)(b) – Interim Development Control Order

No Interim Development Control Order currently applies to the land. Should this change prior to determination of the application, GAAC will provide a supplementary assessment addressing any relevant order.

46(3)(c) – NT EPA Referral

The Stage 2 development is required to be referred to the NT EPA under Part 4, Division 3 of the Environment Protection Act 2019, given the nature and scale of the proposed works. The development has been referred to the NT EPA: GAAC has submitted a Stage 2 Environment Protection Licence (EPL) application and a Stage 2 environmental protection approval (EPA) application, each supported by a dedicated supporting document addressing the relevant environmental matters, and by a Stage 2 Environmental Management Plan (EMP) prepared consistent with the NT EPA's Guideline for the Preparation of an Environmental Management Plan (2015). These processes sit alongside, and are additional to, the broader referral previously made to the NT EPA by Groote Holdings Aboriginal Corporation (GHAC) for the wider Little Paradise development, of which the Stage 2 aquaculture facility forms a component.

46(3)(d) – Merits of the Proposed Development

The proposed development has significant merit on economic, social and environmental grounds:

- Economic and social merit: the development supports the strategic transition of Groote Eylandt from a mining-dependent economy to a diversified, sustainable Blue Economy, led by Anindilyakwa Traditional Owners. It builds on three years of Stage 1 research and development, and is expected to create long-term Indigenous employment, training and enterprise development opportunities.
- Environmental design merit: the facility is designed around low-trophic, extractive aquaculture species (oysters, sea cucumbers, rabbitfish and seaweed) that remove nitrogen, phosphorus and suspended solids from the water column, functioning as a net nutrient sink rather than a source. Water renewal rates (1–5% of pond volume per day) are substantially lower than conventional aquaculture.

- Minimised environmental footprint: the new development is sited largely within, or immediately adjacent to, the existing Stage 1 operational footprint and previously disturbed land, reducing the extent of new disturbance relative to a greenfield site; of the approximately 6.3 ha total clearing area, approximately 2.3 ha was already cleared prior to GAAC's tenure and is included for certainty rather than representing new disturbance. Construction is confined to the dry season, and excavated material is reused on-site rather than imported or disposed of.
- Consistency with government and community priorities: the development aligns with the Anindilyakwa community's identified priorities for aquaculture, fisheries and marine resource development as pillars of a post-mining economy.

46(3)(e) – Physical Characteristics and Land Suitability

The site is located within Aquaculture Lease 01 and Lease 02 at Little Paradise, on the coast adjacent to Bartalumba Bay. Ground levels across the broader Little Paradise project envelope range from approximately 0 m AHD at the coast to approximately 12 m AHD at the western boundary; the Stage 2 footprint sits on the lower-lying, previously disturbed portion of this landform. The site geology contains large sandstone boulders, which has informed a construction methodology that minimises excavation depth and reuses cut material as fill for pond bund walls, rather than importing or exporting material.

The land is suitable for the proposed use: it has direct access to a reliable, high-quality seawater source; three years of operational experience under Stage 1 have demonstrated that the site supports the intended low-trophic aquaculture operations; and the site is already used for aquaculture purposes under the existing leases. Effects on other land are expected to be minimal, given the site's isolation from other land uses, the retention of vegetation buffers around the perimeter and foreshore, and the containment of construction and operational discharges within engineered infrastructure (bioremediation pond, treated discharge to a defined marine outfall).

46(3)(f) – Public Facilities and Open Space

There are no public facilities or public open space located within or in the immediate vicinity of the site; the land is remote from town centres and is not subject to public open space contribution requirements. No land for public facilities or open space is proposed to be provided by GAAC as part of this development, as none is required by the nature or scale of the proposal.

46(3)(g) – Public Utilities and Infrastructure

The site is not connected to, and does not rely upon, reticulated public utilities. Power is generated on-site, with fuel stored at an existing self-bunded diesel tank; no new fuel storage is required for Stage 2. Water supply is drawn directly from Bartalumba Bay via a dedicated seawater intake pipeline, screened intake riser, pump station and rising main constructed and operated by GAAC, rather than via a public water utility. Treated discharge is conveyed via GAAC's own bioremediation pond and outfall infrastructure. All utilities and infrastructure required for the development are therefore provided by GAAC as part of the proposal, and no public utility augmentation or connection is required.

46(3)(h) – Amenity Impact

The site is located within an established aquaculture and industrial precinct at Little Paradise, remote from residential areas and other sensitive receptors. Potential amenity effects during construction, principally noise, dust and visual change, are temporary and are managed through the measures set out in the Stage 2 EPA supporting document and EMP, including dry-season construction timing, dust suppression (water cart application, vegetation buffer retention, vehicle speed restrictions), and staging to limit the area of disturbed ground at any one time. Operational amenity effects are expected to be minimal given the facility's low-

trophic, low-emission design and its location away from other land uses. No significant adverse impact on the existing or future amenity of the area is anticipated.

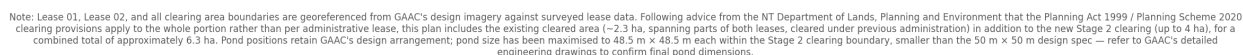
46(3)(j) – Public Interest

The proposed development is considered to provide a clear net benefit to the public interest. It supports long-term Indigenous economic development, employment and training on Groote Eylandt; demonstrates a low-impact, extractive aquaculture model with net-positive water quality outcomes; and builds directly on three years of locally-generated research and development. Potential detriments, principally the temporary construction-phase disturbance associated with the approximately 6.3 ha of clearing now the subject of this application (of which approximately 4 ha is new clearing and approximately 2.3 ha was already cleared under the previous administration), are limited in extent and duration, and are managed through the erosion, dust, biosecurity, emergency response and rehabilitation measures detailed in the Stage 2 EPA supporting document and EMP. On balance, the benefits of the proposed development to the Anindilyakwa community and the broader public interest are considered to outweigh these limited and manageable detriments.

Aquaculture Lease 01 & 02, Little Paradise, Groote Eylandt — Stage 2 Aquaculture Development

Date: September 2026

Site / Clearing Plan — Aquaculture Lease 01 & 02, Little Paradise, Groote Eylandt
Total clearing extent (new + existing): approximately 6.3 ha



Plan Contents and Basis

- Lease boundaries: Lease 02 (area 6.47 ha) and Lease 01 (area 4.02 ha), both derived directly from GAAC's surveyed lease data (KMZ).
- North point and scale bar: derived from the same survey coordinates; the plan is to scale and legible at A3.

- Stage 2 new clearing boundary (~3.79 ha): georeferenced from GAAC's design imagery, consistent with GAAC's Stage 2 EPA supporting document.
- Existing cleared area (~2.30 ha): the area already cleared under the previous administration, spanning parts of both Lease 01 and Lease 02 (encompassing the existing Stage 1 facility, GHAC accommodation, power generation, fuel storage, and laydown area). GAAC understands from DLPE advice that the sub-1 ha clearing exemption under the Planning Act 1999 does not apply separately to each administrative lease, and this area is accordingly included in the clearing application for certainty, notwithstanding that it was cleared prior to GAAC's tenure.
- Total clearing extent: approximately 6.3 ha, comprising up to 4 ha of new Stage 2 clearing and approximately 2.3 ha of existing cleared area now included for certainty.
- Proposed Stage 2 grow-out ponds and bioremediation pond: pond positions retain the same 2-row x 4-column arrangement as GAAC's design imagery (matched against the surveyed lease boundary to fix scale, rotation and position). Pond size has been maximised to 48.5 m × 48.5 m each (~1.88 ha total for the 8 ponds) — the largest uniform pond size that keeps every pond within the surveyed Stage 2 clearing boundary and clear of the bioremediation pond, while allowing a minimum 3 m gap between ponds for an access/embankment strip. This is smaller than the 50 m × 50 m (2,500 m²) ponds described in GAAC's Stage 2 EPL and EPA supporting documents; the bioremediation pond (~1.01 ha) is broadly consistent with those documents.
- Vehicle access: the existing access track enters the lease from the north-east, connecting to the existing Stage 1 facility and, from there, to the proposed Stage 2 pond field.
- Vegetation buffer (retained): the remaining lease area outside the clearing boundaries is shown as retained vegetation buffer, consistent with the vegetation retention approach described in GAAC's supporting documents.

Limitations

The lease boundaries, their areas and dimensions are accurate, being derived directly from GAAC's surveyed lease data. The Stage 2 clearing boundary, existing cleared area, pond, bioremediation pond, Stage 1 facility and GHAC accommodation footprints are georeferenced from GAAC's design imagery rather than from an as-built or engineering survey. Pond positions retain GAAC's as-drawn arrangement, with pond size maximised computationally to the largest uniform size that fits within the Stage 2 clearing boundary alongside the bioremediation pond, at a 3 m minimum gap between ponds; this is smaller than the 50 m × 50 m design spec. The existing cleared area boundary is indicative of the disturbed footprint and has not been separately surveyed. This plan is intended to satisfy the site/clearing plan requirements for the clearing permit application; GAAC's detailed engineering drawings and any DLPE-confirmed survey should be referred to for exact positions and dimensions if required by the consent authority.

Land Type Information and Land Capability Assessment

Prepared with reference to the NT Land Suitability Guidelines (2013) and WANT Geotechnics' geotechnical investigation for Lease 01 and 02 (Project NTG20212375, Dec 2021)

Clearing permit application — Stage 2 Aquaculture Development, Little Paradise

Applicant: Groote Aqua Aboriginal Corporation (GAAC)

Land: Aquaculture Lease 01 and Lease 02, Little Paradise, Groote Eylandt, Northern Territory

Prepared by: Dr. Valentin Thepot, GAAC (vthepot@grooteaqua.com.au / 0460012284)

Date: September 2026

This document provides land type information and a land capability assessment for the Stage 2 clearing permit application. It applies the seven land suitability categories set out in the NT Land Suitability Guidelines (December 2013), grounded in the geotechnical investigation undertaken by WANT Geotechnics for the Bartalumba Bay Logistics Base on Lease 01 and 02 (Project NTG20212375 Rev 0, 5 December 2021), together with information already established in GAAC's Stage 2 EPL and EPA supporting documents and the broader Little Paradise EPA referral. Following advice from the NT Department of Lands, Planning and Environment (DLPE) that the clearing provisions of the Planning Act 1999 and Planning Scheme 2020 apply to the whole portion rather than being restricted to areas covered by an administrative lease, this assessment now covers both Lease 01 and Lease 02, consistent with the amended clearing application, Site/Clearing Plan and shapefile.

1. Land Type Information

- **Tenure:** Aquaculture Lease 01 and Lease 02, held on Aboriginal freehold land under the Aboriginal Land Rights (Northern Territory) Act 1976, administered by the Anindilyakwa Land Trust; the land is unzoned under the NT Planning Scheme 2020.
- **Location and landform:** a coastal lowland site adjoining Bartalumba Bay, Little Paradise, Groote Eylandt. Ground levels across the broader project envelope range from approximately 0 m AHD at the coast to approximately 12 m AHD at the western boundary; within the logistics base area on the same leases, WANT Geotechnics recorded ground levels falling from approximately 18 m AHD to 15 m AHD. The Stage 2 aquaculture development footprint is sited on the lower-lying, previously disturbed portion of this broader landform.
- **Land system and geology:** NT Government Natural Resource Maps indicate the site falls within the “Groote” land system — characterised by rugged quartz sandstone plateaux and hills, with bare rock and shallow lithosols, and no known occurrence of acid sulfate soils. The site is underlain at depth by the Proterozoic-age Dalumbu Sandstone. This is consistent with the large sandstone boulders encountered within the Stage 2 footprint, which have informed the construction methodology (reuse of excavated material as pond bund fill, rather than deep excavation).
- **Soils:** field investigation (16 test pits across Lease 01 and 02) recorded a consistent profile of loose sand (with trace clay) near the surface, grading to medium dense-to-dense sand with trace gravel or clay, over sandstone at rockhead depths ranging from the surface to approximately 2.0 m. Permeability testing recorded rapid drainage, in the order of 4–40 m per day.
- **Groundwater:** not encountered in any of the 16 test pits, excavated to depths of up to 2.0 m, during the November 2021 (dry season) field investigation. Groundwater levels are expected to rise and vary seasonally, particularly during the wet season.
- **Vegetation and existing disturbance:** native coastal woodland and bushland cover the undisturbed portion of both leases. An existing cleared area, comprising the Stage 1 operational facility, accommodation, power generation, fuel storage and laydown area, spans approximately 2.3 ha across Lease 01 and Lease 02, and was cleared under the previous administration of the site prior to GAAC's tenure. The new Stage 2 clearing footprint sits largely within, or immediately adjacent to, this existing disturbance.
- **Climate:** a wet-dry tropical climate, with intense monsoonal rainfall concentrated in the wet season (approximately November to April) and a pronounced dry season (approximately May to October), consistent with the dry-season construction timing adopted for Stage 2. WANT Geotechnics'

trafficability assessment found sandy subsoils support good dry-season trafficability for both light and heavy vehicles, with wet-season access remaining generally workable but prone to rutting in high-traffic areas.

2. Land Capability Assessment

Table 1 applies the seven land suitability categories and Suitability Classes (S1 Highly Suitable to S5 Not Suitable) set out in the NT Land Suitability Guidelines (2013) to the Stage 2 development footprint and the existing cleared area across Lease 01 and Lease 02. Suitability Classes S1–S2 are generally considered unconstrained; Classes S3–S5 are considered constrained to varying degrees and may require additional design, management, or field investigation.

Category	Assessment	Indicative suitability class
Drainage	Confirmed by field investigation: predominantly loose-to-dense sandy soils, no groundwater encountered to 2.0 m depth, and rapid permeability (~4–40 m/day). The development footprint and existing cleared area occupy elevated, previously disturbed ground; the more poorly drained intertidal/foreshore fringe is excluded from the clearing footprint and retained as a vegetation buffer.	S1–S2 (development footprint and existing cleared area); S3–S4 (retained foreshore fringe, not cleared)
On-site wastewater management	Site and Soil Evaluation (AS1547) within Lease 01/02 recorded sandy soils with hydraulic conductivity of 20–30 m/day (Category 1/2), supporting an indicative design loading rate of 20–35 mm/day for primary treated effluent. GAAC's aquaculture process water is managed via engineered treatment (bioremediation pond, ozonation) rather than septic absorption; this category applies mainly to minor staff amenities wastewater, to be sized at detailed design.	S1–S2, supported by field testing within the leases
Erosion risk	Field investigation confirms the near-surface soils are predominantly loose sand — inherently erodible once exposed — consistent with the wet-dry tropics generally. This is the primary driver for GAAC's dry-season-only earthworks, spoil reuse, and vegetation retention commitments (Stage 2 EPA supporting document, Sections 3 and 5). The existing cleared area is already stabilised through ongoing operational use and does not present a comparable erosion risk.	S2–S3 inherent for new clearing; managed to a low residual risk via committed controls. S1–S2 for the existing, stabilised cleared area
Soil salinity	No evidence of saline soils on the elevated development footprint; consistent with typically leached NT coastal soils away from areas of concentrated evaporation.	S1 — not considered a material constraint
Acid sulfate soils (ASS)	NT Government Natural Resource Maps indicate no known occurrence of ASS within the Groote land system covering the site. Where the seawater intake and discharge pipeline approaches the foreshore and mangrove margin, it is designed to run above ground rather than trenched, avoiding excavation in the lower-lying coastal soils where ASS risk, if present, would be greatest.	S1–S2, supported by land system mapping and by the above-ground pipeline design near the foreshore
Storm tide flooding	A search of the Australian Government's Natural Hazards Mapping database returned no inundation/flood data for this area. As a coastal site, the low-lying foreshore fringe remains potentially subject to storm tide inundation during cyclone events; the pond and infrastructure envelope, and the existing cleared area, are set back from the immediate foreshore on higher ground. Site-specific storm tide modelling for this part of Groote Eylandt has not been identified.	Qualitatively low–moderate given site elevation and the absence of mapped hazard; recommend confirming against any available storm tide modelling at detailed design
Riverine flooding	Consistent with the storm tide finding above, the flood hazard database search returned no data for this area, and no mapped watercourse or floodplain traverses either lease.	S1 — not considered a material constraint

3. Supplementary Geotechnical Findings

The following findings from the WANT Geotechnics investigation, while outside the seven NT land suitability categories, provide further support for the general suitability of the land system for development within Lease 01 and 02:

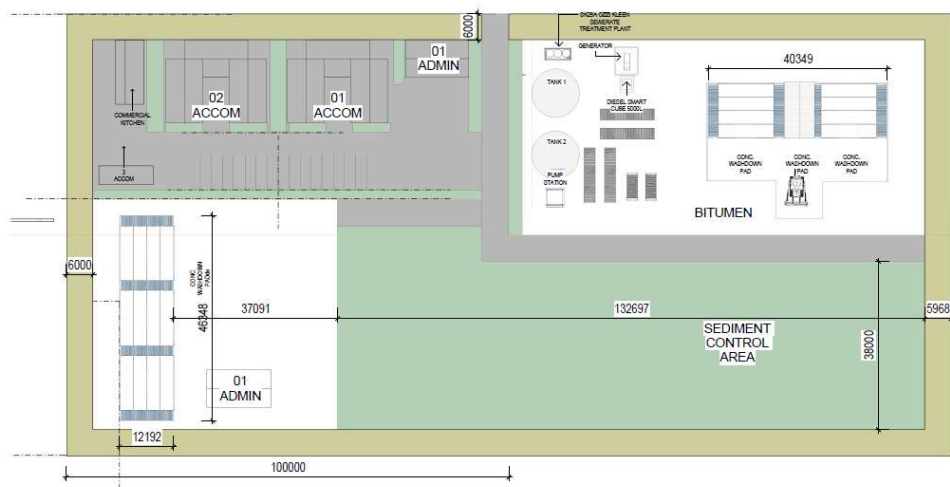
- Natural hazards: no landslide or flood data was returned for the area from the Australian Government's Natural Hazards Mapping database. The site is assessed as having a low earthquake hazard factor of 0.05g (AS1170.4), and liquefaction is considered highly unlikely given the soil types present.
- Site classification: the site is recommended to be classed as Site Class S (slightly reactive) under AS2870, with an allowable bearing pressure of 100 kPa at typical founding depths (0.3 m), increasing to 400 kPa where founded on deeper, denser material or sandstone — indicating generally favourable founding conditions for infrastructure such as the pump station and other minor structures.
- Excavation and trafficability: soils are excavatable by standard excavator/backhoe to the depths investigated. Excavated slopes to 1.5 m depth can generally be cut at 1V:2H in unsaturated sand and gravel, consistent with GAAC's construction methodology.
- Existing quarry: test pitting at the nearby existing gravel pit did not reveal useable sandstone at shallow depth, though sandstone boulders present in the area — including a stronger quartzitic variety — may be a useful source of armourstone for the intake/discharge infrastructure.

4. Summary

The Stage 2 development footprint, together with the existing cleared area now included in GAAC's clearing application across Lease 01 and Lease 02, is considered suitable for the relevant use. It occupies the more elevated, better-drained, and already-disturbed portion of the leases, avoiding the more constrained low-lying foreshore and intertidal margins, and is underlain by sandy, free-draining soils over sandstone consistent with the mapped Groote land system. The principal identified constraint remains erosion risk associated with new clearing, arising from the inherently erodible sandy soils confirmed by field investigation combined with the wet-dry tropics rainfall pattern; this is directly addressed through the dry-season construction timing, spoil reuse, and vegetation retention measures described in GAAC's Stage 2 EPA supporting document and Environmental Management Plan. The existing cleared area, having been stabilised through years of operational use, does not present a comparable erosion risk. Acid sulfate soils present a low residual risk: land system mapping indicates no known occurrence, and the intake/discharge pipeline is designed to run above ground rather than trenched where it approaches the foreshore and mangrove margin, avoiding ground-breaking in the coastal soils where ASS risk would otherwise be greatest. Storm tide flooding is unmapped but retains a qualitative low–moderate rating given the site's coastal setting. Neither is considered likely, on current information, to preclude the proposed development.



5 December 2021



WANT Geotechnics
Geotechnical Investigation Report
for the proposed
Bartalumba Bay Logistics Base
Lease 01 and 02, Deception Bay, Northern Territory
Prepared for the
Anindilyakwa Advancement Aboriginal Corporation
Project NTG20212375 Rev 0

Project: NTG20212375		
Date	Revision	Comments
5 December 2021	0	Draft Issued to Client

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Geotechnical Investigation Report for the Proposed Bartalumba Bay Logistics Base on Lease 01 and 02, Deception Bay, NT

1. Introduction

WANT Geotechnics were commissioned by Gabbert Design, on behalf of the Anindilyakwa Advancement Aboriginal Corporation, to undertake a geotechnical investigation to support the design of a proposed Logistics Base on Lease 01 and 02 on the southeast side of Ngadumiyerrka Road on Groote Eylandt in the Northern Territory. The geotechnical investigation was undertaken in general accordance with WANT Geotechnics proposal NTG20212121P. The new facility will consist of:

- Accommodation
- Administration buildings
- Washdown facilities
- Various aboveground tanks
- Access and hardstand
- Sediment control area

The concept layout is illustrated below.

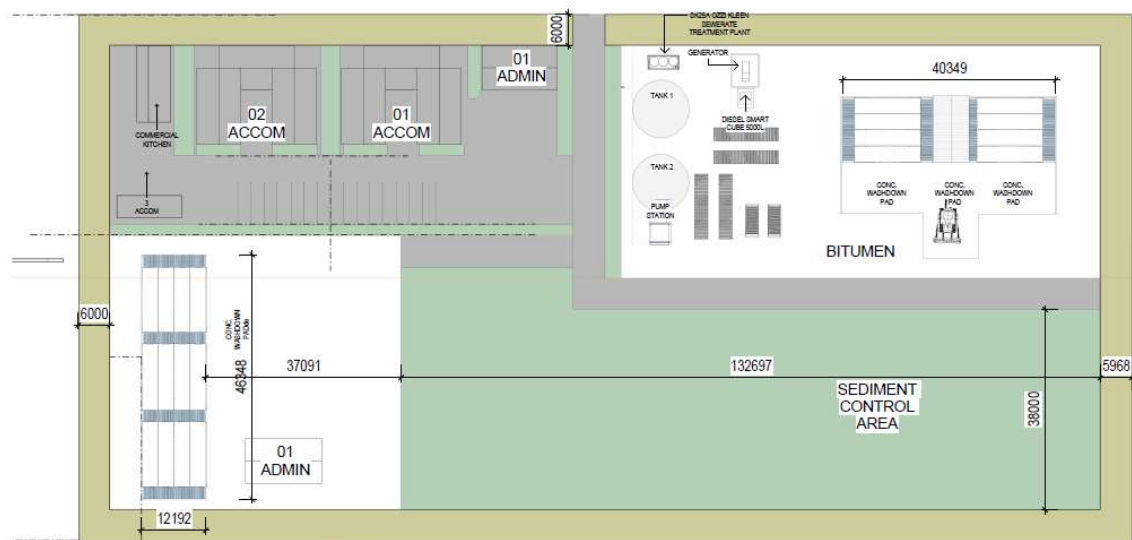


Figure 1: Concept Layout (source: Client)

The objectives of the investigation were to provide a reporting covering:

1. Introduction, Scope, Site Characteristics
2. Investigation Methodology and Investigation Results
3. Assessment including:
 - a. earthworks, site preparation, safe batters, and excavation characteristics
 - b. site classification in accordance with AS2780
 - c. ultimate bearing capacity, footing options, and foundation design parameters
 - d. pavement design parameters

- e. site and soil evaluation
- f. detention basin permeability
- g. groundwater and site drainage characteristics
- 4. Any other geotechnical matters pertinent to the proposed works.
- 5. Appendices including
 - a. Site plans indicating test locations.
 - b. Detailed test pit logs.
 - c. Dynamic cone penetrometer results.
 - d. Photographs of test pits and exploratory locations, and any other pertinent site features; and
 - e. NATA soils laboratory test certificates.

In our judgement, the extent of this investigation has been sufficient to correlate the observed soil conditions with the known geology and published information for this area. However, localised variations are very difficult to locate using boreholes and test pits as natural soils can vary greatly over short distances. In which case, it would be prudent to commission site inspections during construction, in order that the true site conditions are verified.

2. Desktop Study

2.1 Site, Terrain and Geology

The site lies to the southeast side of Ngadumiyerrka Road, some 5km to the northeast of Alyangula on Groote Eylandt in the Northern Territory. Google earth imagery suggests the site generally falls towards the east, from around 18mAHD down to around 15mAHD. The general location of the site is shown in Figure 2 below.

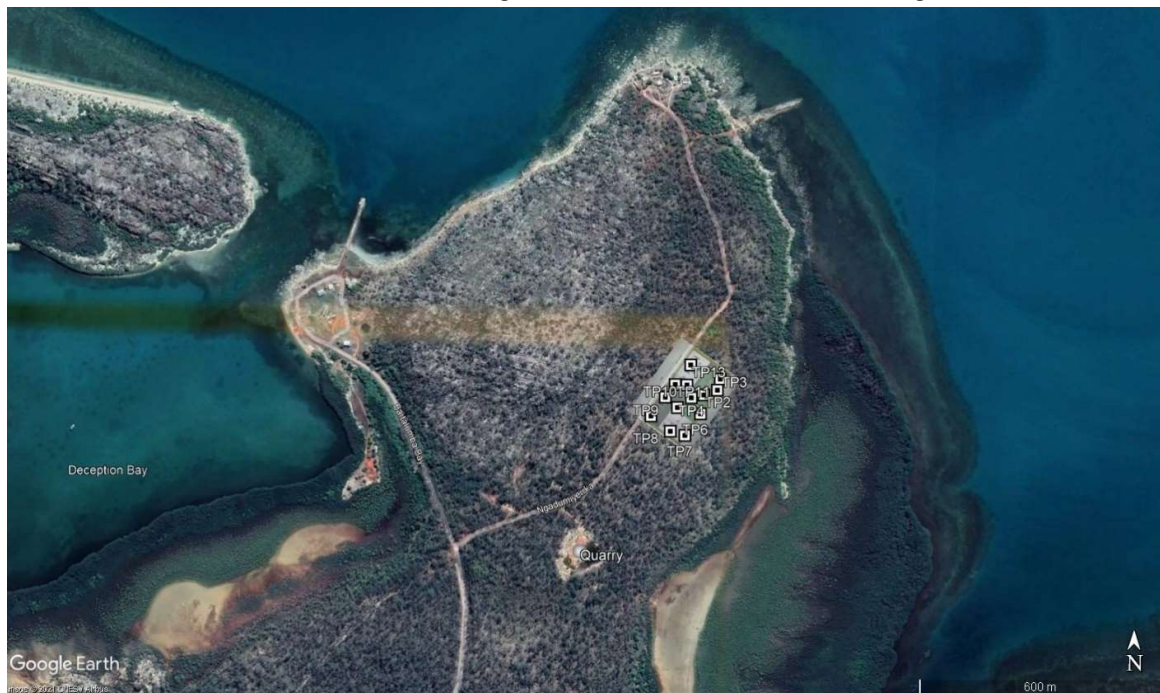


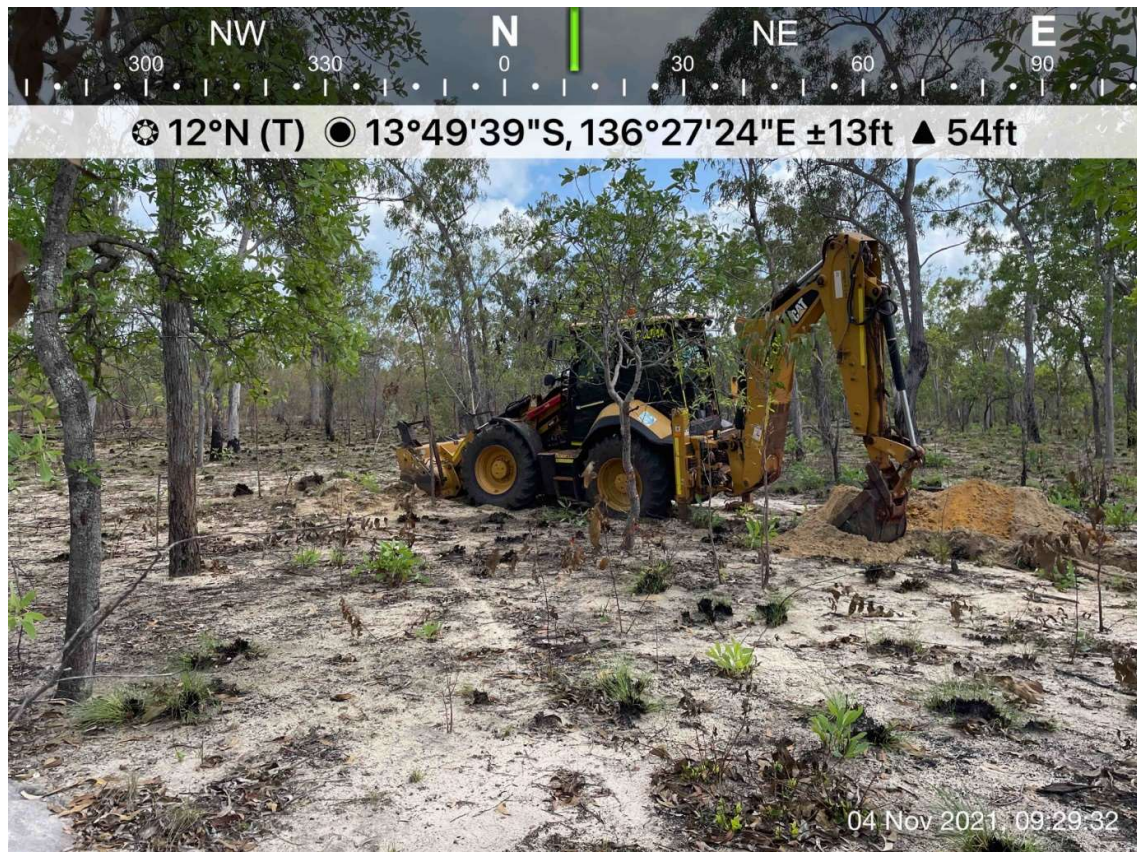
Figure 2: General Location

Reference to NT Government Natural Resource Maps website indicates the entire site to be underlain by the Groote Land System. The following table details the typical characteristics of this land system.

Land System	Class	Landform and Soils	Acid Sulphate Soils
Groote	Rugged quartz sandstone plateaux and hills	Bare rock and shallow lithosols	No occurrence of acid sulphate soils

Table 1: Land System

The site currently comprises mature bushland, and is generally level with partial grass and tree cover as illustrated in the photograph below:



Photograph 1: Typical Site Terrain

Reference to the NT Government Strike website indicates the site is underlain at depth, below the surface soils, by the Proterozoic Age Dalumbu Sandstone.

2.2 Natural hazards

An online search was conducted using the Australian Government *Natural Hazards Mapping* website and other publicly available data sources to assess the potential for the proposed site to be affected by landslides, floods, liquefaction and earthquakes.

2.2.1 Landslides

The web-based landslides query centred on the site returned no data from an interrogation of its landslide database for this area.

2.2.2 Flood

The web-based flood query centred on the site returned no data from an interrogation of its inundation/flood database for this area.

2.2.3 Earthquakes

Seismicity is generally associated with the boundaries of the Earth's tectonic plates. However not all earthquakes occur at plate boundaries, these are termed intraplate earthquakes and generally occur as a result of the release of pressure that has built-up over time as the Earth's crust deforms. In which case, the presence of faults would not be indicative of an increased risk of seismic activity. The site lies some distance from the boundaries of the Indo-Australian tectonic plate, but this does not preclude it from being subject to seismic events. In which case, there remains potential for the area to be affected by seismic activity, and it is recommended that all infrastructure should be designed for earthquake acceleration of 0.05g as indicated in Figure 3.2(E) of AS1170.4.

2.2.4 Liquefaction

The upward propagation of shear waves through the ground in an earthquake induces repeated cycles of loading and unloading within subsoils. These repeated cycles of stress often result in progressively increasing magnitudes of excess porewater pressure within fine granular soils. If the porewater pressures build to a magnitude equal to the confining stress, the effective stress is reduced to zero, at which point the fine granular soil loses its strength and essentially flows like a liquid, hence the term liquefaction. The main factors affecting the liquefaction potential of a soil deposit are: intensity of ground shaking, duration of ground shaking, soil type, initial confining pressure, and relative density or void ratio. Soils with the following characteristics are more susceptible to liquefaction.

- Geological age less than 10 000 years
- Particle size distribution from medium sand to silt size and fines (< 0.06 mm) content less than 15%
- Average grain size less than about 0.7 mm
- Relative density less than about 70%
- Groundwater level within a few metres of the ground surface

In addition, soils must also be near saturation to experience the porewater pressure increase that leads to liquefaction. Soils most susceptible to liquefaction are saturated, loose, uniform, fine grained sands. Liquefaction potential decreases as the density or the fines content increases. Soils with plasticity are not likely to liquefy.

The published geological data reviewed as part of this study suggest it is **highly unlikely** the soils underlying the site would liquefy or undergo significant deformation during an earthquake event.

2.3 Acid sulphate soils (ASS)

Acid sulphate soils (ASS) commonly form in low-energy intertidal settings or areas that are subject to periodic tidal flooding. Such reducing environments may contain sufficient organic matter to promote the formation of iron sulphide through sulphate reduction. Most acid sulphate soils occur in coastal areas below 5 metres above sea level. Acid sulphate soils (ASS) are generally formed where sea levels rose and inundated the land, the sulphate in the seawater mixed with land sediments containing iron oxides and organic matter. The resulting chemical reaction produced large quantities of iron sulphides in waterlogged environments.

The following criteria are likely to determine whether ASS is likely to be present:

- Land with an elevation less than 5 m Australian Height Datum (m AHD)
- Soil and sediment of recent geological age (Holocene)
- Marine or estuarine sediments and tidal lakes, low-lying coastal wetlands or back swamp areas, waterlogged, or scalded areas, stranded beach ridges and adjacent swales or coastal sand dunes, coastal alluvial valleys
- Areas where the dominant vegetation is tolerant of salt, acid and/or waterlogging conditions, e.g., mangroves, saltcouch, swamp-tolerant reeds, rushes, paperbarks and swamp oak; and
- Areas identified in geological descriptions or in maps as bearing sulphide minerals, coal deposits or marine shales/sediments deep older estuarine sediments below ground surface of either Holocene or pre-Holocene age

Reference to the NT Government NR Maps website indicates the land system on which the site sits has no known occurrence of ASS. During the recent investigation selected samples were obtained for ASS screening, on behalf of CDM Smith who are retained on the project for environmental consultancy services, reference should be made to their report with regards to actual ASS soils and their potential presence on the site.

3. Scope of Works and Methodology

The proposed intrusive investigation was to comprise the following scope of works.

1. A site walkover by an experienced Engineering Geologist
2. Excavate 10 test pits to a depth of 2.0m, or prior refusal by excavator/backhoe, on a 50m grid to provide coverage of the whole site.
3. Excavation of additional test pits in the nearby gravel pit to investigate presence of sandstone.
4. Logging of excavations by suitably experienced engineering geologist with 25 years' experience
5. Conduct Variable Energy Dynamic Cone Penetration (VEDCP) test from the surface at specified test pits to target depth (or practical refusal).
6. Representative sampling of the subsoils to be tested in a Darwin-based NATA accredited laboratory and comprising:
 - a. Determination of particle size distribution (4 no.)
 - b. Atterberg Limits and linear shrinkage (4 no.)
 - c. California Bearing Ratio and compaction for the subgrade (2 no)
7. Undertake permeability testing at 4 locations, as follows:
 - a. 2 locations targeting the septic / wastewater system with photographs appropriate for a Site and Soil Evaluation to assist with the design of a wastewater system
 - b. 2 locations within the sediment control area to provide permeability data on the subsoils to assist with the detention basin design, this data will be augmented with particle size distribution.
8. Reinstatement of the test holes by layering and compacting spoil back into the hole.

4. Investigation Results

The scope of works and summarised ground conditions encountered in the test pits are summarised in Tables 2 and 3 below and detailed on the logs along with the Dynamic Cone Penetrometer (DCP) test results in Appendix B. The following strata descriptions only detail the main elements; colour variations and descriptions of minor constituents i.e., proportions such as ‘trace’ and/or ‘with/some’ are detailed on the logs in Appendix B.

It should be noted the geotechnical descriptions below and on the logs are based on the 2017 amendments to AS1726, where a soil is described as a clay or silt if there is 35% or more silt or clay in the subsoil. Prior to this amendment the cut off between clay/silt and sand/gravel was 50%. The following tables summarise the test pits completed, and ground conditions encountered.

Target	Location	Easting	Northing	Termination	Geotechnical Samples	Permeability test	DCP
Septic	TP1	657530.00 m E	8470949.00 m S	0.50m	-	✓	-
	TP2	657561.00 m E	8470956.00 m S	0.50m	-	✓	-
	TP3	657601.00 m E	8470995.00 m S	0.50m	-	✓	-
Access	TP4	657496.00 m E	8470925.00 m S	2.00m	-	-	✓
Retention Basin	TP5	657594.00 m E	8470968.00 m S	1.50m	-	✓	-
	TP6	657553.00 m E	8470910.00 m S	1.50m	-	✓	-
	TP7	657515.00 m E	8470857.00 m S	1.50m	-	✓	-
Washdown	TP8	657479.00 m E	8470867.00 m S	2.00m	CBR, PSD, AL	-	✓
Accommodation	TP9	657431.00 m E	8470904.00 m S	2.00m	PSD, AL	-	✓
	TP10	657466.00 m E	8470950.00 m S	2.00m	PSD, AL	-	✓
Tanks and Hardstand	TP11	657490.00 m E	8470981.00 m S	2.00m	-	-	✓
	TP12	657519.00 m E	8470980.00 m S	2.00m	-	-	✓
Washdown	TP13	657528.00 m E	8471029.00 m S	2.00m	CBR, PSD, AL	-	✓
Existing Gravel Pit	TP14	657250.00 m E	8470577.00 m S	0.80m	-	-	-
	TP15	657236.00 m E	8470534.00 m S	1.00m	-	-	-
	TP16	657267.00 m E	8470582.00 m S	0.50m	-	-	-

Table 2: Scope of Works Completed

Strata	Location												
	TP1	TP2	TP3	TP4	TP5	TP6	TP7	TP8	TP9	TP10	TP11	TP12	TP13
Loose SAND with/trace clay	0.00-0.45m	0.00-0.45m	0.00-0.75m	0.00-0.10m	0.00-0.30m	0.00-0.40m	0.00-0.20m	0.00-0.60m	0.00-0.70m	0.00-0.70m	0.00-0.80m	0.00-0.55m	0.00-1.60m
Medium dense to dense SAND trace gravel/clay	0.45-0.80m	0.45-0.65m	0.75-0.85m	0.10-0.50m	0.30-0.90m	-	0.20-1.40m	0.60-0.80m	0.70-1.20m	-	0.80-1.70m	0.55-0.80m	-
Dense SAND gravel / boulders	-	-	-	-	-	0.40-1.30m	-	-	-	-	-	-	-
Medium dense to very dense GRAVEL sandy	-	-	-	-	-	-	-	-	1.20-1.80m	0.70-0.75m	-	-	-
SANDSTONE	-	-	-	0.50-0.55m	0.90-0.95m	1.30-1.35m	1.40-1.45m	0.80-1.00m	1.80-2.00m	0.76-0.80m	1.70-1.75m	0.80-2.00m	1.60-1.65m
Groundwater Depth	Not encountered												
Termination	Target	Target	Target	Rock	Rock	Rock	Rock	Rock	Target	Rock	Rock	Target	Rock

Table 3: Summarised Ground Conditions

The ground conditions are characterised by a variable depth to rockhead, in places rock can be seen at the existing surface and in others it may be as deep as 1.80m.

Atterberg limits, particle size distribution and California Bearing Ratio (CBR) tests were carried out on representative samples of material likely to be encountered as subgrade material. The results of these tests are presented in Appendix C and are summarised in the following table.

Test Pit	Strata	Clay / Silt %	Sand %	Gravel %	Liquid Limit	Plasticity Index	Linear Shrinkage	CBR

Table 4: Engineering Characteristics Test Results

5. Engineering Comments

5.1 Site Preparation

All earthworks should be carried out in general accordance with the relevant Department of Infrastructure, Planning and Logistics (DIPL) specification.

Prior to construction, uncontrolled fill, topsoil or material containing organic matter should be stripped from load bearing / structural parts of the site. This material is not considered suitable for use as selected fill but can be stockpiled for later use as non-structural fill purposes.

For building slabs, the exposed surface should then be wetted or dried back to approximate optimum moisture content (OMC) and the exposed subgrade compacted to 98% standard maximum dry density (SMDD), as required by AS3798 for commercial developments. A final test roll, under the supervision of a suitably qualified and experienced engineering geologist, should be undertaken to identify any remaining areas requiring further rolling (sand and gravel) or removal (clay and silt).

If required, additional fill for the building footprint should comprise granular material that is placed in 250mm thick layers, and then compacted to 98% SMDD, within $\pm 2\%$ of OMC. Placement of additional fill should be subject to Level 1 Inspection and Testing, as required by AS 3798.

5.2 Excavation characteristics

Based on the field investigation it is judged that most of the soils encountered will be excavatable to the depths investigated with a backhoe or similar capacity excavator (for this investigation a backhoe was utilised).

5.3 Trafficability

Based on local climate, the findings from the investigation and our experience, the following comments on trafficability are considered relevant.

- **Wet Weather Access**
Given the subsoils are predominantly sand, if construction is planned during a wet season or period of wet weather then, for both light and heavy vehicles/plant, trafficability should not be an issue although areas of high traffic will become rutted. It may, however, be prudent to consider closing the site during and immediately after heavy rainfall for a short period whilst the subsoils drain.
- **Dry Weather Access**
If construction is planned during a dry season / dry weather, then for both light and heavy vehicles/plant, trafficability is expected to be good.

5.4 Excavated slopes / trenches

Temporary cut slopes to a maximum depth of 1.5m should not be steeper than 1V:2H in unsaturated sand and gravel soils and near vertical in weathered rock provided that:

- They are barricaded when not in use
- They are not left open for more than 24 hours
- No surcharge loading is applied within 2.5m of the edge of the excavation
- No groundwater inflows are encountered

Where access for a worker or deeper excavations are required, the temporary excavation batters should be regraded to no steeper than 1.5H: 1V or supported by properly designed shoring.

5.5 Site Hazard Factor and Subsoil Class

The methods of assessing earthquake risk classification are outlined in Australian Standards AS 1170.4, Structural Design Actions Part 4: *Earthquake actions in Australia*. The Hazard Factor is determined by the geographical location of the site. Based on the site being Groote Eylandt and with reference to Figure 3.2E in AS1170.4, the site is located in a zone with a hazard factor of 0.05g.

Based on the investigations undertaken and the ground conditions encountered, we recommend that the site be classed as Class C_e – *Shallow Soil Site*.

5.6 Building Site Classification

Australian Standard AS 2870 provides a system of site classification as shown in the table below.

Class	Predicted Surface Movement	Foundation
A		Most sand and rock sites with little or no ground movement from moisture changes
S	<20mm	Slightly reactive clay or silt sites with slight ground movement from moisture changes
M	20mm to 40mm	Moderately reactive clay or silt sites which can experience moderate ground movement from moisture changes
H1	40mm to 60mm	Highly reactive clay site, which can experience high ground movement from moisture changes
H2	60mm to 75mm	Highly reactive clay site, which can experience very high ground movement from moisture changes
E	>75mm	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P		Filled sites
P		Sites which include: soft soils, such as soft clays, silts or organic soils, loose sands, landslip, mine subsidence, collapsing soils, soils subject to erosion, reactive sites subject to abnormal moisture conditions, sites with highly variable conditions such as weathered dolerite dykes, and sites which cannot be classified otherwise.

Table 5: General Definition of Site Classes

The standard applies to residential structures but can be applied to structures with similar loads. The results of this investigation indicate at likely founding level competent sands are likely to be encountered. Based on the following:

- Taking standard founding level to be around 0.30m to 0.40m
- Site preparation recommendations from Section 5.1 are adhered to; and

The based on AS2870 and the findings from the ground investigation the site classification for the areas associated with the individual test pits must be classified as follows:

- **Test Pits TP4 and TP8 to TP13** **S CLASS**

5.7 Foundations

5.7.1 Shallow Strip and Pad Footings

Footing systems for structures similar to residential dwellings on Class S sites can be designed in accordance with standard S Class footings as set out in Section 3 of AS2870 and designed using a maximum allowable bearing pressure of 100kPa. Alternatively, the following table provides an assessment of the allowable bearing capacity with a Factor of Safety (FOS) of 3 for footings at various depths, keeping settlement below 25mm.

Location	Footing Depth	Allowable Bearing Capacity
TP04	0.30m	100kPa
	0.50m	400kPa
TP08	0.30m	100kPa
	0.80m	400kPa
TP09	0.30m	100kPa
	1.00m	
TP10	0.30m	100kPa
	0.75m	400kPa
TP11	0.30m	100kPa
	0.80m	150kPa
TP12	0.30m	100kPa
	0.80m	400kPa
TP13	0.30m	100kPa
	1.00m	

Table 6: Allowable Bearing Capacity

5.7.2 Bored Piers

If proposed, then design of concrete bored piers should be carried out in accordance with AS2159, and it is recommended that design in compression and uplift be based on the parameters given in the following tables.

Strata Description	Young's Modulus (MPa)	Horizontal Modulus (MPa)	Ultimate Shaft Adhesion (kPa)	Ultimate End Bearing (kPa)	Typical Depth Range
Loose sand soils	4	3	Ignore	n/a	0.00-0.10m
Medium dense sand soils	12	8	25	1000	0.10-0.50m
SANDSTONE	200	150	50	12000	>0.50m

Table 7: Bored Pier Design Parameters Test Pit TP4

Strata Description	Young's Modulus (MPa)	Horizontal Modulus (MPa)	Ultimate Shaft Adhesion (kPa)	Ultimate End Bearing (kPa)	Typical Depth Range
Loose sand soils	4	3	Ignore	n/a	0.00-0.70m
Medium dense sand soils	12	8	25	1000	0.70-0.80m
SANDSTONE	200	150	50	12000	>0.80m

Table 8: Bored Pier Design Parameters Test Pit TP8, TP10 and TP12

Strata Description	Young's Modulus (MPa)	Horizontal Modulus (MPa)	Ultimate Shaft Adhesion (kPa)	Ultimate End Bearing (kPa)	Typical Depth Range
Loose sand soils	4	3	Ignore	n/a	0.00-0.70m
Medium dense sand soils	12	8	25	1000	0.70-1.80m
SANDSTONE	200	150	50	12000	>1.80m

Table 9: Bored Pier Design Parameters Test Pit TP9

Strata Description	Young's Modulus (MPa)	Horizontal Modulus (MPa)	Ultimate Shaft Adhesion (kPa)	Ultimate End Bearing (kPa)	Typical Depth Range
Loose sand soils	4	3	Ignore	n/a	0.00-0.80m
Dense sand soils	48	36	55	4500	0.80-1.70m
SANDSTONE	200	150	50	12000	>1.70m

Table 10: Bored Pier Design Parameters Test Pit TP11

Strata Description	Young's Modulus (MPa)	Horizontal Modulus (MPa)	Ultimate Shaft Adhesion (kPa)	Ultimate End Bearing (kPa)	Typical Depth Range
Loose sand soils	4	3	Ignore	n/a	0.00-1.60m
SANDSTONE	200	150	50	12000	>1.60m

Table 11: Bored Pier Design Parameters Test Pit TP13

During the wet season the groundwater level will rise and be encountered near the ground surface. If pier construction is carried out during the wet season, casing, dewatering of pier excavations or tremie construction techniques may be required. With the above points in mind, it is suggested that pier construction be carried out during the dry season if possible.

Prior to placement of blinding, reinforcement or concrete, all foundation excavations should be inspected by a suitably experienced engineering geologist to confirm that founding conditions are suitable for the proposed building loads. If, during construction, it is apparent that the foundation conditions are different from those described in this report then further geotechnical advice should be sought from WANT Geotechnics.

5.8 Pavement Design Parameters

Atterberg limits, particle size distribution and 4 day soaked CBR test at 95% modified compaction were carried out on representative samples of material likely to be encountered as subgrade material. The results of these test are presented in Appendix C and are summarised in the following table.

Test Pit	Strata	4 Day Soaked CBR at 95%MMDD	Recommended Design CBR

Table 12: Pavement Design Parameters

The subsoils are relatively uniform, predominantly sand, provided the following subgrade preparation recommendations are adhered to then a design **CBR of 15** may be adopted:

- Strip subsoils to subgrade level, tyne / rip to a depth of 300mm, moisture condition and compact to 95%MMDD.
- Inspect and proof roll the prepared subgrade with a minimum of 3 passes of a 30 to 40 tonne multi tyred roller, or similar, to identify any areas of weak materials, and
- If weak subgrade areas are identified during the proof rolling, excavate, and replace with granular filling material, placed in lifts not exceeding 250 mm loose thickness with each lift compacted to a minimum of 95% MMDD at a moisture content within a range of 80-120% of modified optimum.

5.9 Retention Basin

It is understood that a retention basin is proposed in the strip of land between test pits TP5 and TP7. In this area the subsoils are characterised by the presence of loose to dense sands underlain by low to medium rock strength sandstone. Rockhead was seen to be between 0.90m and 1.40m in the three pits that were excavated.

Permeability tests were undertaken in each test pit, and the subsoils have been assessed to have an estimated permeability around 4 to 40m per day.

5.10 Site and Soil Evaluation

The following summarises a site and soil evaluation for the area under investigation. The full report on the site and soil evaluation for the site is included in Appendix D.

Based on the ground conditions encountered, the following table provides a Site and Soil Evaluation in general accordance with AS1547.

Location	Depth (mm)	Colour (moist)	Field texture	Coarse fragments	Structure	Soil Category	Hydraulic Conductivity
TP1	800	Yellow brown	SAND trace gravel	Many >50%	Apedal	1/2	21m/day
TP2	600						29m/day
TP3	750	Brown to grey brown	SAND trace clay				30m/day

Table 13: Soil Evaluation

The subsoils have been assessed to have an estimated permeability around 20 to 30m per day. Reference to AS/NZS1547 *On-site domestic wastewater management* indicates that for such soils the following apply:

- A Design Loading Rate of 20mm to 35mm/day would be appropriate for primary treated effluent, and 50mm/day for secondary treated effluent. The following note from Table L1 is also relevant and should be borne in mind:

NOTES:

- 1 The treatment capacity of the soil and not the hydraulic capacity of the soil or the growth of the clogging layer govern the effluent loading rate in Category 1 and weakly structured Category 2 soils. Land application systems in these soils require design by a suitably qualified and experienced person, and distribution techniques to help achieve even distribution of effluent over the full design surface (see L6.2 and Figure L4 for recommended discharge method by discharge control trench). These soils have low nutrient retention capacities, often allowing accession of nutrients to groundwater.

- A Drip Irrigation Rate of 5mm/day would be appropriate. The following note from Table M1 is also relevant and should be borne in mind:

- 2 For Category 1, 2, and 6 soils, the drip irrigation system has a depth of 100 – 150 mm in good quality topsoil (see CM1 and M3.1).

It should be borne in mind the DLR figures have been assessed from clean water permeability tests and does not take into account bio build-up or siltation from surface infiltration.

5.11 Groundwater and Drainage

The fieldwork was undertaken in October 2021, and groundwater was not encountered in any of the test pits excavated. Groundwater levels will vary with the seasons. Given the subsoils encountered, it is expected that for both footing and trench excavations, groundwater can be managed by a pump placed in a sump type arrangement.

5.12 Geotechnical Related Construction Issues and Potential Solutions.

Based on the materials encountered and the aims of the project, then it is not expected that there will be any significant geotechnical related construction issues, although the variable depth to rock will likely make excavation difficult.

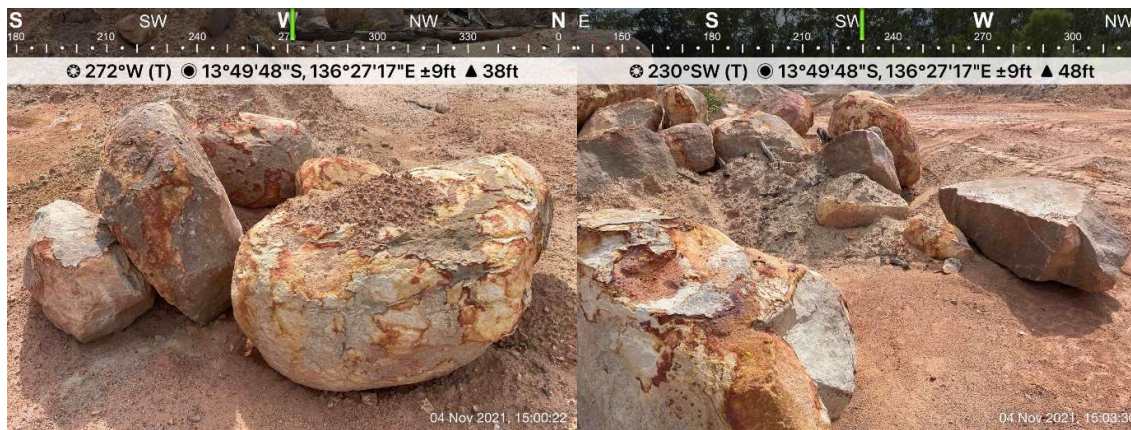
5.13 Existing Gravel Pit

In addition to the ground investigation on Leases 1 and 2, three test pits were excavated in the nearby gravel pit. The aim of the test pitting was to investigate the potential presence of sandstone rock. The following table summarises the ground conditions revealed in those additional test pits.

Strata	Location		
	TP14	TP15	TP16
CLAY sandy with gravel	0.00-0.25m	0.00-1.00m	0.00-0.50m
Cemented laterised soils	Not encountered	0.40-1.00m	Not encountered
Laterised extremely weathered SANDSTONE	0.25-0.80m	Not encountered	0.50m

Table 14: Summarised Ground Conditions (Gravel Pit)

The test pits in the gravel pit did not reveal potentially useable sandstone rock. Useable sandstone may exist at depth, but the backhoe met refusal prior to reaching such materials. There are a limited number of sandstone boulders present in the area, as illustrated in the photographs of the following page.



Photographs 2 and 3: Sandstone Boulders

Generally, there were two varieties of sandstone boulders noted. The rounded sandstone boulders in Photograph 2 that are generally weaker with a weathered rind that can be powdered and rubbed away with strong finger pressure, and the significantly stronger quartzitic sandstone that forms less rounded boulders – see boulder on right-hand side of Photograph 3. The quartzitic sandstone, if present in sufficient quantities, would likely be a useful source of armourstone for breakwaters etc.

6. References

1. Australian Standard AS 1170.4 *Structural Design Actions Part 4: Earthquake Actions in Australia*
2. Australian Standard AS 1726 *Geotechnical site investigations*
3. Australian Standard AS 2159 *Pile Design and Installation*
4. Australian Standard AS 2870 *Residential Slabs and Footings*
5. Australian Standard AS 3798 *Guidelines on Earthworks for Commercial and Residential Developments*
6. Look B (2007) *Handbook of Geotechnical Investigation and Design Tables*
7. Briaud JL (2013) *Geotechnical Engineering Unsaturated and Saturated Soils*

7. Limitations

SCOPE OF SERVICES

This geotechnical report has been prepared in accordance with the scope of services set out in the agreement between WANT Geotechnics and their client and is subject to any qualifications and assumptions set out in the report. In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

In preparing the report, WANT Geotechnics has relied upon data, surveys, and plans provided by the client. WANT Geotechnics has not verified the accuracy or completeness of the data, to the extent that the any statements, opinions, facts, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WANT Geotechnics will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have not been fully disclosed to WANT Geotechnics.

GEOTECHNICAL INVESTIGATION

Geotechnical engineering reports are prepared to meet the specific scope of the client and may not necessarily be adequate for a construction contractor. This report was prepared expressly for the client and expressly for purposes indicated by the client or his representative. Use by any other persons for any purpose, or by the client for a different purpose, is not recommended. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

LIMITATIONS OF SITE INVESTIGATION

In making an assessment of a structure from a single exploratory location there is the possibility that variations may occur that were not encountered. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however, this often does not result in any overall cost savings for the project. The data derived from the investigation and subsequent laboratory testing have been extrapolated to form an inferred model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the structure. Actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies. The exploratory test records are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation and cannot always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigation; however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

SUBSURFACE CONDITIONS ARE TIME DEPENDENT

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration. Construction operations, at or adjacent to the site, and natural events, such as floods or groundwater fluctuations may also affect subsurface conditions and thus the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

EXPLORATORY LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final exploratory logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final exploratory logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of exploratory log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to 'Guidelines for the Provision of Geotechnical Information in Construction Contracts' published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

OTHER LIMITATIONS

WANT Geotechnics will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

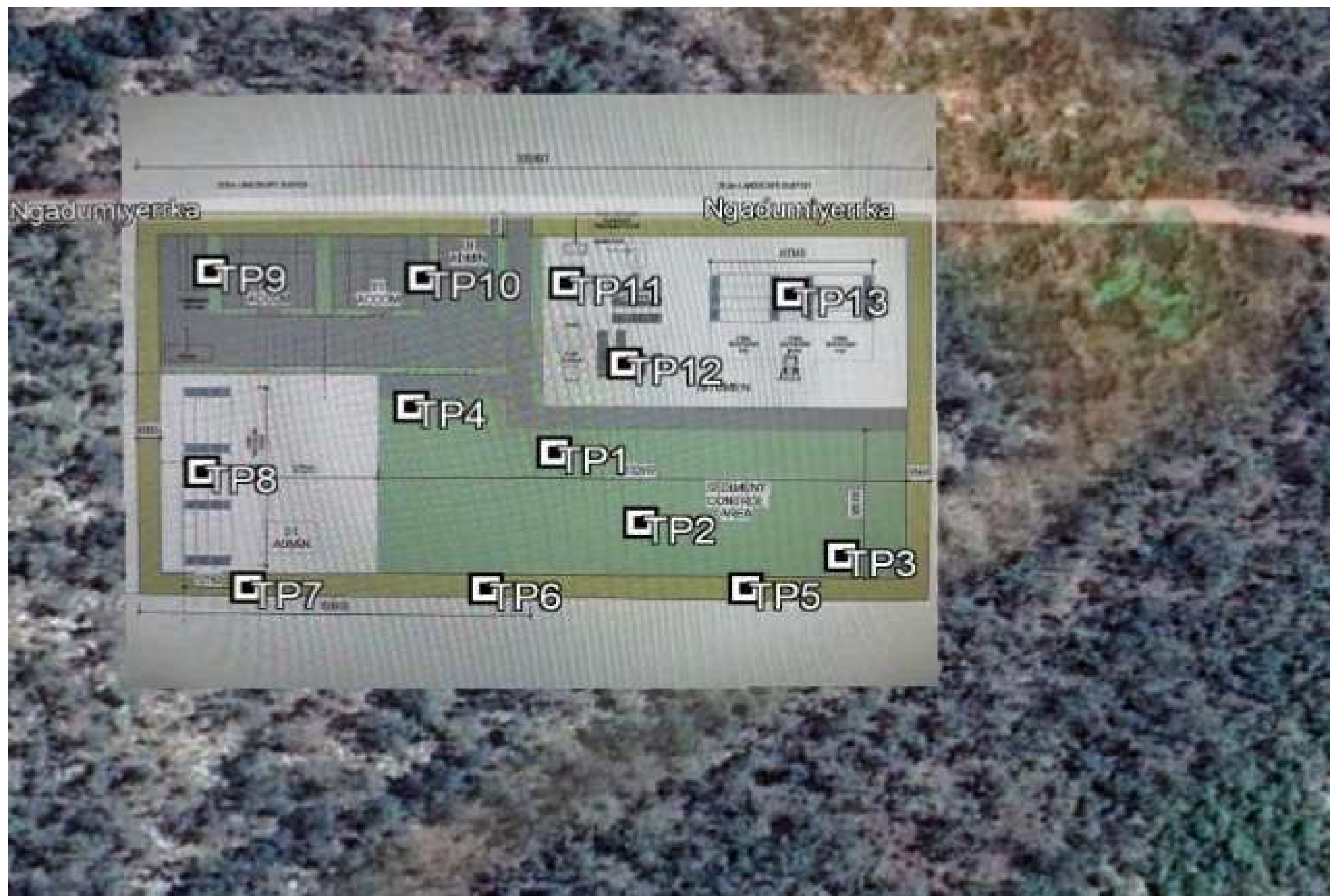
WANT Geotechnics Pty Ltd

"Unfortunately, soils are made by nature and not by man, and the products of nature are always complex. As soon as we pass from steel and concrete to earth, the omnipotence of theory ceases to exist. Natural soil is never uniform. Its properties change from point to point while our knowledge of its' properties is limited to those few spots at which the samples have been collected. In soil mechanics the accuracy of the computed results never exceeds that of a crude estimate and the principal function of theory consists in teaching us what and how to observe in the field"

Karl Terzaghi – Founder of Modern Geotechnology

Appendix A

Test Pit Location Plans





Client: Anindilyakwa Advancement Aboriginal Corporation

Drawn by: S Flux

Scale: NTS

Date: 29 Nov 2021

Test Pit Location Plan

Existing Gravel Pit

Deception Bay, Northern Territory

Project No. NTG20212375

Drawing No. 2

Revision: 0

Appendix B

Explanatory Notes
Test Pit Logs and VEDCP Results

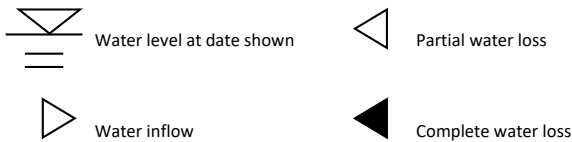
Explanatory Notes - Soil Description

In engineering terms soil includes every type of uncemented or partially cemented inorganic material found in the ground. In practice, if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters, with secondary textures in lower case. The dominant feature is assessed from the Unified Soil Classification system and a soil symbol is used to define a soil layer.

METHOD

Method	Description
AS	Auger Screwing
BH	Backhoe
CT	Cable Tool Rig
EE	Existing Excavation/Cutting
EX	Excavator
HA	Hand Auger
HQ	Diamond Core - 63mm
NQ	Diamond Core - 47mm
PQ	Diamond Core - 85mm
JET	Jetting
NMLC	Diamond Core –52mm
PT	Push Tube
RAB	Rotary Air Blast
RB	Rotary Blade
RT	Rotary Tricone Bit
TC	Auger TC Bit
V	Auger V Bit
WB	Washbore

WATER



Not observed: The borehole/test pit was dry soon after excavation. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING

Sample	Description
B	Bulk Disturbed Sample
D	Disturbed Sample
Jar	Jar Sample
SPT	Standard Penetration Test
U50	Undisturbed Sample –50mm
U75	Undisturbed Sample –75mm

UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as, sieve analysis, liquid limit and plasticity index.

USC Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
CI	Clay of medium plasticity
OL	Organic soil of low plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peaty Soil

MOISTURE CONDITION

Dry	- Cohesive soils are friable or powdery Cohesionless soil grains are free-running
Moist	- Soil feels cool, darkened in colour Cohesive soils can be moulded Cohesionless soil grains tend to adhere
Wet	- Cohesive soils usually weakened Free water forms on hands when handling

PLASTICITY

The potential for soil to undergo change in volume with moisture change is assessed from its degree of plasticity. The classification of the degree of plasticity in terms of the Liquid Limit (LL) is as follows:

Description of Plasticity	LL (%)
Low	<35
Medium	35 to 50
High	>50

COHESIVE SOILS - CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by pocket penetrometer values and by resistance to deformation to hand moulding.

A Pocket Penetrometer may be used in the field or the laboratory to provide an approximate assessment of the unconfined compressive strength (UCS) of cohesive soils. The undrained shear strength of cohesive soils is approximately half the UCS. The values are recorded in kPa as follows:

Strength	Symbol	Undrained Shear Strength, C_u (kPa)
Very Soft	VS	< 12
Soft	S	12 to 25
Firm	F	25 to 50
Stiff	St	50 to 100
Very Stiff	VSt	100 to 200
Hard	H	> 200

COHESIONLESS SOILS - RELATIVE DENSITY

Relative density terms such as very loose, loose, medium, dense and very dense are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values. Other condition terms, such as friable, powdery or crumbly may also be used.

Term	Symbol	Density Index	N Value (blows/0.3 m)
Very Loose	VL	0 to 15	0 to 4
Loose	L	15 to 35	4 to 10
Medium Dense	MD	35 to 65	10 to 30
Dense	D	65 to 85	30 to 50
Very Dense	VD	>85	>50

COHESIONLESS SOILS PARTICLE SIZE DESCRIPTIVE TERMS

Name	Subdivision	Size
Boulders		>200 mm
Cobbles		63 mm to 200 mm
Gravel	coarse	20 mm to 63 mm
	medium	6 mm to 20 mm
	fine	2.36 mm to 6 mm
Sand	coarse	600 μ m to 2.36 mm
	medium	200 μ m to 600 μ m
	fine	75 μ m to 200 μ m

Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

METHOD

Refer soil description sheet

WATER

Refer soil description sheet

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) or Total Core Recovery (TCR) is given where:

TCR (%) = $\frac{\text{length of core recovered}}{\text{length of core run}}$

SCR (%) = $\frac{\text{length of core recovered with at least 1 full circumference}}{\text{length of core run}}$

RQD (%) = $\frac{\text{Sum of Axial lengths of core > 100mm long}}{\text{length of core run}}$

ROCK MATERIAL WEATHERING

Rock weathering is described using the abbreviations and definitions used in AS1726.

Symbol	Term	Definition
RS	Residual Soil	Soil definition on extremely weathered rock; the mass structure and substance are no longer evident; there is a large change in volume but the soil has not been significantly transported
XW	Extremely Weathered	Rock is weathered to such an extent that it has 'soil' properties, i.e. It either disintegrates or can be remoulded in water
HW	Highly Weathered	The rock substance is affected by weathering to the extent that limonite staining or bleaching affects the whole rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength is usually decreased compared to the fresh rock. The colour and strength of the fresh rock is no longer recognisable.
MW	Moderately Weathered	The whole of the rock substance is discoloured, usually by iron staining or bleaching, to the extent that the colour of the fresh rock is no longer recognisable
SW	Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength from fresh rock
FR	Fresh	Rock shows no sign of decomposition or staining

ROCK STRENGTH

Rock strength is described using AS1726, as follows:

Term	Symbol	Point Load Index Is ₍₅₀₎ (MPa)
Extremely Low	EL	<0.03
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	>10

○ Diametral Point Load Index test

● Axial Point Load Index test

DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

Term	Defect Spacing	Bedding
Extremely closely spaced	<6 mm	Thinly Laminated
	6 to 20 mm	Laminated
Very closely spaced	20 to 60 mm	Very Thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2 m	Thick
Very widely spaced	>2 m	Very Thick

DEFECT DESCRIPTION

Type:	Definition:
B	Bedding
BP	Bedding Parting
F	Fault
C	Cleavage
J	Joint
SZ	Shear Zone
CZ	Crushed Zone
DB	Drill Break

Planarity:	Roughness:
P – Planar	R – Rough
Ir – Irregular	S – Smooth
St – Stepped	Sl – Slickensides
U – Undulating	Po – Polished

Coating or Infill:	Description
Clean	No visible coating or infilling
Stain	No visible coating or infilling but surfaces are discoloured by mineral staining
Veneer	A visible coating or infilling of soil or mineral substance but usually unable to be measured (<1mm). If discontinuous over the plane, patchy veneer
Coating	A visible coating or infilling of soil or mineral substance, >1mm thick. Describe composition and thickness

The inclinations of defects are measured from perpendicular to the core axis.



TEST PIT LOG

TP1

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
								5 10 15 20
	0.10				SAND with clay, brown, loose, with roots, moist	L	M	
					SAND trace clay and boulders, light grey to grey brown spotted white, loose to medium dense, dry	L-MD	D	
	0.45							
					SAND trace gravel, yellow brown, medium dense, dry	MD		
	0.80	Permeability test at 0.8m						
					Target depth reached			

GROUNDWATER	PENETRATION	FIELD DATA SYMBOLS	DENSITY	CONSISTENCY
water level (static)	1 - no resistance	shear vane test	VL (very loose)	VS (very soft) <12kPa
water level (at excavation)	ranging to:	pocket penetrometer	L (loose)	S (soft) 12-25
outflow / inflow	4 - refusal		MD (medium dense)	F (firm) 25-50
		Permeability Test	D (dense)	St (stiff) 50-100
Weathering		Undisturbed tube sample	VD (very dense)	VSt (very stiff) 100-200
FR - Fresh; SW - Slightly Weathered		Disturbed sample		H (hard) >200
MW - Mod Weathered; HW - Highly Weathered		Bulk sample	MOISTURE CONDITION	
XW - Xtremely Weathered; RS - Residual Soil			D=dry M=moist W=wet	

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole 1



Test Hole 1 pit face



TEST PIT LOG

TP2

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
								5 10 15 20
	0.10				SAND with clay, brown, loose, with roots, moist	L	M	
					SAND trace clay and boulders, light grey to grey brown spotted white, loose to medium dense, dry	L-MD	D	
	0.45							
					SAND trace gravel, yellow brown, medium dense, dry	MD		
	0.65	Permeability test at 0.6m						
					Target depth reached			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Extremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face



TEST PIT LOG

TP3

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
								5 10 15 20
	0.10				SAND with clay, brown, loose, with roots, moist	L	M	
					SAND trace clay, brown to grey brown, loose to medium dense, dry	L-MD	D	
	0.75	Permeability test at 0.75m						
	0.85				SAND trace clay, yellow brown, medium dense, dry	MD		
					Traget depth reached			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Xtremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face

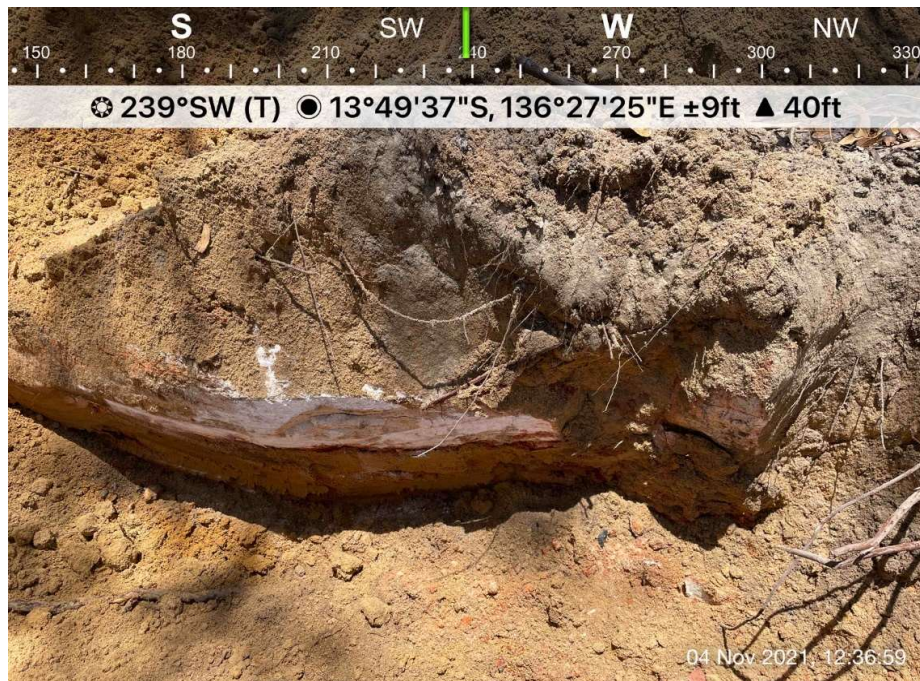
Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face



TEST PIT LOG

TP6

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
								5 10 15 20
	0.10	Permeability test at 0.5m			SAND with clay, light brown to light grey, loose, with roots, dry	L	M	
	0.40				SAND trace clay, brown to grey brown, loose to medium dense, dry	L-MD	D	
					SAND trace gravel, yellow brown, dense, dry	D		
		Permeability test at 1.0m			0.60m: Sandstone BOULDER 900 x 600 x 600mm			
	1.30				SANDSTONE moderately weathered, medium strength	ROCK		
	1.35							
					Virtual machine refusal on rock			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Extremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face

GROUNDWATER	PENETRATION	FIELD DATA SYMBOLS	DENSITY	CONSISTENCY
 water level (static)	1 - no resistance	 shear vane test	VL (very loose)	VS (very soft) <12kPa
 water level (at excavation)	ranging to:	 pocket penetrometer	L (loose)	S (soft) 12-25
 outflow / inflow	4 - refusal		MD (medium dense)	F (firm) 25-50
		 Permeability Test	D (dense)	St (stiff) 50-100
Weathering		 Undisturbed tube sample	VD (very dense)	VSt (very stiff) 100-200
FR - Fresh; SW - Slightly Weathered		 Disturbed sample		H (hard) >200
MW - Mod Weathered; HW - Highly Weathered		 Bulk sample		
XW - Xtremely Weathered; RS - Residual Soil			MOISTURE CONDITION	
			D=dry M=moist W=wet	

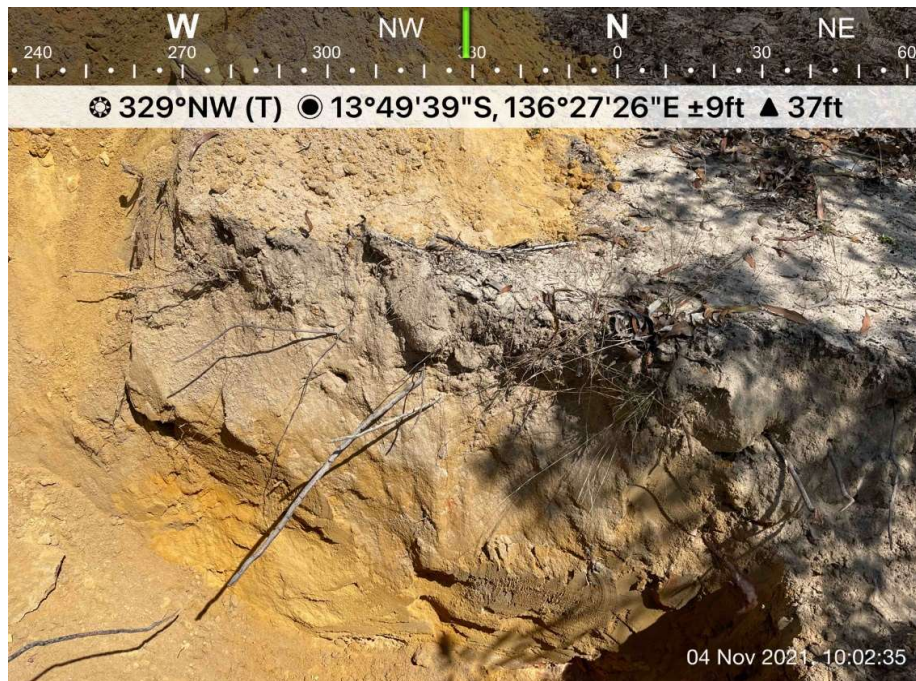
Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face



TEST PIT LOG

TP8

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
								5 10 15 20
	0.05				SAND with clay, brown, loose, roots, moist SAND trace clay, light grey to grey brown spotted white, loose, roots, dry	L	D	
	0.40	0.20-0.60m			SAND trace gravel, yellow brown, loose, dry Medium dense from 0.60m	MD		
	0.80				SANDSTONE light red brown to pink and white, moderately weathered, low to medium strength	ROCK		
	1.00				Virtual machine refusal on rock			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Extremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face



TEST PIT LOG

TP9

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
						L	D	5 10 15 20
	0.25				SAND trace clay, light grey to grey brown spotted white, loose, roots, dry			
					SAND trace gravel, yellow brown, medium dense, dry	L-MD		
		0.30-1.20m			Medium dense from 0.70m			
	1.20				GRAVEL sandy, yellow and red brown, medium dense to dense, dry. Partially cemented with fragments up to boulder size	MD-D		
	1.80							
	2.00				SANDSTONE light red brown to pink and white, moderately weathered, low to medium strength	ROCK		
					Target depth reached			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Xtremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face



TEST PIT LOG

TP10

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA				MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
							5 10 15 20
0.05				SAND with clay, brown, loose, roots, moist	L	M	
				SAND light grey and light brown, loose, roots, moist			
0.20-0.70m							
0.70				GRAVEL sandy, red and yellow brown, cemented, dry	VD	D	
0.75				SANDSTONE moderately weathered, medium strength	ROCK		
0.80				Virtual machine refusal on rock			

GROUNDWATER	PENETRATION	FIELD DATA SYMBOLS	DENSITY	CONSISTENCY
water level (static)	1 - no resistance	shear vane test	VL (very loose)	VS (very soft) <12kPa
water level (at excavation)	ranging to:	pocket penetrometer	L (loose)	S (soft) 12-25
outflow / inflow	4 - refusal		MD (medium dense)	F (firm) 25-50
		Permeability Test	D (dense)	St (stiff) 50-100
Weathering		Undisturbed tube sample	VD (very dense)	VSt (very stiff) 100-200
FR - Fresh; SW - Slightly Weathered		Disturbed sample		H (hard) >200
MW - Mod Weathered; HW - Highly Weathered		Bulk sample	MOISTURE CONDITION	
XW - Xtremely Weathered; RS - Residual Soil			D=dry M=moist W=wet	

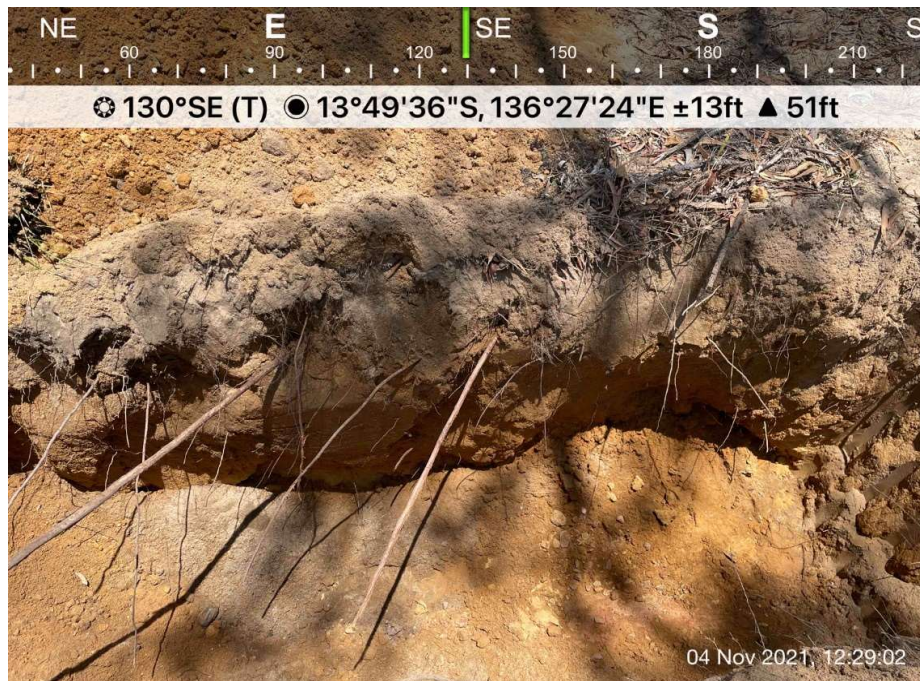
Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face



TEST PIT LOG

TP11

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
								5 10 15 20
	0.15				SAND with clay, light brown to light grey, loose, with roots, dry	L	D	
					SAND trace clay, grey to yellow brown, loose, moist		M	
	0.60				SAND trace gravel, yellow brown, dense, moist			
					Dense from 0.80m	D		
	1.70							
	1.75				SANDSTONE moderately weathered, medium strength	ROCK		
					Virtual machine refusal on rock			

GROUNDWATER

- ▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Xtremely Weathered; RS - Residual Soil

PENETRATION

- 1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

- ✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

- VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

- VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200

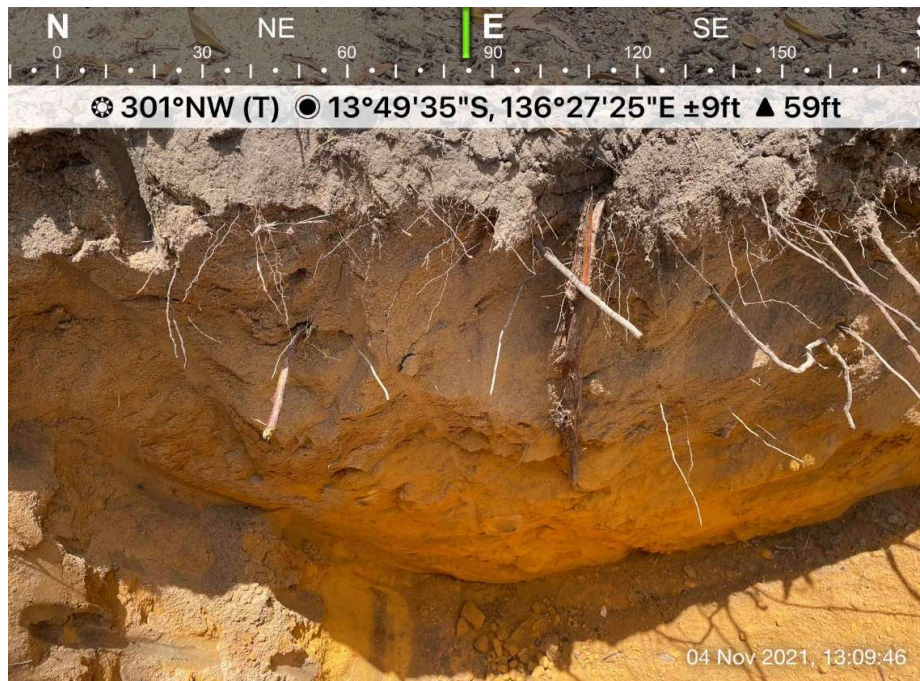
Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face

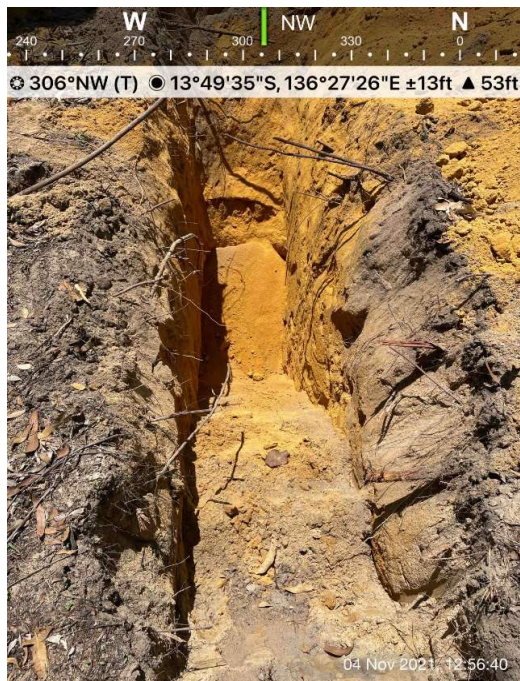
Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face

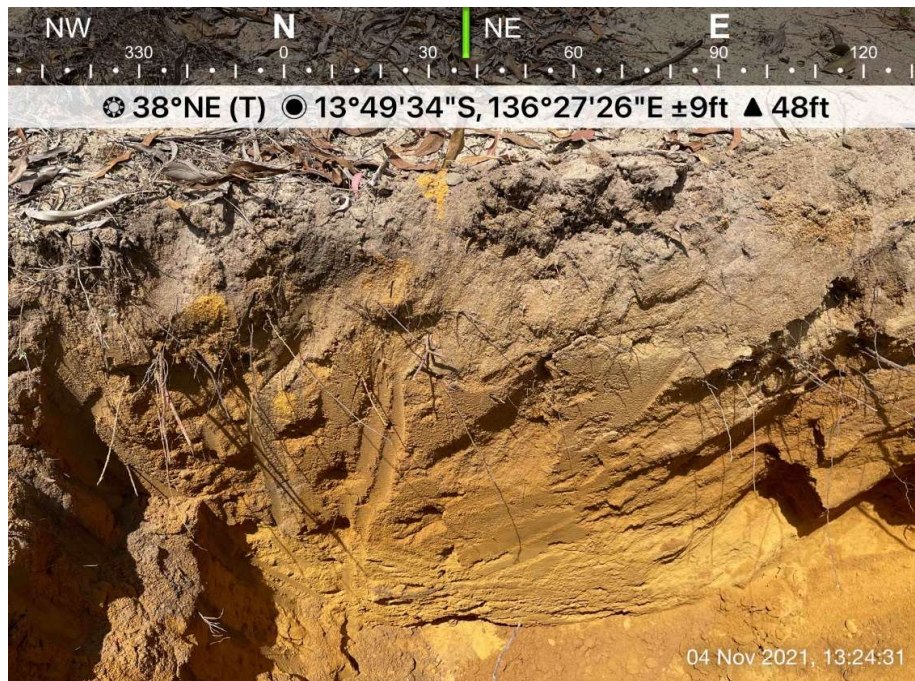
Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Natural Ground

Logged: SF
Checked: MF



Location of Test Hole



Test Hole pit face



TEST PIT LOG

TP14

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Gravel Pit

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
						St	D	5 10 15 20
	0.25				CLAY sandy with gravel, low plasticity, red to purple brown, stiff, dry			
	0.80				Laterised extremely weathered SANDSTONE recovered as GRVAEL and COBBLE size fragments in sand matrix			
					Virtual machine refusal			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Extremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Gravel Pit

Logged: SF
Checked: MF



Location of Test Hole



Test Hole in Laterised soils



TEST PIT LOG

TP15

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Gravel Pit

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
						St	M	5 10 15 20
	0.40				CLAY with gravel and sand, low plasticity, light grey to off white mottled red and orange, laterised, stiff, moist			
	1.00				Refusal in laterised soils at depths of between 0.40m and 1.00m			
					Virtual machine refusal			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Xtremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200



TEST PIT PHOTOGRAPHS

TP15

Sheet 2 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Gravel Pit

Logged: SF
Checked: MF



Test Hole Spoil



Test Hole pit face



TEST PIT LOG

TP16

Sheet 1 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Gravel Pit

Logged: SF
Checked: MF

FIELD DATA					MATERIAL SUBSTANCE	SOIL CONDITION		COMMENTS
	Depth (m)	Samples and tests	Groundwater	Penetration Resistance	SOIL TYPE: unified soils classification, colour, structure, particle characteristics, geological origin and minor components	Density	Moisture Condition	Dynamic Cone Penetrometer
								5 10 15 20
	0.50				Laterised extremely weathered SANDSTONE recovered as GRVAEL and COBBLE size fragments in sand matrix			
					Virtual machine refusal			

GROUNDWATER

▼ water level (static)
▼ water level (at excavation)
◀▶ outflow / inflow

Weathering

FR - Fresh; SW - Slightly Weathered
MW - Mod Weathered; HW - Highly Weathered
XW - Extremely Weathered; RS - Residual Soil

PENETRATION

1 - no resistance
ranging to:
4 - refusal

FIELD DATA SYMBOLS

✕ shear vane test
⊥ pocket penetrometer
○ Permeability Test
■ Undisturbed tube sample
● Disturbed sample
□ Bulk sample

DENSITY

VL (very loose)
L (loose)
MD (medium dense)
D (dense)
VD (very dense)

MOISTURE CONDITION

D=dry M=moist W=wet

CONSISTENCY

VS (very soft) <12kPa
S (soft) 12-25
F (firm) 25-50
St (stiff) 50-100
VSt (very stiff) 100-200
H (hard) >200



TEST PIT PHOTOGRAPHS

TP16

Sheet 2 of 2

Project: Logistics Base
Location: Groote Eylandt
Job No. NTG20212375

Client: Anindilyakwa Advancement Aboriginal Corporation
Equipment: Backhoe with tiger teeth bucket
Surface Conditions: Gravel Pit

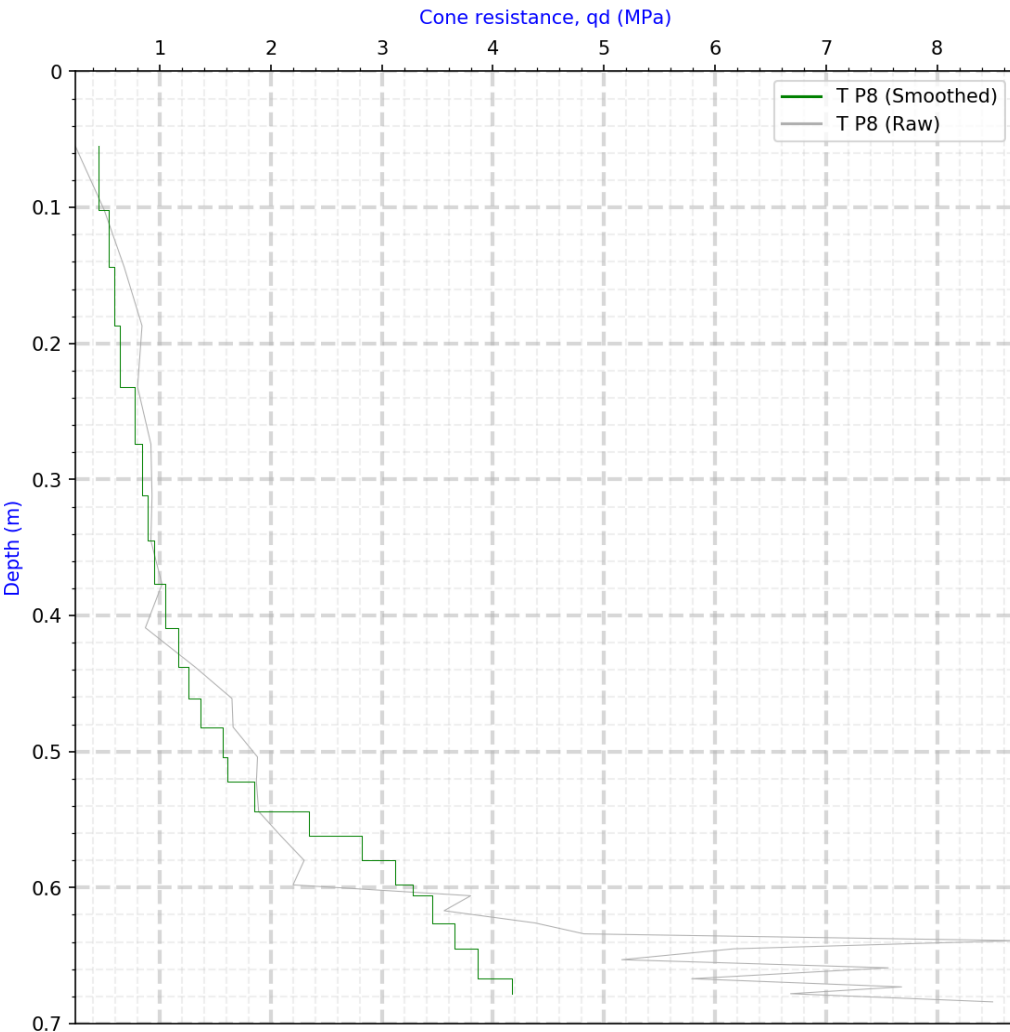
Logged: SF
Checked: MF



Location of Test Hole



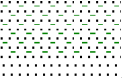
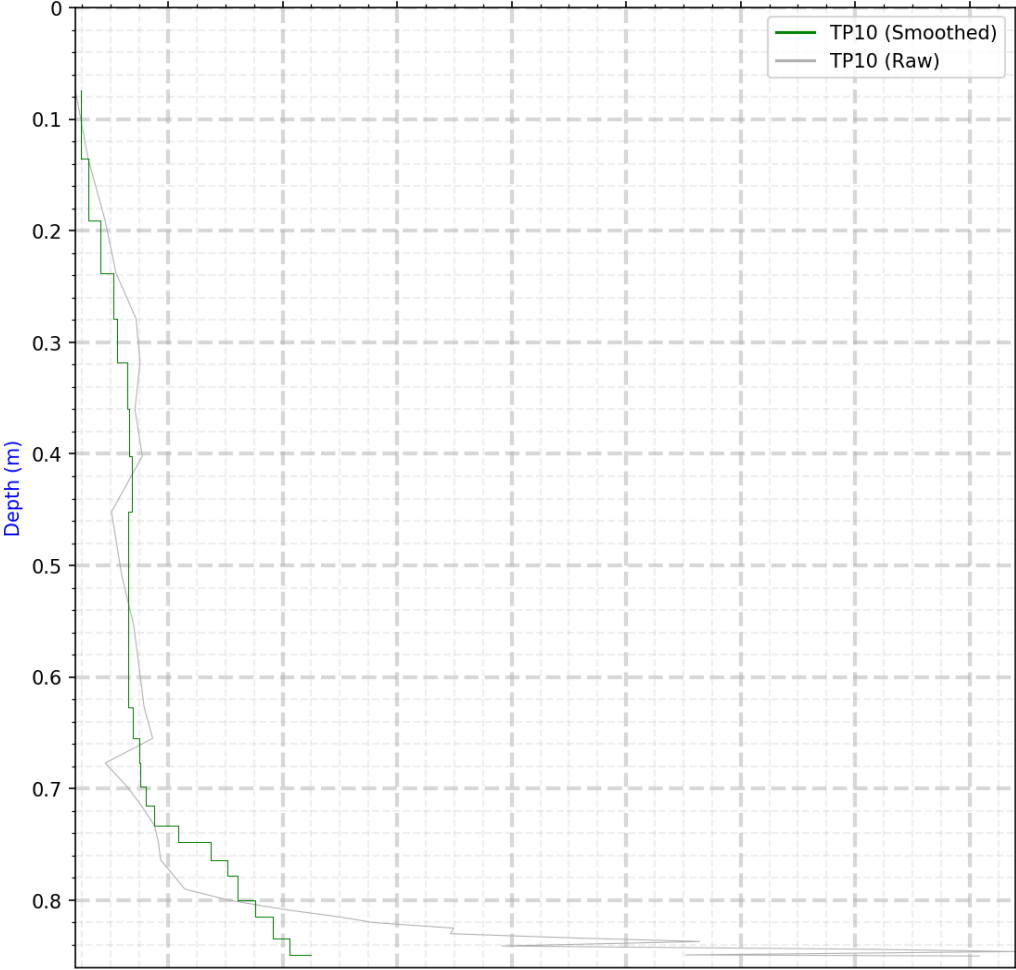
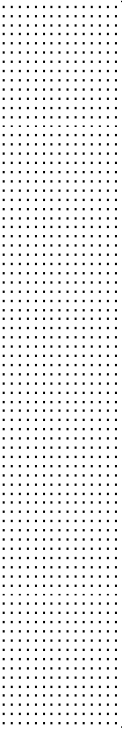
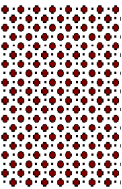
Test Hole pit face

Dynamic penetrometer test with variable energy : Soil investigation																	Location : Bartalumba Bay										
																	Date : 01/12/2021										
Soundings results							Results of laboratory tests										Results of penetrometric tests & load bearing capacity estimation										
Type : Machine : Tool : Inclination(deg) : Operator : Supervisor : Comments :							Sounding : Date : 01/12/2021 Long. : Lat. : Alt.(m) :							Laboratory : Operator : Date : Ref : Comments :							Type : Panda Sounding : T P8 Date : 04/11/2021 Time : 10:07:49 Operator : Organisation : Section : 4cm² Mass : Manual Long. : Lat. : Alt.(m) : Comments :						
Stratigraphy							Physical characteristics										Dynamic penetrometer test with variable energy										
Alt.(m) :	Depth	ID Layer	Geology	Groundwat.	Nature	Description	Sample	Wnat (%)	Dmax (mm)	2mm (%)	80µm (%)	VBS	Wp	WL	IP	Material	Torque (N.m)	Cone resistance, qd (MPa)							qd(MPa)		
	0.05	1			Clayey sand	SAND with clay, brown, loose, roots[...]																					
	0.4	2			Sand	SAND trace clay, light grey to grey brown spotted white, loose to medium dense, roots, dry												0.63±0.0									
	0.7	3			Sand	SAND trace gravel, yellow brown, loose to medium dense, dry												1.61±0.0									

Dynamic penetrometer test with variable energy : Soil investigation

Location :	Bartalumba Bay
Date :	01/12/2021

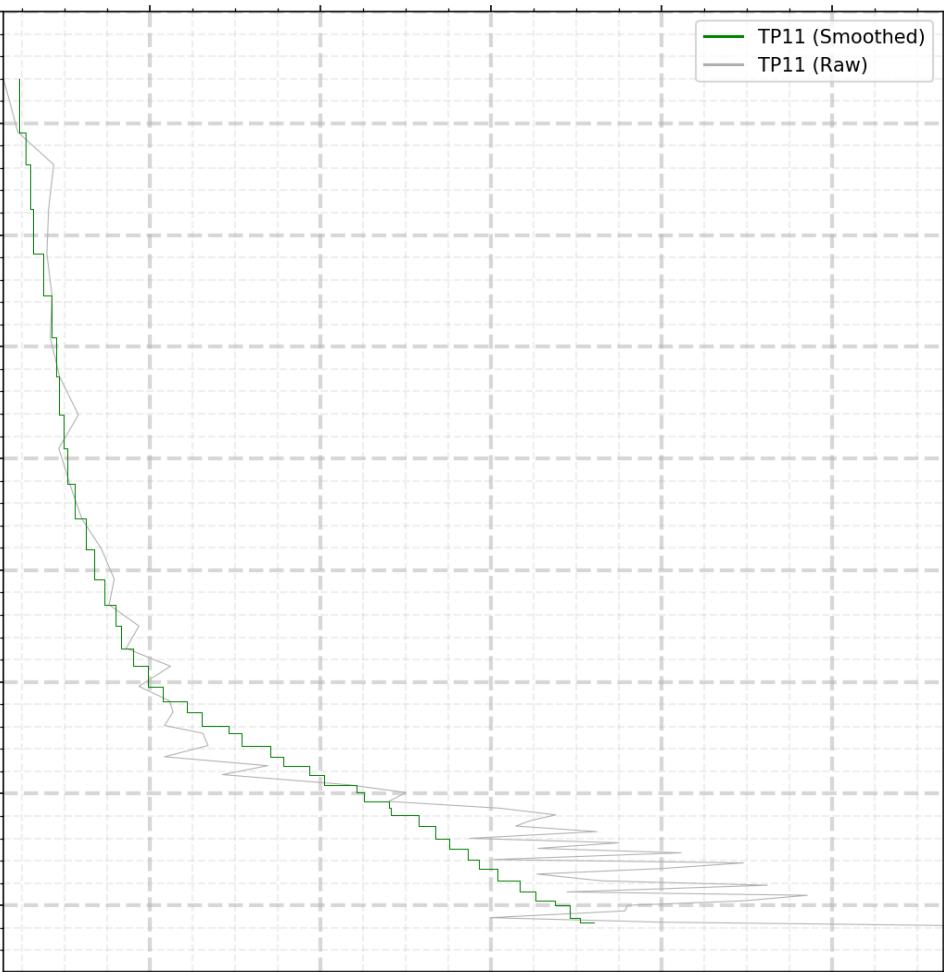
Soundings results			Results of laboratory tests			Results of penetrometric tests & load bearing capacity estimation					
Type :	Sounding :		Laboratory :	Date :		Type :	Panda	Operator :		Long. :	
Machine :	Date :	01/12/2021	Operator :	Ref :		Sounding :	TP10	Organisation :		Lat. :	
Tool :	Long. :					Date :	04/11/2021	Section :	4cm²	Alt.(m) :	
Inclination(deg) :	Lat. :					Time :	12:48:22	Mass :	Manual		
Operator :	Alt.(m) :										
Supervisor :											
Comments :			Comments :			Comments :					

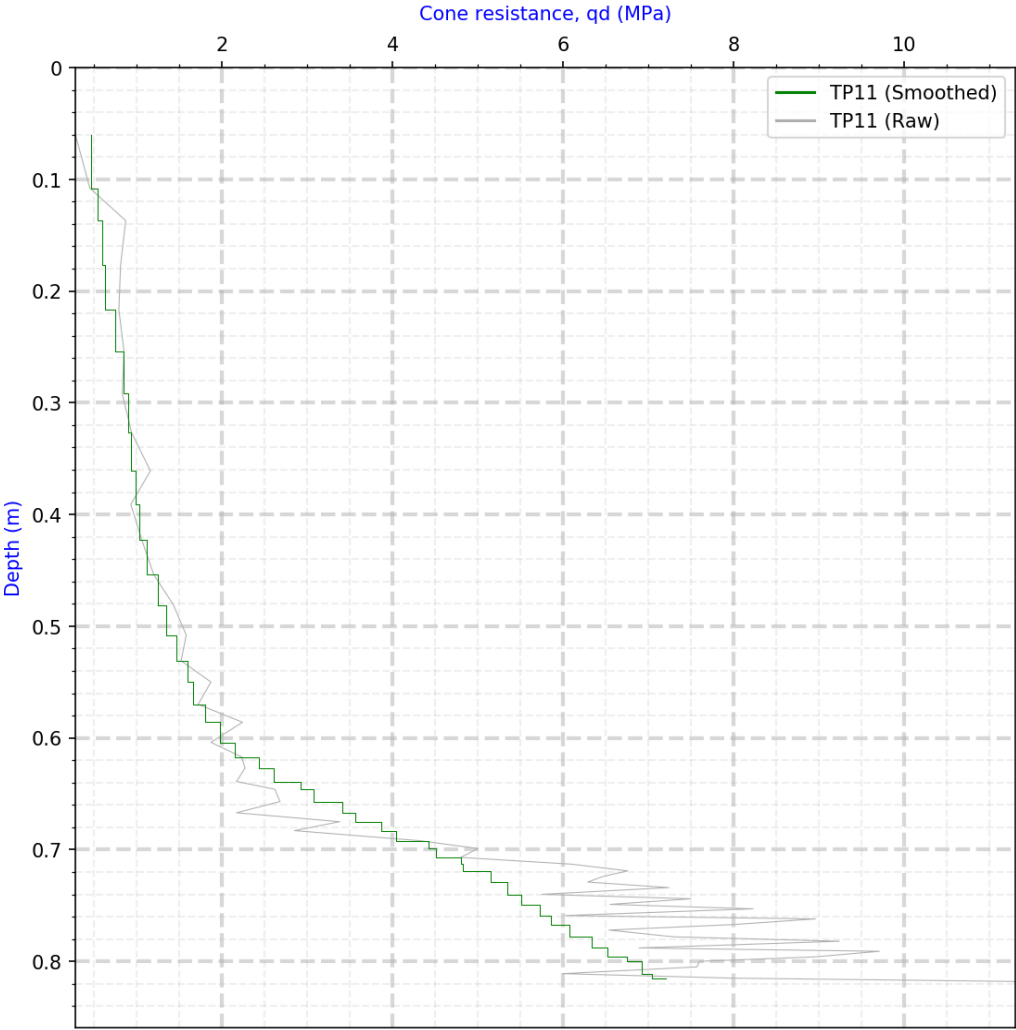
Stratigraphy						Physical characteristics										Dynamic penetrometer test with variable energy									
Alt.(m) :	Depth	ID Layer	Geology	Groundwat.	Nature	Description	Sample	Wnat (%)	Dmax (mm)	2mm (%)	80µm (%)	VBS	Wp	WL	IP	Material	Torque (N.m)	Cone resistance, qd (MPa)						qd(MPa)	
	0.05	1			Clayey sand	SAND with clay, brown, loose, roots[...]																		1.18±0.31	
		2			Sand	SAND light grey and light brown, loose, dry																			
	0.7																								
	0.86	3			Sandy gravel	GRAVEL sandy, red and yellow brown, cemented, dry																			

Dynamic penetrometer test with variable energy : Soil investigation

Location :	Bartalumba Bay
Date :	01/12/2021

Soundings results			Results of laboratory tests			Results of penetrometric tests & load bearing capacity estimation					
Type :	Sounding :		Laboratory :	Date :		Type :	Panda	Operator :	Long. :		
Machine :	Date :	01/12/2021	Operator :	Ref :		Sounding :	TP11	Organisation :	Lat. :		
Tool :	Long. :					Date :	04/11/2021	Section :	Alt.(m) :		
Inclination(deg) :	Lat. :					Time :	13:39:47	Mass :	Manual		
Operator :	Alt.(m) :										
Supervisor :											
Comments :			Comments :			Comments :					

Stratigraphy						Physical characteristics										Dynamic penetrometer test with variable energy				
Alt.(m) :	Depth	ID Layer	Geology	Groundwat.	Nature	Description	Sample	Wnat (%)	Dmax (mm)	2mm (%)	80µm (%)	VBS	Wp	WL	IP	Material	Torque (N.m)	Cone resistance, qd (MPa)		qd(MPa)
	0.15	1			Clayey sand	SAND with clay, light brown to light grey, loose, with roots, dry														
	0.6	2			Sand	SAND trace clay, grey to yellow brown, loose, moist													1.3±0.0	
	0.8	3			Sand	SAND trace gravel, yellow brown, medium dense, moist														



Dynamic penetrometer test with variable energy : Soil investigation																			Location : Bartalumba Bay Date : 01/12/2021				
Soundings results Type : Machine : Tool : Inclination(deg) : Operator : Supervisor : Comments : Sounding : Date : 01/12/2021 Long. : Lat. : Alt.(m) :							Results of laboratory tests Laboratory : Operator : Date : Ref : Comments :										Results of penetrometric tests & load bearing capacity estimation Type : Panda Sounding : TP12 Date : 04/11/2021 Time : 13:26:08 Operator : Organisation : Section : 4cm² Mass : Manual Long. : Lat. : Alt.(m) : Comments :						
Stratigraphy							Physical characteristics										Dynamic penetrometer test with variable energy						
Alt.(m) :	Depth	ID Layer	Geology	Groundwat.	Nature	Description	Sample	Wnat (%)	Dmax (mm)	2mm (%)	80µm (%)	VBS	Wp	WL	IP	Material	Torque (N.m)	Cone resistance, qd (MPa) TP12 (Smoothed) TP12 (Raw) Depth (m) qd(MPa)					
	0.1	1			Clayey sand	SAND with clay, light brown to ligh[...]																	
	0.7	2			Sand	SAND trace clay, grey to yellow brown, loose to medium dense, dry												2.77±1.14					
	1.0	3			Sand	SAND trace gravel, yellow brown, medium dense, dry												5.1±0.0					

Dynamic penetrometer test with variable energy : Soil investigation																		Location : Bartalumba Bay							
																		Date : 01/12/2021							
Soundings results							Results of laboratory tests											Results of penetrometric tests & load bearing capacity estimation							
Type : Machine : Tool : Inclination(deg) : Operator : Supervisor : Comments :							Sounding : Date : 01/12/2021 Long. : Lat. : Alt.(m) :							Laboratory : Operator : Date : Ref :							Type : Panda Sounding : TP13 Date : 04/11/2021 Time : 13:55:14 Operator : Organisation : Section : 4cm² Mass : Manual Long. : 136.457504 E Lat. : -13.826094 N Alt.(m) :				
							Comments :											Comments :							
Stratigraphy							Physical characteristics											Dynamic penetrometer test with variable energy							
Alt.(m) :	Depth	ID Layer	Geology	Groundwat.	Nature	Description	Sample	Wnat (%)	Dmax (mm)	2mm (%)	80µm (%)	VBS	Wp	WL	IP	Material	Torque (N.m)	Cone resistance, qd (MPa) qd(MPa)							
	0.1	1			Sand	SAND trace clay, light grey to grey[...]												0 0.2 0.4 0.6 0.8 1 1.2 1.4 1.6							
	0.45	2			Sand	SAND trace clay, grey to yellow brown, loose, moist												1.16±0.0							
	1.65	3			Sand	SAND trace gravel, yellow brown, loose, dry												1.32±0.49							
																		TP13 (Smoothed) TP13 (Raw)							

Dynamic penetrometer test with variable energy : Soil investigation

Location :	Bartalumba Bay
Date :	01/12/2021

Soundings results			Results of laboratory tests			Results of penetrometric tests & load bearing capacity estimation					
Type :	Sounding :		Laboratory :	Date :		Type :	Panda	Operator :	Long. :	136.457077 E	
Machine :	Date :	01/12/2021	Operator :	Ref :		Sounding :	TP4	Organisation :	Lat. :	-13.827233 N	
Tool :	Long. :					Date :	04/11/2021	Section :	4cm²	Alt.(m) :	
Inclination(deg) :	Lat. :					Time :	13:08:06	Mass :	Manual		
Operator :	Alt.(m) :										
Supervisor :											
Comments :											
			Comments :			Comments :					

Stratigraphy						Physical characteristics										Dynamic penetrometer test with variable energy			
Alt.(m) :	Depth	ID Layer	Geology	Groundwat.	Nature	Description	Sample	Wnat (%)	Dmax (mm)	2mm (%)	80µm (%)	VBS	Wp	WL	IP	Material	Torque (N.m)	Cone resistance, qd (MPa)	
	0.1	1			Clayey sand	SAND with clay, light brown to light grey, loose, with roots, dry													
	0.86	2			Sand	SAND trace clay, grey to yellow brown, loose to medium dense, dry												1.76±0.73	

Depth (m)

Dynamic penetrometer test with variable energy : Soil investigation

Location :	Bartalumba Bay
Date :	01/12/2021

Soundings results			Results of laboratory tests			Results of penetrometric tests & load bearing capacity estimation					
Type :	Sounding :		Laboratory :	Date :		Type :	Panda	Operator :	Long. :		
Machine :	Date :	01/12/2021	Operator :	Ref :		Sounding :	TP9	Organisation :	Lat. :		
Tool :	Long. :					Date :	04/11/2021	Section :	4cm²	Alt.(m) :	
Inclination(deg) :	Lat. :					Time :	09:24:14	Mass :	Manual		
Operator :	Alt.(m) :										
Supervisor :											
Comments :			Comments :			Comments :					

Stratigraphy						Physical characteristics										Dynamic penetrometer test with variable energy				
Alt.(m) :	Depth	ID Layer	Geology	Groundwat.	Nature	Description	Sample	Wnat (%)	Dmax (mm)	2mm (%)	80µm (%)	VBS	Wp	WL	IP	Material	Torque (N.m)	Cone resistance, qd (MPa)		qd(MPa)
	0.25	1			Sand	SAND trace clay, light grey to grey brown spotted white, loose, roots, dry													0.64±0.0	
	1.0	2			Sand	SAND trace gravel, yellow brown, loose to medium dense, dry													3.59±1.77	

Depth (m)

0

0.2

0.4

0.6

0.8

1

Cone resistance, qd (MPa)

0

2

4

6

8

10

TP9 (Smoothed)

TP9 (Raw)

Appendix C

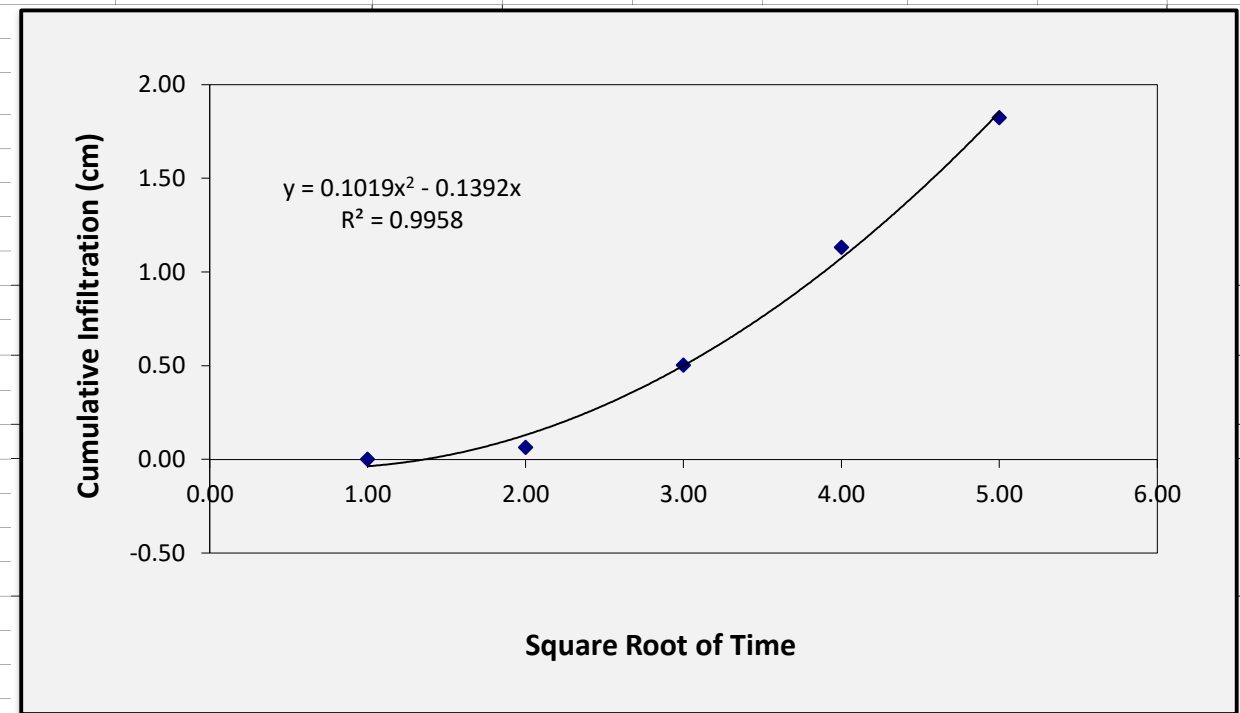
Laboratory Test Results

Appendix D

Site and Soil Evaluation

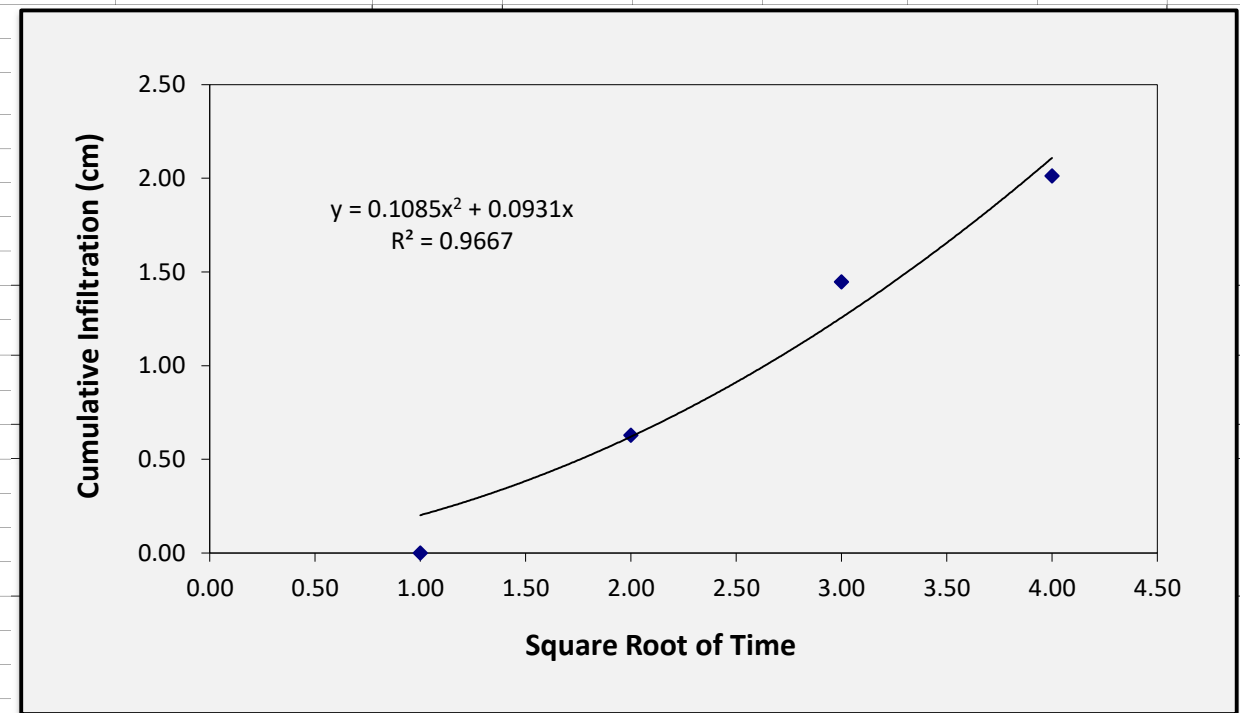
[illegible]

➡	MiniDisk
➡	loamy sand
➡	2



[illegible]

➡	MiniDisk
➡	loamy sand
➡	2



Instructions

Step 1: Enter measurement times beginning with zero

Step 2: Enter corresponding volume measurements

Step 3: Adjust selection field on graph to fit data

[illegible]

Step 4: Select Infiltrometer Type

MiniDisk

Step 5: Select Soil Type

sand

Step 6: Select Suction

2

Radius	2.25 cm/s
--------	-----------

alpha	0.145
-------	-------

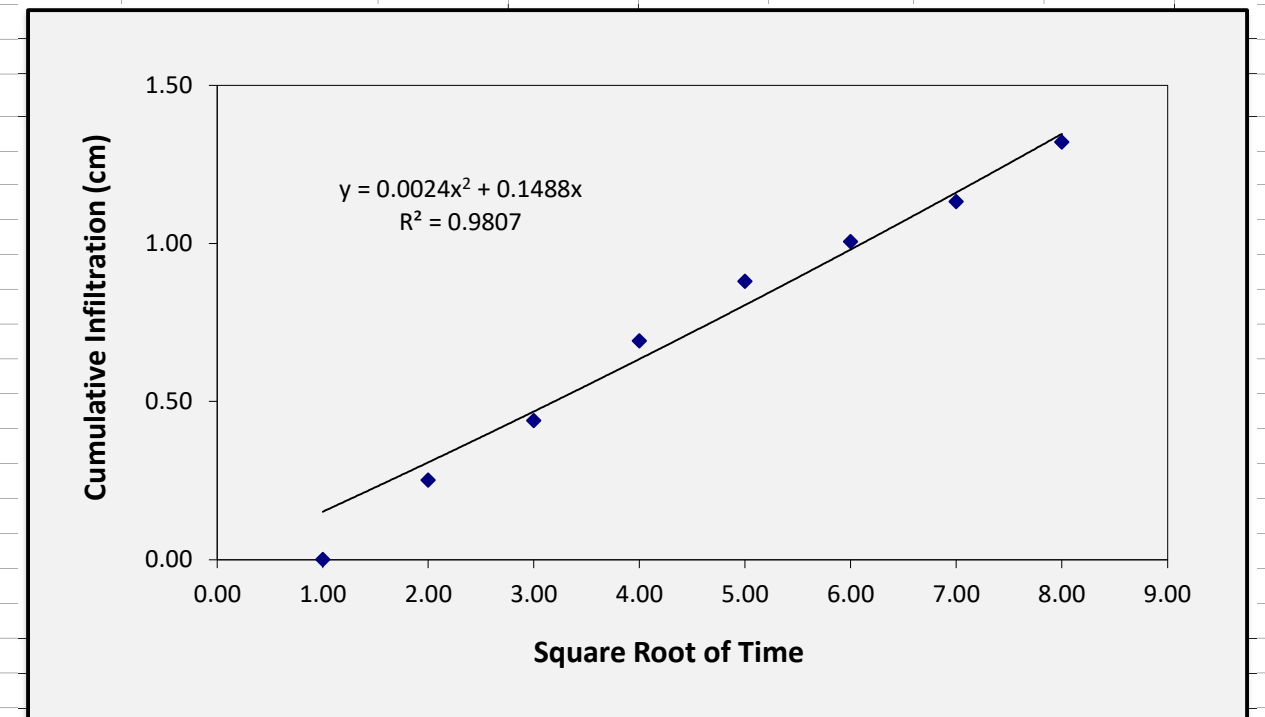
n/h_o	2.68
---------	------

Suction	-2 cm/s
---------	---------

A	1.727907568
---	-------------

C1 0.008930684 cm/s

K	0.005168496 cm/s
---	------------------



Instructions

Step 1: Enter measurement times beginning with zero

Step 2: Enter corresponding volume measurements

Step 3: Adjust selection field on graph to fit data

[illegible]

Step 4: Select Infiltrometer Type

MiniDisk

Step 5: Select Soil Type

sand

Step 6: Select Suction



2

Radius	2.25 cm/s
--------	-----------

alpha	0.145
-------	-------

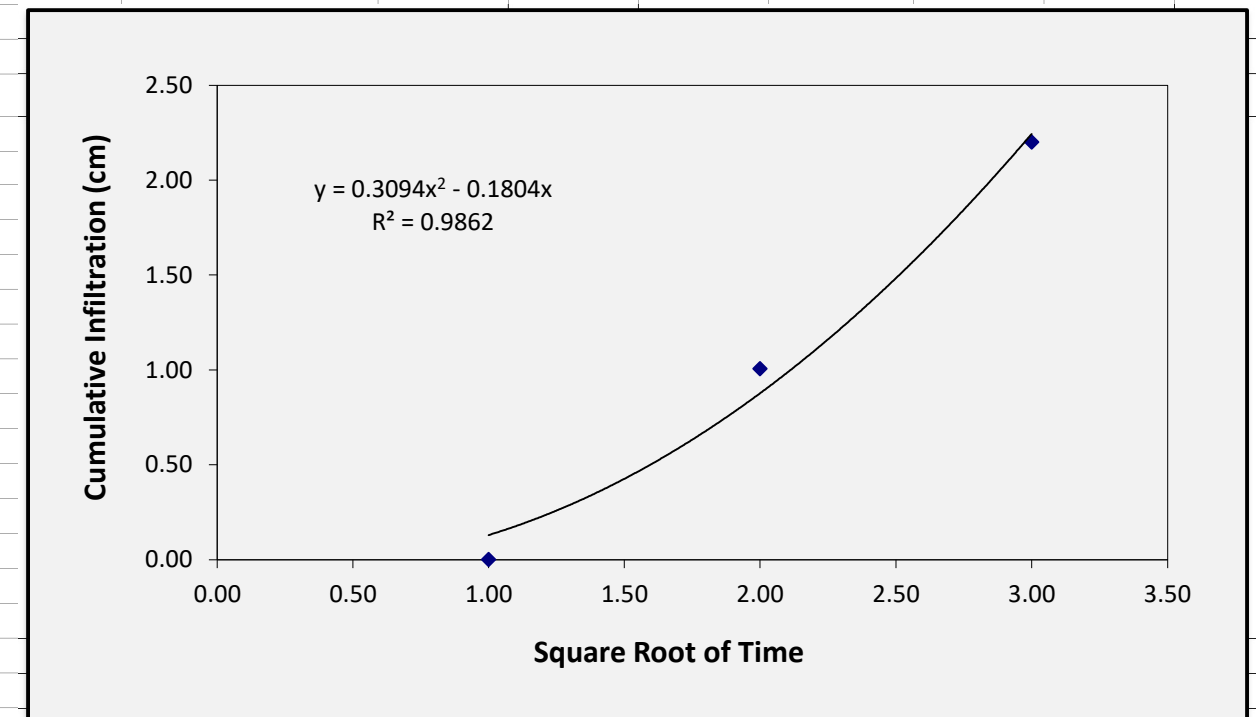
n/h_o	2.68
---------	------

Suction	-2 cm/s
---------	---------

A	1.727907568
---	-------------

C1 0.08853498 cm/s

K	0.051238262 cm/s
---	------------------



Instructions

Step 1: Enter measurement times beginning with zero

Step 2: Enter corresponding volume measurements

Step 3: Adjust selection field on graph to fit data

[illegible]

Step 4: Select Infiltrometer Type

Step 5: Select Soil Type

Step 6: Select Suction

Radius	2.25 cm/s
--------	-----------

alpha	0.145
-------	-------

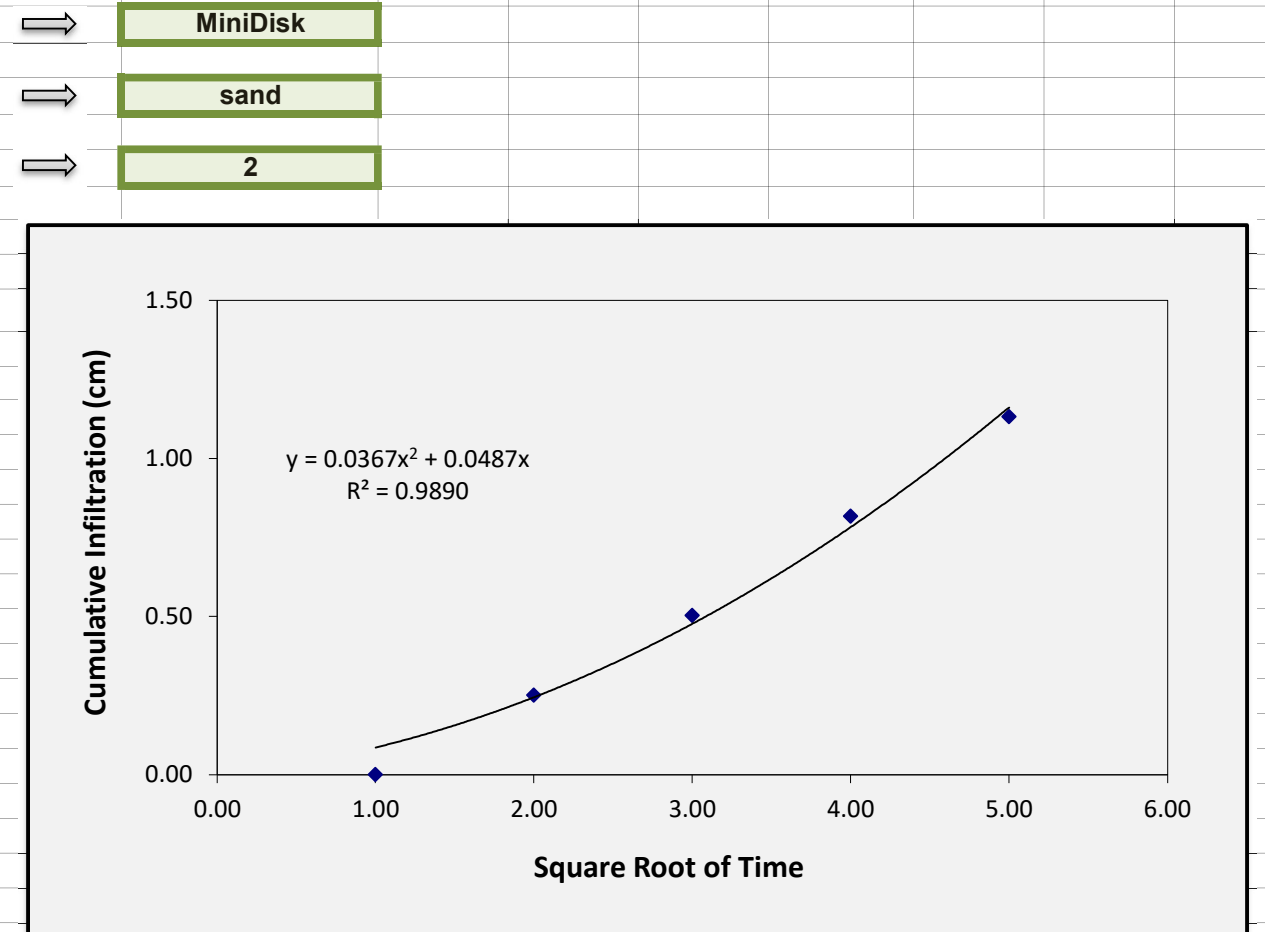
n/h_o	2.68
---------	------

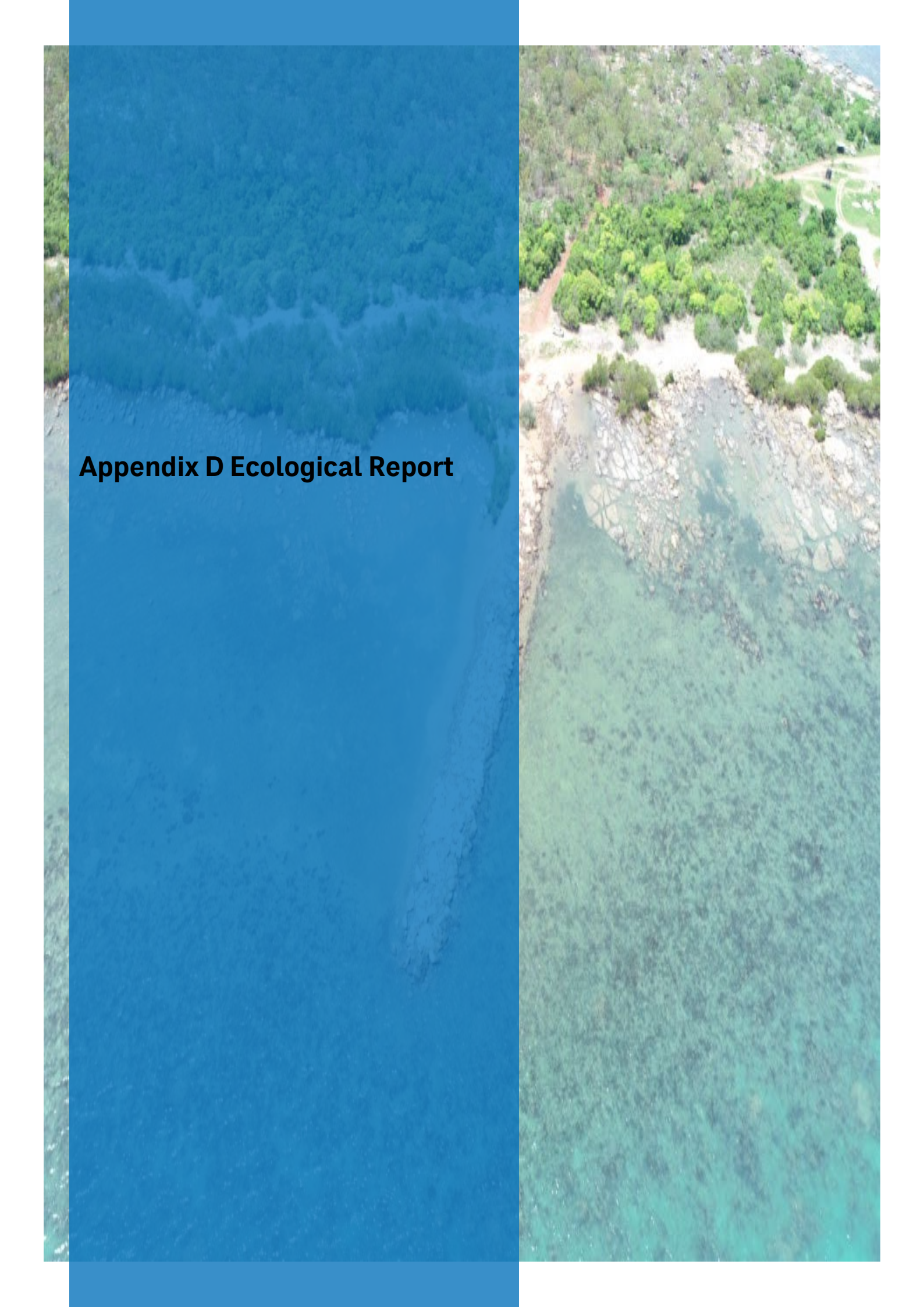
Suction	-2 cm/s
---------	---------

A	1.727907568
---	-------------

C1	0.021886855 cm/s
----	------------------

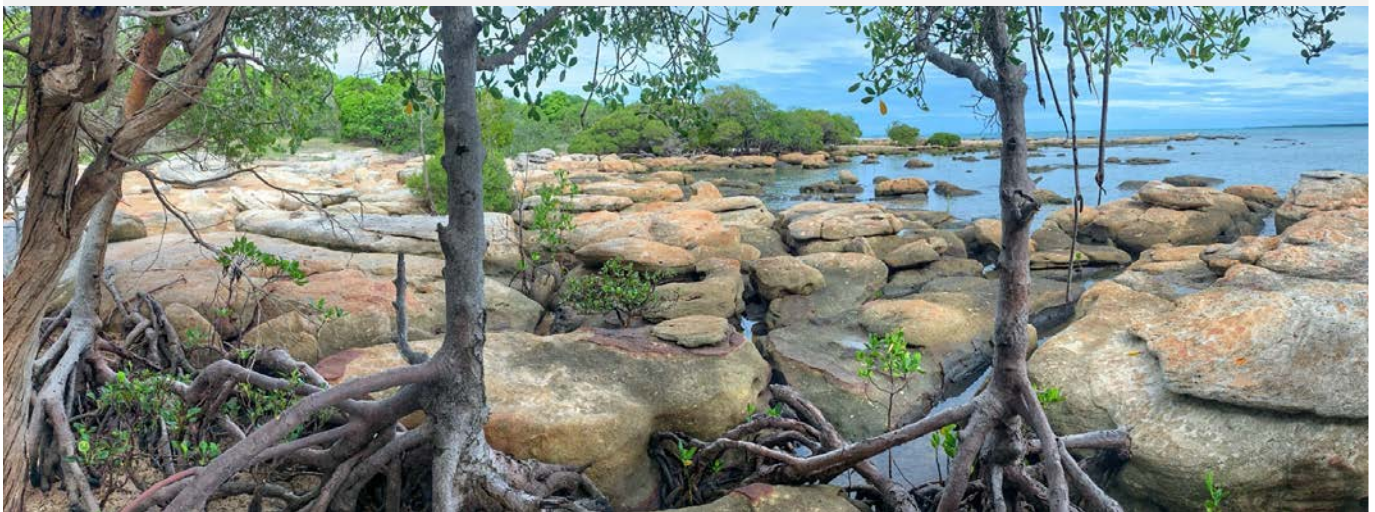
K	0.012666681 cm/s
---	------------------



An aerial photograph of a coastal area, showing a mix of green vegetation, sandy beaches, and rocky shorelines. The water is a deep blue, and the land is covered in dense green trees and shrubs. A blue overlay covers the left side of the image, and the text "Appendix D Ecological Report" is written in white on this overlay.

Appendix D Ecological Report

**Little Paradise
Lease 1 and 2 /
Marina Precinct
Terrestrial Ecology
Assessment**



Revision 1

Prepared for
**Groote Holdings Aboriginal
Corporation**

6 April 2024



Project

Little Paradise Development Precinct Terrestrial Ecology Assessment 2024

Report Author/s

Paul Barden, Ecological Management Services Pty Ltd

Client

Groote Holdings Aboriginal Corporation

Client Contact

Des O'Sullivan GHAC

Disclaimer

Ecological Management Services Pty Ltd has prepared this report for the use of Groote Holdings Aboriginal Corporation. The report has been prepared in accordance with the scope of work and for the purpose outlined by Groote Holdings Aboriginal Corporation and based on consultation with the Northern Territory Government Flora and Fauna Division (2021-2022). This report provides technical information derived from the field surveys undertaken at sites in the Project Area for the use of GHAC in assessing potential issues associated with proposed developments and management actions. Ecological Management Services Pty Ltd does not warrant in any way whatsoever that the material contained in this report is fit for use for any other purpose or by any other party. This report should not be reproduced in whole or part for any use whatsoever without the express written permission of Ecological Management Services Pty Ltd.

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This report is an update of reporting and data compiled within the project area in in October-November 2022 and February-March 2023. Additional field survey has not been undertaken during the preparation of this report.

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Coolum Beach QLD 4573 Australia

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Acknowledgements

We are grateful to:

- The traditional owners of the Little Paradise area, for providing permission to access areas to conduct ecological surveys.
- Anindilyakwa Land Council, assistance during the Traditional Owner consultation process during surveys.

Document History

Version	Date	Author	Reviewer
Draft	31 March 2024	P. Barden	CDM Smith
Revision 1	6 April 2024		

Cover photo

Coastal area near the proposed marina, Little Paradise area.

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ABBREVIATIONS

ARU	Acoustic Recording Unit
ALA	Atlas of Living Australia
DCCEEW	Commonwealth Department Climate Change, Energy, the Environment and Water
DEE	Commonwealth Department of Environment and Energy
DENR	Department of Natural Resources
DEPWS	Department of Environment, Parks and Water Security
EMS	Ecological Management Services Pty Ltd
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
MNES	Matters of National Environmental Significance
TPWC Act	Northern Territory <i>Parks and Wildlife Conservation Act 1976</i>

Executive Summary

Groote Holdings Aboriginal Corporation (GHAC) is preparing to construct several facilities the vicinity of Little Paradise (Ngadumiyerrka), Groote Eylandt. The Project Area includes a development area covering approximately 20 hectares (the Project Area) to the east of township of Alyangula on Groote Eylandt (Figure 1). The project area includes sections of Lease 1 and Lease 2 at the north-eastern end of the Little Paradise peninsula and a proposed landing and marina precinct (Figure 1).

Ecological Management Services Pty Ltd was commissioned to conduct a targeted ecological survey of the proposed Little Paradise study development precinct area to inform development options and identify ecological issues or constraints. The survey (EMS 2023) was designed to identify existing site conditions and ecological management issues relating to terrestrial flora and fauna and marine shore and migratory birds.

This document presents an update and review of the EMS (2023) assessment, focusing Lease 1 and 2 and the Marina Precinct (Figure 1). Information used in this report is derived from broader surveys conducted in 2021 and 2022 and reported in EMS (2023). The current assessment did not include additional field surveys.

Summary and Recommendations

- Several ecological constraints areas were identified in the Little Paradise surveys, including threatened and migratory fauna species and culturally and ecologically significant habitats.
- Important habitat types such as monsoon forest, mangroves and tidal salt pans are present within the broader study area. These habitats should be avoided where possible during the planning and design phase.
- Endangered and vulnerable plant species were not detected within the Project Area.
- Weeds are present in the local area and there is a risk that the project will increase their number and distribution. The risk of the project in relation to weeds will be minimised if appropriate controls are implemented.
- Three EPBC Act listed threatened fauna species, the northern blue-tongued skink, northern quoll and northern masked owl, were detected in terrestrial habitats within or adjacent to the Project Area footprint.
- The northern quoll was identified as occurring across the study area with an estimated range of 7 individuals falling within the clearance footprint based on a density estimate by Heiniger et al. (2021).

- The proposed development area would require disturbance to a small percentage of the home range of one or two pairs of northern masked owl. Several locations were identified as supporting roost locations for this species within the study area (monsoon forest near the marina and Lease 1 and 2).
 - Significant (listed) threatened and migratory bird species (DOE 2015c) were present in small numbers on the eastern coast of the Little Paradise peninsula. Several of these species are listed as critically endangered, endangered and vulnerable under the EPBC Act. This requires control and management of discharge from the proposed aquaculture facility to avoid impacts on sensitive marine tidal flats and salt pans where shorebirds feed to the east of Lease 1 and 2.
 - Controls on disturbance in tidal areas, aquaculture discharge and sedimentation should be applied to minimise off-site impacts on marine and tidal habitats (threatened and migratory shorebirds).
- Summary and Recommendations

P. A. Barden

Ecological Management Services Pty. Ltd.

6 April 2024

1.0 Introduction

Groote Holdings Aboriginal Corporation Pty Ltd is preparing to construct several facilities the vicinity of Little Paradise (Ngadumierrka), Groote Eylandt. The Project Area includes a development area covering approximately 20 hectares (the Project Area) to the east of township of Alyangula on Groote Eylandt (Figure 1). The project area includes sections of Lease 1 and Lease 2 at the north-eastern end of the Little Paradise peninsula and a proposed landing and marina precinct (Figure 1).

Ecological Management Services Pty Ltd was commissioned to conduct a targeted ecological survey of the proposed Little Paradise study development precinct area to inform development options and identify ecological issues or constraints. The survey (EMS 2023) was designed to identify existing site conditions and ecological management issues relating to terrestrial flora and fauna and marine shore and migratory birds, including:

- A description of the native flora and fauna of the area.
- Review of vegetation mapping in the development footprint and identification of significant habitats/vegetation types.
- Assessment of Northern Territory and/or Commonwealth listed threatened or migratory species and Matters of National Environmental Significance (MNES).
- Identify important habitats for threatened species, significant vegetation and other ecological constraint areas.
- Develop recommendations for design and management measures to minimise and avoid impacts on threatened species, culturally and ecologically significant habitats and MNES.

This document presents an update and review of the EMS (2023) assessment, focusing on the north-eastern component of the Project Area (Lease 1 and 2 and the Marina Precinct). Information reported from the original surveys is contained in EMS (2023) and this document should be referred to regarding detailed methods and regional context. The current assessment and update did not include additional field surveys.

EMS (2023) included an assessment of the terrestrial and marine shore ecology of the Project Area with specific reference to the requirements listed above, including surveys for threatened and migratory species as defined in the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*

(EPBC Act) and Northern Territory *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act). The surveys were conducted in three phases between January 2021 and October 2022. The surveys did not include surveys of listed threatened marine species such as cetaceans and marine turtles and marine components were limited to mangrove and saline salt pan environments, shorebirds and migratory marine birds (EMS 2023).

The Project development envelope and disturbance footprints (= clearing boundary) include specific areas with the broader the Lease areas and are indicated in Figure 1 and other Figures in this report.

1.1 OBJECTIVES AND SCOPE

Threatened species and migratory species listed in the EPBC Act and TPWC Act occur or potentially occur within the study area. Several habitat types that occur within the Project Area are also considered biologically or culturally significant within the Anindilyakwa Indigenous Protected Area (Taylor 2016). These habitats are significant due to their potential to support threatened species, elevated levels of biodiversity, restricted landscape resources and/or cultural values (Taylor 2016). The objective of the EMS (2023) was to assess the habitats within the Project Area and to undertake an assessment of the potential for the project to have an impact on significant habitats, migratory species and threatened flora and fauna species and MNES.

The study included:

- Review existing databases and mapping data to generate lists of significant flora and fauna and significant habitats known to occur or potentially occur in the Project Area;
- Review of a Commonwealth Protected Matters report to identify MNES relevant to the Project Area;
- Conduct a field survey to assess the presence of threatened plant species;
- Conduct targeted fauna surveys to determine the presence of EPBC Act and TPWC Act listed fauna species;
- Conduct targeted fauna surveys to determine the presence of EPBC Act listed migratory fauna (terrestrial and coastal inshore migratory bird species);
- Identify significant terrestrial flora and fauna species and habitats under relevant legislation and provide recommendations for mitigating impacts on significant habitats or sites within the study area.

1.2 LEGISLATIVE FRAMEWORK

1.2.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is administered by the Commonwealth Department Climate Change, Energy, the Environment and Water (DCCEEW). It is designed to conserve biodiversity through the protection of threatened species (critically endangered, endangered and vulnerable) and ecological communities, migratory, marine and other protected species listed in schedules under the Act. The EPBC Act also provides a framework for the identification and listing of key threatening processes impacting listed threatened species or communities. The Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, migratory species, ecological communities and heritage places, defined in the Act as Matters of National Environmental Significance (MNES). MNES as defined under the EPBC Act relevant to the current Project include:

- Listed threatened species and ecological communities;
- Migratory species protected under international agreements; and
- Key threatening processes.

1.2.2 Northern Territory Territory Parks and Wildlife Conservation Act 1976

The TPWC Act provides for the creation and management of parks and reserves, and the conservation and sustainable utilisation of wildlife. The TPWC Act is administered by the Northern Territory Department of Environment Parks and Water Security (DEPWS). Species that are threatened are listed in schedules under the TPWC Act and are managed maintain or promote an increase in population numbers.

1.3 PROJECT AREA DESCRIPTION

The Project Area covers two Leases and proposed marina site at the northern end of the Little Paradise Development Precinct northeast of Alyangula (Figure 1). The terrestrial components of the Project Area cover approximately 20 hectares, with the proposed Project Footprint covering a smaller area within the Project Area (Figure 1). The terrestrial component of the Project Area is primarily covered by areas of intact tall open forest and woodland, with common canopy species including *Eucalyptus tetradonta*, *Eucalyptus miniata*, *Corymbia kombolgiensis*, *Corymbia polycarpa* and *Callitris intratropica*. Areas of closed monsoon vine forest and mangrove closed forest occur within and adjacent to the marina area. Rocky foreshores, mangroves and tidal salt pans occur in areas adjacent to the Project Area on the coast. Minor areas within the Project Area have been cleared or modified for access roads, hard rock and gravel quarrying and other infrastructure development during earlier development phases.

1.4 LAND USE, TOPOGRAPHY, LAND SYSTEMS AND GEOLOGY

The greater Little Paradise development precinct area supports a range of habitats, including marine, strand, mangrove, grassland, forest and woodland ecosystems that are currently managed for conservation and preservation of cultural heritage within the Anindilyakwa Indigenous Protected Area (Taylor 2016). Several existing roads and unformed tracks servicing the Bartalumba and Little Paradise communities occur within the Project Area and several locations have been cleared and modified in the past for the extraction of construction materials and Section 19 development areas. There is a small outstation community close to the Project Area at Little Paradise (Figure 1). There is an existing derelict landing facility at the location of the proposed Project landing site to the south-east of the Little Paradise outstation. This area currently supports a cleared access track, a former laydown/turning area and a partially intact rock wall extending approximately 200 m across the reef flat.

Most of the Project Area is located on relatively level terrain several meters above adjacent coastal tidal marine habitats. The low areas to the east of the Project Area are dominated by extensive tidal foreshores, salt pans and mangroves on tidal mud flats. Areas of dissected sandstone are located on the Little Paradise peninsula west of Lease 1 and 2. Occasional outcropping quartzite rock occurs in the northern low-lying areas in Lease 1 and 2.



FIGURE 1 Little Paradise
Lease 1 and 2 + Marina Precinct
Study Area

2.0 Survey Methods

Survey methods described here are derived from EMS (2023). The surveys were designed to assess the potential for listed threatened species, significant habitats and matters of national environmental significance (MNES) within and adjacent to the Little Paradise Development Precinct. The assessment focused on terrestrial flora and fauna species and considered birds that occur in marine, tidal or wetland habitats on the margins of the Project Area (e.g., migratory shorebirds). The methods were based on a preliminary review of the threatened species known to occur in the Groote archipelago, EPBC protected matters reports and species that potentially occur in the local area based on existing records or known habitat.

The field surveys were conducted with reference to a preliminary area of interest that covered a broad area of the Little Paradise peninsula. Surveys were focused on the main Leases and the development footprint and components of the development footprint as these were identified. Surveys for mobile species such as birds included sites within other areas of the Little Paradise peninsula.

Table 2.1 and 2.2 present a list of the listed threatened flora and fauna species that are confirmed or potentially occur within the Project Area based on existing data and known habitat preferences. These Tables list species for which there are existing records for the Groote Archipelago and do not include near threatened and data deficient species or marine species.

2.1 FLORA FIELD ASSESSMENT METHODS

The flora field work was conducted during mid-January 2021 and during several periods during the late wet season/early to mid-dry season 2022. Field surveys were undertaken by botanist Kym Brennan. The surveys focused on searching for threatened and significant plant species in habitats based on existing data and the experience of the botanist. The flora searches focused on escarpment shrublands and wetlands and included other areas of monsoon closed forest and *Eucalyptus* dominated open woodland/forest. Incidental observations were also collated during walked transect searches conducted at intervals across the main survey area and at key locations on the margins of the study area.

2.2 FAUNA SURVEY METHODS

2.2.1 Diurnal Avian Surveys

Target species: Listed threatened forest birds and migratory/threatened marine and shorebirds.

A standardised search (Watson 2003) methodology was employed to sample birds in the Little Paradise Project Area. This method enabled timed avian searches to be conducted in specific habitats and while

moving through areas of the site during the setting of camera trap grids and conducting other transect based surveys. The method was designed to provide an estimate of avian species richness and an accurate estimate of the completeness of the survey based on the rate of accumulation of new species. This approach has the advantage allowing continuous real-time monitoring of survey completeness, combining completeness estimation with a quantitative results-based stopping rule. As a result, the standardised search yields inventories of fixed and known completeness (Watson 2003).

Birds were surveyed within the Project Area and in adjacent habitats and locations during January 2021, July 2022 and August 2022 (Figure 2). Standardised searches were conducted by moving throughout the broad vegetation type and identifying all birds observed or heard during a 15-minute period (Watson 2003). All bird taxa observed were recorded and the observer was free to move within the habitat within the count period. Care was taken to limit sampling to a broad vegetation class (e.g., monsoon forest or Eucalypt forest). A waypoint was recorded at the starting point for each sample location (Figure 2). Birds were excluded from a count if they were overflying the habitat and not actively engaged in hunting or foraging.

A total of 100 x 15-minute avian surveys (25 survey hours) were undertaken across the 2021-2022 survey period on the Little Paradise peninsula and areas to the west of Deception Bay. 61 x 15-minute standard searches were undertaken in the 2021 survey period. These searches were focused on the northern section of the Project Area at Lease 1 and 2, terrestrial components of the Marina Precinct, and included mangroves, rocky shores and salt pans to the east of the study area. These surveys were designed to assess populations of migratory and threatened shorebirds and marine birds. Thirty-nine additional 15-minute surveys were undertaken opportunistically in July and August 2022, focusing on open forest and woodland in the southern Lease areas and sandstone escarpment areas to the south and west of Deception Bay. Incidental sightings of birds were collated during other surveys within the study area and from camera trapping.

2.2.2 Rodent Burrow Spoil Surveys

Target species: Northern hopping-mouse (*Notomys aquilo*)

Rodent burrow searches were conducted by walking transects (99.36 km) across suitable habitats within the Little Paradise peninsula to assess the presence of characteristic signs of the northern hopping-mouse (endangered, EPBC Act) (burrow spoil heaps, pop holes and tracks) based on the sampling methodology recommended by Diete (2015). The ground transect surveys covered all Lease areas south of the Little Paradise marina precinct that support potential *Notomys aquilo* habitat based on existing understanding

of habitat preferences (Figure 2). The surveys were not applied to escarpment areas, as northern hopping-mouse do not occur in these habitats (Diete et al. 2016a). The main Project Area (Leases 1-7) were traversed at 50 m intervals on east-west transects and locations in the vicinity of the landing site were also assessment. The 50 m ground transect interval was considered appropriate due to elevated levels of visibility due to the area being burnt prior to the surveys.

Aerial transects (65 km) were also used to identify potential rodent burrow spoils from the air that could then be further investigated on the ground. The aerial transects were undertaken on the 6/7/2022 by flying a helicopter (Jet Ranger) at low speed above the canopy and recording the location any potential burrow spoils sighted. The entire Project Area footprint and adjacent Lease areas (excluding sandstone habitat) was covered at 300 m transect intervals with repeat transects over some areas. Locations where potential burrows were identified were visited on the ground to collect measurements and assess the site.

Potential rodent burrow systems located in the transect surveys were inspected and searches were conducted for access “pop” holes within a 6 m radius of the spoil. Targeted camera trapping was conducted at spoils that met criteria as potential delicate mouse (*Pseudomys delicatulus*) or northern hopping-mouse burrows based on burrow spoil and pop hole structural criteria (Diete 2015). Delicate mice are discussed in the report as they are known to produce burrows that are smaller but similar in structure to those of the northern hopping-mouse (Diete et al. 2016a).

Camera traps (Reconyx HP2 Black Flash) baited with a standard bait chamber and additional sunflower seeds were set within 2 m of potential hopping-mouse spoil heaps or pop hole, to determine if a rodent species was present.

2.2.3 Masked Owl Acoustic Recording

Target species: Northern masked owl (*Tyto novaehollandiae kimberli*)

Northern masked owls were sampled using fixed autonomous acoustic recorders (ARUs) across the Project Area (Figure 2). The arrangement of the recorders was designed to provide coverage of the site using the inferred distance that masked owl calls can be detected based on previous survey work on Groote Eylandt (at least 500 m; Figure 2). Surveys in the northern and eastern Lease areas were conducted using Wildlife Acoustics SM4 and Frontier Laboratories BAR LT bioacoustic recorders attached to trees and set to record on a daily schedule (6 units, 120 recording nights) (Figure 2.3). Recording at two arrays of Titley Chorus ARUs were conducted in the Leases along the Bartalumba Road in the 2022 dry season (41 units, 1025 recording nights). Acoustic recordings were scanned using customized northern masked owl signal

detection parameters in Kaleidoscope 5.4.8. Signal detection parameters were based on call parameter extractions from Groote Eylandt recordings of northern masked owl calls. All recordings were scanned to identify files containing target call types based on signal parameters and were rescanned with pairwise classifiers (cluster analysis) procedures in Kaleidoscope. Files identified by the procedures were manually reviewed to confirm northern masked owl calls.

2.2.4 Northern Masked Owl Call Broadcast

Target species: Northern masked owl (*Tyto novaehollandiae kimberli*)

Broadcast call surveys were used to assess the presence of the northern masked owl (vulnerable, EPBC Act) within the Project Area during the current survey using a methodology based on DEWHA (2010). Surveys were conducted at long term monitoring sites along the Bartalumba-Little Paradise Road and at several additional sites along an unformed track to the south of Deception Bay (Figure 2). Broadcast surveys were only undertaken when weather conditions were suitable, including winds and clear conditions.

The main call broadcast stations in the Little Paradise area were sampled on one night in January, March, April, June, July, September, October, November and December 2021, with additional sampling in July 2022 (83 call broadcast station samples).

On arrival at a broadcast station, a brief spotlight scan and listening period was undertaken to determine the presence of owls in the local area. If no owls were detected, northern masked owl screech and chatter calls with intervening periods of silence were broadcast using a modified 10w transistor megaphone (Toa). The sequence of call broadcast and silence was repeated several times for a total broadcast session of 10 minutes at each station. Observers located within 50 m of the broadcast station listened for call responses and recorded observations of approaching owls. If masked owls were detected at a station, the session was discontinued. If owls were not detected during the 10-minute call broadcast period, a subsequent 5-minute period of listening and spotlighting was undertaken in the area immediately surrounding the broadcast station.

Incidental sightings of other nocturnal fauna species were recorded during and following the call broadcast session.

2.2.5 Northern Masked Owl Habitat Tree Assessments

Target species: Northern masked owl (*Tyto novaehollandiae kimberli*)

During ground transect searches conducted at 50 m spacing across the main Little Paradise peninsula (Figure 2), potential habitat trees with large hollows suitable for masked owls were identified and marked. These transects were not conducted in the Leases in the western sandstone areas, as there were no large trees with hollows suitable for masked owls present in these shrubby and low woodland vegetation types.

Trees that were identified as potentially supporting hollows suitable for masked owls were inspected with a 19 m extendible pole with a mounted camera system (GoPro Hero 5 with a 600-lumen light attachment). Hollows were investigated to determine occupancy by wildlife species and to determine suitability as roost or nesting sites for northern masked owls. Searches for owl pellets and other signs of occupation were conducted at the base of suitable habitat trees.

2.2.6 Camera Trapping

Target species: Northern quoll (*Dasyurus hallucatus*), brush-tailed rabbit-rat (*Conilurus penicillatus*), northern brush-tailed possum (*Trichosurus vulpecula arnhemensis*)

Camera trapping was undertaken at locations across the Little Paradise area using 4-camera grids based on the methods described by Gillespie et al. (2015) and targeted camera traps for northern hopping-mice (discussed in Section 3.3.2). A total of 110 camera trap stations were set within the broader area between January 2021 and October 2022 for a total of 6,262 camera trap nights (Figure 2; Table 2.3).

Table 2.3 Camera Trap Effort, Little Paradise Project Area 2021-2022

Survey Phase	Area	Number of Camera Traps	Camera Trap Nights
January 2021	Northern Leases (Lease 1-3) and Marina Precinct	32	1856
June 2021	West and south of Deception Bay, sandstone escarpment Lease 8 and 9	36	2409
June 2022	Southern Lease areas (Lease 4 to 7), sandstone areas north of Telstra Hill	42	1997
Total		110	6262

Cameras traps (Reconyx HP2 White Flash focused to 150 cm) were deployed as 4-camera grids at representative locations across the study area. Reconyx HP2X black flash cameras focused to 150 cm were used for rodent burrow spoil deployments. Cameras were set for day and night operation/rapid-fire/high sensitivity/three images and one ten second video per trigger. A PVC rain harvesting vent cowl with insect

proof mesh was attached to a survey peg 1.5 m from each camera trap and baited with a standard bait mix of honey, oats, peanut paste and sunflower seeds. Additional sunflower seeds were spread at the base of each bait station. The bait chamber was attached to a tree or rock in rocky habitats. Camera trap arrays were set as a 1-hectare camera grid, with one camera located on each corner of the grid (Gillespie et al. 2015). In some habitats, including narrow valleys in sandstone areas and coastal bands of monsoon forest, the grid was elongated to fit the linear nature of the habitat.

2.2.7 Microbat Bat Surveys

Target species: Ghost bat (*Macroderma gigas*), bare-rumped sheath-tailed bat (*Saccolaimus saccolaimus*)

Bat acoustic surveys, trapping, roost searches and observational surveys targeting bats were undertaken between January 2021 and November 2022. This included hand-held acoustic sampling using a Titley Scientific Walkabout (full spectrum) recorder during spotlight and owl call broadcast survey and at the landing site (approximately 6 hours), spotlighting, roost searches and remote bat echolocation call recording at fixed stations (Figure 2; Table 2.4).

Fixed remote detection surveys were conducted using Titley Scientific AnaBat Swift bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise) with external full spectrum microphones, mounted at 1.5 m on a fixed point, a tree branch or trunk facing an open area, water body or track. The units were set at nine locations within the Little Paradise/Deception Bay area for a total of 264 sampling nights (Figure 2; Table 2.4). Recorders were placed at sites expected to increase the chances of recording passing bats, including next to open water bodies and adjacent to potential roost sites in sandstone escarpment areas. Calls were recorded in full spectrum WAV format and analysed using methods outlined in Armstrong et al. (2021a,b) (Appendix 4). The bat acoustic analysis methods are detailed in Specialised Zoological (2022) (Appendix 2).

Roost searches were undertaken at sites where complex sandstone occurs within or immediately adjacent to the Lease areas. The searches included checking caves and crevices for roosting live bats and evidence of bat occupation, such as feeding remains and scat piles. Limited opportunistic bat trapping was undertaken using a harp trap in the vicinity of the marina precinct area during January 2021. A single standard sized double bank harp trap was placed in a gap in monsoon forest and operated between dusk and dawn for 6 nights to sample bat species whose presence can be difficult to confirm because their echolocation calls resemble those of another species.

Table 2.4 Bat Survey Sites and Deployment Duration: Fixed Acoustic Recording

Site	Serial Number	Survey	First night	Last night	Nights
Session1 Swift 1 2021 Open Dam	583084	Phase 1	19/02/2021	21/02/2021	3
Session1 Swift 2 LP Sandstone Edge 2021	583079	Phase 1	22/01/2021	13/02/2021	23
Session1 Swift 3 Open Forest	568046	Phase 1	22/01/2021	3/02/2021	13
Session2 Swift 1 Monsoon Forest Creek	583084	Phase 2	2/07/2021	1/08/2021	31
Session2 Swift 2 Camp Sandstone Margin	583079	Phase 2	29/06/2021	12/08/2021	45
Session2 Swift 1 Escarpment Cave Entrance	568046	Phase 2	27/06/2021	4/08/2021	40
Session3 Swift 2 Telstra Hill Sandstone	583079	Phase 3	18/06/2022	9/08/2022	53
Session3 Swift 3 Telstra Hill Sandstone	568046	Phase 3	18/06/2022	8/08/2022	52
Little Paradise Acoustic Array June 2022	655072	Phase 3	21/07/2022	23/07/2022	4

2.2.8 Limitations

The methods applied in the survey were targeted towards a sub-set of threatened and significant fauna species and groups. Additional survey methods would need to be applied within the Project Area to obtain baseline biodiversity data covering a full range of common species, including reptiles, amphibians and other fauna groups. The survey does not represent an assessment of the biodiversity and species richness of all flora and fauna groups and many additional species are likely to occur in the study area. The survey methodology did not include assessment of marine species such as marine fishes, cetaceans and marine turtles.



- Project Area
- Sandstone Outcrops and Escarpment
- Fauna Survey Methods 2021-2022**
- Camera Trap Stations
- ◆ Avian Survey Sites
- Fixed Bat Detection Sites
- ◆ Masked Owl Acoustic Recording Units
- Northern Masked Owl Call Broadcast Sites
- Walked Survey Transects Northern Hopping-mouse and Masked Owl Habitat Trees

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Plan Reference E-2024
Base mapping layers supplied by AUSLIG

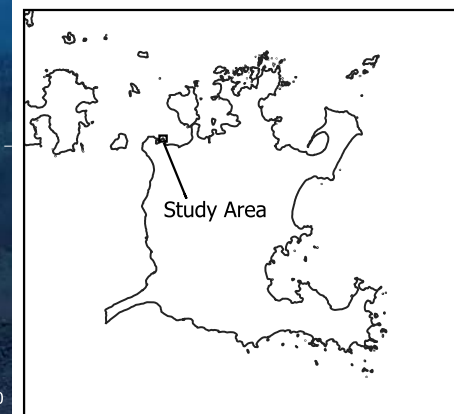


FIGURE 2 Little Paradise
Lease 1 and 2 + Marina Precinct
Fauna Survey Methods
2021-2022

Table 2.1 Status and Survey Methods: Potential Significant Flora and Fauna Species, Little Paradise Development Precinct (EMS 2023)

Source: 1 = NT Government Flora and Fauna Atlas (NTG 2023); 2 = Atlas of Living Australia (ALA 2023); 3 = Historic Surveys and Collections; 4 = Barden unpublished survey records;
 Highlighted rows indicate species that require confirmation on Groote Eylandt. Status: CE = Critically Endangered; EN = Endangered; VU = Vulnerable.

Common Name	Scientific Name	Status		Record Source	Habitat	Known or Potential Threats	Survey Methods	Potential Occurrence		
		EPBC	NT					Project Area	Project Area Surrounds	Groote Eylandt
Bladderwort	<i>Utricularia singeriana</i>		VU	1	Freshwater wetlands	Climate change, fire, land clearing	Flora survey	Unlikely	Not Confirmed	1 record
Sedge	<i>Eleocharis retroflexa</i>	VU		1	Freshwater wetlands	Climate change, fire, land clearing	Flora survey	Unlikely	Not Confirmed	1 record
Migratory and Threatened Shorebirds		VU/ EN/ CE	VU	1, 2	Saline wetlands, tidal flats, rocky shores, mangroves	Climate change, habitat loss, disturbance, changes in water conditions and quality at feeding sites	Avian surveys	Confirmed	Confirmed	Confirmed
Northern Masked Owl	<i>Tyto novaehollandiae kimberli</i>	VU	VU	1,2,4	Open woodland and forest	Altered fire regimes, collapse of prey populations	Habitat tree surveys Call broadcast/ spotlight survey, audio recordings	Confirmed	Confirmed	Confirmed
Northern Brushtail Possum	<i>Trichosurus vulpecula arnhemensis</i>	VU		1	Monsoon forests, adjacent open forest	Altered fire regimes, feral cats, land clearing, climate change	Camera trapping Spotlight survey	Not Confirmed	Not Confirmed	Observational Records
Northern Quoll	<i>Dasyurus hallucatus</i>	EN	CE	1, 2, 3, 4	Open forest and woodlands, rocky habitats, beach and dune fields	Altered fire regimes, cane toads, feral cats	Camera trapping Tracks and other incidental observations	Confirmed	Confirmed	Confirmed
Ghost Bat	<i>Macroderma gigas</i>	VU	NT	1, 2, 3, 4	Open forests, woodland, escarpments, dune fields, offshore islands	Disturbance at roost or breeding sites, altered fire regimes, collapse of prey populations	Incidental spotlight observations Bat call echolocation detection	Not Confirmed	Confirmed	Confirmed
Northern Hopping-mouse	<i>Notomys aqualo</i>	EN	VU	1, 2, 4	Open forests, woodland, dune fields on sandy soils	Altered fire regimes, feral cats	Transect spoil searches Camera trapping	Not Confirmed	Historic Records	Confirmed
Brush-tailed Rabbit Rat	<i>Conilurus penicillatus</i>	VU	VU	1, 2, 3	Open woodland and forest	Altered fire regimes, feral cats	Camera trapping	Not Confirmed	Not Confirmed	Confirmed

Common Name	Scientific Name	Status		Record Source	Habitat	Known or Potential Threats	Survey Methods	Potential Occurrence		
		EPBC	NT					Project Area	Project Area Surrounds	Groote Eylandt
Pale Field-rat	<i>Rattus tunneyi</i>		VU	3	Open grassy forests and woodland	Altered fire regimes, feral cats	Camera trapping, search for burrow systems	Unlikely	Not Confirmed	Unlikely
Yellow-spotted Monitor	<i>Varanus panoptes</i>		Vu	1, 3	Open grassy forests and woodland, drainage areas	Cane toads	Camera trapping, observational surveys	Unlikely	Not Confirmed	Unlikely
Mertens' Water Monitor	<i>Varanus mertensi</i>	EN	VU	1,2	Creeks and riverine forest, dams and lakes, drains	Cane toads	Camera trapping, observational surveys	Not Confirmed	Confirmed	Confirmed
Northern Blue-tongue Skink	<i>Tiliqua scincoides intermedia</i>	CE		1, 2	Open forest, riparian, monsoon forest, sandstone, coastal dunes	Altered fire regimes, cane toads, habitat loss	Camera trapping, observational surveys	Not Confirmed	Confirmed	Confirmed

Table 2.2 Survey Methods for Threatened Fauna Species: Little Paradise Development Precinct (EMS 2023)

CE = Critically endangered; E = Endangered; VU = Vulnerable; NT = Near threatened.

Common Name	Scientific Name	Status		Notes	Survey Methods	References
		EPBC	NT			
Threatened/ Migratory Shorebirds		CE, E	VU	Regional records, coastal tidal flats and saline habitats.	Ground and aerial counts in marine wetlands and coastal shore habitats.	DOE (2015a, 2015c)
Northern Masked Owl	<i>Tyto novaehollandiae kimberli</i>	VU	VU	This species is widespread on Groote Eylandt and Winchelsea Island. There are existing records within the study area. Potentially vulnerable to disturbance of important roost or nest sites, particularly large old growth trees supporting large hollows and dense patches of riparian or monsoon vine forest.	- Surveys of habitat trees to determine presence of other potential day time roost/nest sites. - Checks of large tree hollows using a pole mounted camera system. - Nocturnal call broadcast surveys at the appropriate time of year. - Acoustic recording units (ARUs)	DEWHA (2010a) Barden <i>et al.</i> 2021
Northern Brushtail Possum	<i>Trichosurus vulpecula arnhemensis</i>	VU		Status on Groote Eylandt poorly known but appears to be uncommon. Several observational records are associated with monsoon vine forests (Armstrong 2012; Mahney et al. 2009).	- Spotlight surveys. - Camera traps.	TSSC 2021
Northern Quoll	<i>Dasyurus hallucatus</i>	EN	CE	This species is widespread on Groote Eylandt and Winchelsea Island. Habitat includes open forests, woodlands, swamp forest, grassland and rehabilitation/disturbed areas. The main threatening processes for this species are thought to be cane toads and altered fire regimes.	- Collation of incidental sightings during nocturnal and diurnal site surveys - Identification of tracks and scats indicating occupation. - Camera traps. - Assessment of potential den locations (e.g., hollow logs, termite mounds).	Commonwealth of Australia (2016)
Ghost Bat	<i>Macroderma gigas</i>	VU	NT	Recorded across Groote Eylandt and several smaller islands, including Connection Island (NTG 2022). Forages in tall open forests, swamp forests and woodlands in lowland areas, with roost sites located in sandstone escarpments and boulder piles (Barden 2015).	- Observations during spotlight and nocturnal surveys. - Searches for roosting bats and scats at roost sites in culverts, sandstone and boulder piles. - Acoustic detections using full spectrum detectors, near potential roost sites.	DEWHA (2010b) Barden 2015

Common Name	Scientific Name	Status		Notes	Survey Methods	References
		EPBC	NT			
Northern Hopping-mouse	<i>Notomys aquilo</i>	EN	VU	Patchy distribution on Groote Eylandt, no other records on other islands in the archipelago (Dixon and Barden 2018). No recent records close to Alyangula/Little Paradise.	- Transect searches for signs of occupancy, particularly burrow systems (pop holes and spoils). - Conduct targeted camera trapping if potential burrows or other signs of occupancy are detected.	Diete (2015) Diete et al. (2014) TSSC (2021)
Brush-tailed Rabbit Rat	<i>Conilurus penicillatus</i>	VU	VU	Records from across Groote Eylandt but not reported from other islands in the archipelago. There are no recent records from areas close to Alyangula/Little Paradise.	- Spotlight survey. - Camera traps.	TSSC (2016b) Commonwealth of Australia (2011)
Pale Field-rat	<i>Rattus tunneyi</i>		VU	Extensive recent surveys on Groote Eylandt have not detected this species. Status on Groote Eylandt is unknown but considered unlikely to occur there. The only record is a single historical damaged skull (1972) which could represent several rodent species.	- Burrow searches. - Spotlight survey. - Camera traps.	Young and Hill (2012)
Floodplain Monitor	<i>Varanus panoptes</i>		VU	<i>V. panoptes</i> was listed as present on Groote Eylandt during a 2009 survey (Mahney <i>et al.</i> 2009). However, there are no specimen records from the archipelago and recent genetic studies indicate that the only large lowland/floodplain goanna on Groote is <i>Varanus gouldii</i> (Barden, unpublished data).	- Collation of incidental sightings during nocturnal and diurnal site surveys. - Camera trapping.	Ward et al. (2012a)
Mertens' Water Monitor	<i>Varanus mertensi</i>	EN	VU	This species is common on Groote Eylandt. Associated with streams and wetland habitats. Previous sightings at waterbodies south of Little Paradise.	- Collation of incidental sightings during diurnal site surveys - Camera traps.	Ward et al. (2012b)
Northern Blue-tongue Skink	<i>Tiliqua scincoides intermedia</i>	CE	DD	This species is common on Groote Eylandt in most habitats, including open forest, woodland, swamp forest, monsoon vine forest, coastal dunes, riparian and sandstone habitat.	- Collation of incidental sightings during diurnal site surveys - Camera traps.	TSSC

3.0 Results

3.1 VEGETATION MAPPING

Four vegetation map units have been identified in the Project Area (Lease 1 and 2 and the marina precinct terrestrial component) in existing mapping (EMS 2023) (Figure 3; Table 3.1). The main areas of lease 1 and 2 are covered by *Eucalyptus tetrodonta* and *Callitris intratropica* dominated woodland and forest (VMU 40a). Other vegetation classes cover comparatively minor sections of the leases. This includes small areas of closed monsoon forest (VMU 2), mangrove closed forest (VMU 1) and rocky shore habitat (VMU 93) close to the marina precinct (Figure 3). Habitat to the east of leases 1 and two that may be impacted by water discharges and associated infrastructure include saline salt pans (VMU 100) and mangrove closed forest (VMU 1) (Figure 3).

Several of the vegetation communities within or adjacent to the Project Area are of biodiversity or cultural significance, including saline salt pans (habitat for threatened and migratory shorebirds), mangroves, rocky shores and closed monsoon forest.

3.2 EXISTING FLORA DATA AND THREATENED FLORA

None of the plant species recorded in the Little Paradise Project Area during previous surveys are listed as critically endangered, endangered or vulnerable under the EPBC Act and TPWC Act (EMS 2023). The flora of the greater Groote Archipelago currently has no species listed as critically endangered or endangered, but two are regarded as vulnerable, including *Eleocharis retroflexa* (EPBC Act) and *Utricularia singeriana* (TPWC Act). These species have only been collected from wetland habitats on Groote Eylandt. The seasonal wetland areas in the Project Area are less likely to support these species, and surveys in these areas in 2022 failed to detect threatened plants (EMS 2023).

Several plant species that have been collected at sites in the general Project Area are listed as data deficient by the Northern Territory Government (NTG 2023; Table 3.2; Figure 4). None of these species were detected during the 2021-2022 surveys (Kym Brennan, pers com. EMS 2023) (Appendix 1). The previous records of data deficient plant species are outside the current Development footprint at lease 1 and 2 and the marina area. One of these species, *Halophila decipiens*, is a marine sea grass species that was collected in Deception Bay (Figure 4) and may occur at other sites in shallow coastal marine habitats. Based on current knowledge of the site and the habitats within the wider Project Area, the prospect threatened plant species in the higher risk categories (endangered, vulnerable) occurring within the local area appears to be low (EMS 2023).



FIGURE 3 Little Paradise
 Lease 1 and 2 + Marina Precinct
 Vegetation Mapping Units



- Project Area
- Little Paradise Data Deficient
Plants NT Fauna Atlas NOV 2022**
- ▲ Enhalus acoroides
- Halophila decipiens
- ◆ Polymeria pusilla
- ⊙ Proiphys alba
- Sedopsis sp. Sandstone
- Synostemon trachyspermus

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 Plan Reference E-2024
 Base mapping layers supplied by AUSLIG;
 NTG NR MAPS

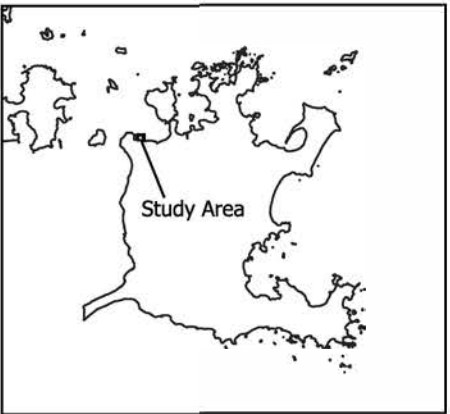


FIGURE 4 Little Paradise
 Lease 1 and 2 + Marina Precinct
 Data Deficient Plants - Existing Data

Table 3.1 Little Paradise Project Area – Lease 1 and 2 and Marina Precinct Dominant Vegetation Units

Unit		Unit Description	Landscape	Soils	Land System	Topography	Project Area Leases Hectares
1		Closed mangrove forest	Marine muds and tidal areas	Marine mud and sand	Littoral	Marine plain	0.3
2		Dry coastal monsoon vine Low Closed Forest (<i>Drypetes</i> Closed Forest)	Coastal sand plains and dunes	Deep red earthy sands, red orthic tenosols	Queue	Level to gently undulating sandplains	1.5
40a		<i>Eucalyptus tetrodonta</i> / <i>E. miniata</i> +/- <i>C. polycarpa</i> woodland with low shrub and tussock grass dominated understorey on lateritic plains and low rises (lowlands).	Weathered sand and lateritic plains	Deep red siliceous sands, red orthic tenosols	Groote/ Queue	Level to gently undulating sandplains	17
93		Rock platform with scattered low shrubs	Coastal rock platforms	Saline muds and cracking clays, marine sands	Littoral	Coastal rock shelves	0.5
100		Marine tidal salt pans	Marine muds and tidal areas	Marine mud and sand	Littoral	Marine plain	0
Total Hectares							19.3

Table 3.2 Data Deficient Plant Species Recorded in the Little Paradise Study Area: Existing Data (EMS 2023)

Scientific Name	Collector	Status	Location	Easting	Northing
<i>Sedopsis sp. Sandstone</i>	Kym Brennan	Data Deficient	Sandstone	655465.8	8471775
<i>Sedopsis sp. Sandstone</i>	Dale Dixon	Data Deficient	Sandstone	656880.4	8470976
<i>Synostemon trachyspermus</i>	Jenni Low Choy	Data Deficient	Telstra Hill	655037	8468686
<i>Proiophys alba</i>	Kym Brennan	Data Deficient	Deception Bay West	655435	8470786
<i>Halophila decipiens</i>	C. Thorogood	Data Deficient	Deception Bay	656583	8471272
<i>Polymeria pusilla</i>	Kym Brennan	Data Deficient	Deception Bay West	655509.2	8471440
<i>Enhalus acoroides</i>	J. Waddy	Data Deficient	Yinungwakardamurrumanja	655049.8	8472244

4.0 Fauna Survey Results

4.1 Recent Threatened Species Status Changes – EPBC Act

Several fauna species detected in the area surrounding the Little Paradise northeastern leases have undergone changed under the EPBC Act since the completion of previous assessment reporting (EMS 2023). Most of these species (11 species) are migratory shorebirds and two are reptiles (Table 4.1). These species have been recorded previously in the Groote Archipelago and could occur at low numbers in tidal and marine habitats adjacent to the Project Area. One species, the common greenshank, is now listed as Endangered and has previously been reported in tidal salt pan habitat to the east of the Project Area (EMS 2023).

Two reptile species that have previously been reported on the northern Little Paradise peninsula have also undergone status change under the EPBC Act. The northern blue-tongued Skink is now listed as Critically Endangered and was recorded on camera traps to the west of lease 1 and 2 (EMS 2023). Habitat for this species occurs in Lease 1 and 2. The Merten's water monitor is now listed as Endangered and was recorded on several occasions to the south-west of the project area in a disused water-filled quarry (EMS 2023). This species is less likely to occur in the Project Area but may move into flooded areas and streams in the wet season.

Table 4.1 Threatened Fauna Species with Changed Status Under the EPBC ACT, 2023 and 2024

Common Name	Scientific Name	Distribution	Current Status	Listing Date
Northern Blue-tongued Skink	<i>Tiliqua scincoides intermedia</i>	Recorded in the northeastern Little Paradise Project Area	Critically Endangered	21-Dec-2023
Mertens' Water Monitor	<i>Varanus mertensi</i>	Recorded in the vicinity of the northeast Little Paradise Project Area	Endangered	21-Dec-2023
Nunivak Bar-tailed Godwit	<i>Limosa lapponica baueri</i>	Possible in saline wetlands and salt pans	Endangered	5-Jan-2024
Northern Siberian Bar-tailed Godwit	<i>Limosa lapponica menzbieri</i>	Possible in saline wetlands and salt pans	Endangered	5-Jan-2024
Black-tailed Godwit	<i>Limosa limosa</i>	Possible in saline wetlands and salt pans	Endangered	5-Jan-2024
Common Greenshank	<i>Tringa nebularia</i>	Recorded in salt pans adjacent to study area	Endangered	5-Jan-2024
Ruddy Turnstone	<i>Arenaria interpres</i>	Possible in tidal wetlands and rocky shores	Vulnerable	5-Jan-2024
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	Possible in saline wetlands and salt pans	Vulnerable	5-Jan-2024
Red Knot	<i>Calidris canutus</i>	Possible in saline wetlands and salt pans	Vulnerable	5-Jan-2024
Great Knot	<i>Calidris tenuirostris</i>	Possible in saline wetlands and salt pans	Vulnerable	5-Jan-2024
Asian Dowitcher	<i>Limnodromus semipalmatus</i>	Possible in saline wetlands and salt pans	Vulnerable	5-Jan-2024
Grey Plover	<i>Pluvialis squatarola</i>	Possible in saline wetlands and salt pans	Vulnerable	5-Jan-2024
Terek Sandpiper	<i>Xenus cinereus</i>	Possible in tidal wetlands and rocky shores	Vulnerable	5-Jan-2024

4.2 EXISTING DATA REVIEW

EMS (2023) provided a review of existing fauna data prior to the 2021-2022 surveys. There were few existing fauna records for the Project Area in existing databases, with total of fifty bird species are listed in the NT Fauna Atlas for the area surrounding Little Paradise (DEPWS 2023) and forty-six bird species in the Atlas of Living Australia (ALA 2023). There were no existing listed threatened reptile, amphibian or bird records predating the current surveys within the Project Area (EMS 2023). Listed threatened and significant species previously recorded in the broader area around Deception Bay, nearby coastal habitats and areas south towards the Rowell Highway include the northern quoll, Mertens' water monitor (*Varanus mertensi*) and several threatened, migratory and marine birds (Figure 5; Table 4.2).

There were existing historical records of the northern hopping-mouse close to the Alyangula, however these records are likely to be poorly geolocated specimens derived from other areas of Groote Eylandt (EMS 2023).

Table 4.2 Threatened Fauna Species: Existing NT Fauna Atlas Records from Little Paradise Surrounding Area (EMS 2023)

Common Name	Scientific Name	EPBC Act	Site Area
Lesser Sand Plover	<i>Charadrius mongolus</i>	Migratory, Endangered	Salt pan SE of Little Paradise
Eastern Curlew	<i>Numenius madagascariensis</i>	Migratory, Critically Endangered	Deception Bay shoreline
Northern Masked Owl	<i>Tyto novaehollandiae</i>	Vulnerable	Rowell Highway (Barden)
Northern Quoll	<i>Dasyurus hallucatus</i>	Endangered	Lease 7 and other localities
Northern Brushtailed Possum	<i>Trichosurus vulpecula arnhemensis</i>	Vulnerable	SE of study area
Northern Hopping-mouse	<i>Notomys aqilo</i>	Endangered	Alyangula – probable inaccurate record locality from historical specimens
Mertens' Water Monitor	<i>Varanus mertensi</i>	Under Assessment	Rowell Highway (Barden)
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Vulnerable	Alyangula main beach



- Project Area
- NR Maps Little Paradise Listed
EPBC Little Paradise FEB 2023
- Eastern Curlew
Critically Endangered EPBC
 - ◆ Greater Sand Plover
Vulnerable EPBC
 - ⊙ Northern Quoll
Endangered EPBC

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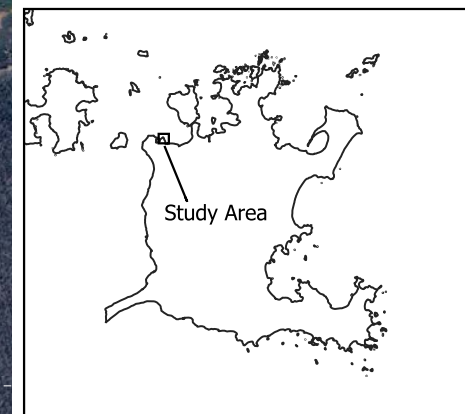


FIGURE 5 Little Paradise
Lease 1 and 2 + Marina Precinct
Existing Fauna Threatened Species
Records

4.3 DIURNAL AVIAN SURVEY RESULTS

A total of eighty-two bird species were detected during the avian surveys at Little Paradise area, including records from standardised searches, camera traps, spotlight survey and incidental sightings (EMS 2023). Surveys in the monsoon closed forest, coastal tidal flats, rocky shores and mangroves recorded eleven species listed as migratory and threatened under the EPBC Act (Table 4.3; Figure 6)

Migratory shorebirds were roosting or feeding on tidal salt flats to the east of the Project Area in small groups of 10 to 20 individuals (Table 4.3; Figure 6). This included regular groupings of up to six eastern curlew (Critically Endangered, EPBC Act) and up to twenty lesser sand plover (Endangered, EPBC Act) and greater sand plover (vulnerable, EPBC Act). Common greenshank (Endangered, EPBC Act) were also sighted on the tidal salt flats.

Smaller numbers of other migratory shorebirds and migratory terns were located on salt pans adjacent to mangroves and at rocky foreshore areas adjacent to the proposed landing site. The overall numbers of listed threatened and migratory birds detected in these areas were low, with the largest number in a single count being a mixed flock of twenty-five migratory and threatened shorebirds. The main areas supporting threatened and migratory shorebirds are not within the areas that would be directly cleared for the proposed developments in the Lease 1 and 2 or marina areas. However, many of these species feed in tidal flats that would be subject to discharge flows from the proposed aquaculture facility at Lease 1 and 2. A small area of rocky shore habitat at the Little Paradise marina site occasionally supports small numbers of migratory shorebirds, such as the (migratory) common sandpiper (*Actitis hypoleucos*) (EMS 2023). However, this area is unlikely to support numbers at significant levels under Commonwealth Government criteria (DOE 2015c).

Table 4.3 Avian Species: Standardised Search, Camera Trap and Nocturnal Survey Data (EMS 2023)

Numbers = number of searches that a species was detected in for each habitat. Additional notations indicate detected in nocturnal survey/spotlight (NOCT) and detected by camera trap (CT).

Habitat	Status EPBC Act	Monsoon Forest	Mangroves/ Salt Pan	Mangroves/ Rocky Shores	Melaleuca Woodland	Sandstone Woodland/Shrubland	Open Forest/ Woodland	Incidence
Common Name								
Arafura Fantail	Migratory	1						0.05
Australasian Darter		1		2				0.05
Australian Magpie							4 CT	0.07
Australian Owlet-nightjar							1	0.02
Bar-shouldered Dove		6 CT	2		CT	CT	17 CT	0.41
Beach Stone-curlew			1					0.02
Black-faced Cuckoo-shrike		1				1		0.03
Blue-winged Kookaburra						1	5	0.10
Brahminy Kite			1					0.02
Brown-capped Emerald Dove		5 CT				CT	1	0.10
Brown Honeyeater		9 CT	5	4	1	1	11	0.51
Brown Whistler		3						0.05
Brush Cuckoo		1				1	8	0.16
Bush Stone-curlew							1, CT, NOCT	0.02
Caspian Tern	Migratory			1				0.02
Chestnut Rail				1				0.02
Common Cicadabird							6	0.10
Collared Kingfisher			1					0.02
Common Bronzewing		CT				1	3 CT	0.07
Common Greenshank	Migratory/ Endangered		2					0.03
Common Sandpiper	Migratory			4				0.07

Habitat	Status EPBC Act	Monsoon Forest	Mangroves/ Salt Pan	Mangroves/ Rocky Shores	Melaleuca Woodland	Sandstone Woodland/Shrubland	Open Forest/ Woodland	Incidence
Greater Crested Tern	Migratory			5				0.08
Dollarbird			1				1	0.03
Double-barred Finch		1					1	0.03
Eastern Curlew	Migratory/ Critically Endangered		4					0.07
Eastern Osprey	Migratory		2					0.03
Eastern Reef Egret				1				0.02
Forest Kingfisher						1	8	0.15
Great Bowerbird		5 CT				1 CT		0.10
Great-billed Heron				2				0.03
Greater Sand Plover	Migratory/ Vulnerable		3					0.05
Green Oriole		8					5	0.21
Green-backed Gerygone		4						0.07
Grey Shrike-thrush		1					4	0.08
Grey-crowned Babbler							2	0.03
Leaden Flycatcher							8 CT	0.13
Lemon-bellied Flycatcher							3	0.05
Lesser Sand Plover	Migratory/ Endangered		2					0.03
Little Bronze-cuckoo		1				1	2	0.07
Little Friarbird							7 CT	0.11
Little Tern	Migratory			3				0.05
Little Woodswallow							1	0.02
Mangrove Gerygone		1	5	1				0.11
Mangrove Golden Whistler		3	1					0.07
Masked Lapwing			3				CT	0.05
Mistletoebird		2	2	1		2	15	0.36
Northern Fantail		5		1		1	18	0.41
Northern Masked Owl	Vulnerable						NOCT	
Olive-backed Oriole						1	14	0.25
Orange-footed Scrub Fowl		3 CT	1					0.07
Paperbark Flycatcher						1		0.02
Peaceful Dove						1	9 CT	0.16

Habitat	Status EPBC Act	Monsoon Forest	Mangroves/ Salt Pan	Mangroves/ Rocky Shores	Melaleuca Woodland	Sandstone Woodland/Shrubland	Open Forest/ Woodland	Incidence
Pheasant Coucal			1		CT	2	4	0.11
Pied Butcherbird						2	7	0.15
Rainbow Bee-eater			1				6	0.11
Rainbow Pitta		2 CT						0.03
Red-backed Fairy-wren						2	7	0.15
Red-capped Plover			2					0.03
Red-collared Lorieet		4		1		1	10	0.26
Red-headed Honeyeater		10	8	2				0.33
Red-tailed Black-cockatoo				1		2	10	0.21
Red-winged Parrot		3	1	2		1	8 CT	0.25
Rose-crowned Fruit-dove		2						0.03
Rufous Whistler		1				2	17	0.33
Rufous-banded Honeyeater			1				2	0.05
Shining Flycatcher		1	3					0.07
Silver Gull				1				0.02
Silver-crowned Friarbird		4	1		1	4	17	0.44
Southern Boobook						NOCT	NOCT	0.00
Spangled Drongo		2				1	7	0.16
Striated Pardalote					1		17	0.30
Sulphur-crested Cockatoo						1	1	0.03
Tawny Frogmouth							1 NOCT	0.02
Torresian Crow							1 CT	0.02
Varied Triller		2						0.03
Whimbrel	Migratory		3					0.05
Whistling Kite					1	1	1	0.05
White-bellied Cuckoo-shrike		1	1			2	6	0.16
White-bellied Sea-eagle						1		0.02
White-gaped Honeyeater		3		2			3	0.13
White-throated Honeyeater		3			1	1	9	0.23
Yellow White-eye		2	3					0.08
Total Species		34	27	18	7	30	47	

Table 4.4 Threatened and Migratory Species Detected in Marine and Tidal Habitats

Common Name	Scientific Name	Listed Migratory EPBC	Status		Record Location – Little Paradise		
			EPBC Act	TPWC Act	Eastern Tidal Flats/ Salt Pans	Rocky Shores/ Landing Area/Little Paradise	Deception Bay/Bartalumba Western Shore Line
Lesser Sand Plover	<i>Charadrius mongolus</i>	M	EN	VU	X		
Greater Sand Plover	<i>Charadrius leschenaultii</i>	M	VU	VU	X		
Eastern Curlew	<i>Numenius madagascariensis</i>	M	CE	VU	X		
Whimbrel	<i>Numenius phaeopus</i>	M		NT	X		X
Common Greenshank	<i>Tringa nebularia</i>	M	EN		X		
Common Sandpiper	<i>Actitis hypoleucos</i>	M				X	X
Caspian Tern	<i>Hydroprogne caspia</i>	M				X	
Greater Crested Tern	<i>Thalasseus bergii</i>	M				X	
Little Tern	<i>Sternula albifrons</i>	M				X	
Eastern Osprey	<i>Pandion haliaetus</i>	M			X		X
Total	10	10			6	4	3



Project Area

EPBC Act Threatened and Listed Migratory Shorebirds

- Eastern Curlew
CRITICALLY ENDANGERED
- ▲ Common Greenshank
ENDANGERED
- ▲ Lesser Sand Plover
ENDANGERED
- Greater Sand Plover
VULNERABLE
- ◇ Common Sandpiper
Listed Migratory
- ◇ Whimbrel
Listed Migratory

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Base mapping layers supplied by AUSLIG

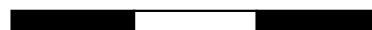
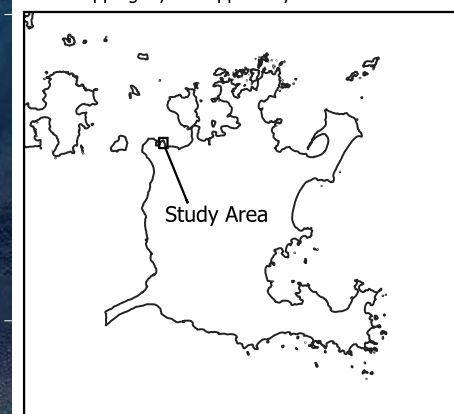


FIGURE 6 Little Paradise
Lease 1 and 2 + Marina Precinct
EPBC Threatened + Migratory
Shorebird Species 2021-2022

4.4 NORTHERN HOPPING-MOUSE SURVEY RESULTS

Aerial and ground transect searches for northern hopping-mouse failed to detect burrows with characteristics indicating the presence of this species in the Little Paradise Leases (EMS 2023). Nineteen spoils were detected in ground and aerial surveys but all were identified as having been constructed by the delicate mouse (least concern, EPBC Act/TPWC Act) based on known criteria (EMS 2023). There were also no detections of northern hopping-mouse in the extensive camera trapping conducted across the Little Paradise Leases in 2021-2022 (110 camera trap stations, 6,262 camera trap nights).

4.5 NORTHERN MASKED OWL CALL BROADCAST SURVEY RESULTS

Northern masked owls were detected on nine occasions during call broadcast sessions and nocturnal observations within the broader Little Paradise Lease areas in 2021-2022 (EMS 2023). There were several sightings or recordings of northern masked owls in the vicinity of Lease 1 and 2 (Figure 7). Sightings of northern masked owls were spread along the Bartalumba Road from close to the Rowell Highway to the area south of Little Paradise, indicating that the resident masked owls are foraging across most of these eastern Lease areas (Leases 1-7) (EMS 2023). Significantly, in September 2022 a masked owl fledgling was sighted begging for food from an adult at Lease 4, suggesting that masked owls nested in the local area. Dense monsoon forest on the margins of Lease 1 and 2 and the marina area could act as diurnal roost sites for northern masked owl, highlighting the ecological importance of this habitat.

The call broadcast response data indicates that it is likely that northern masked owl forage across most of the terrestrial habitats within the Little Paradise area. The entire Project Area would comprise components the home range areas of one or two pairs of northern masked owls (EMS 2023). Based on data from other masked owl races, it is likely that each northern masked owl (pair) home range is between 500 and 1000 hectares (EMS 2023).

4.6 NORTHERN MASKED OWL HABITAT TREES

Potential northern masked owl nest (habitat) trees were not identified within Lease 1 and 2 and the marina area. Suitable nesting trees were detected to the south of Lease 2, including in an area of large, old growth *Eucalyptus tetradonta* in the southern area of Lease 3 and Lease 4 (EMS 2023). This is the same area where a fledgling masked owl was sighted in September 2022. Several other high quality nest trees (n=3) were identified in Lease 7; however these trees were not clustered at one site (EMS 2023).



Project Area

Terrestrial Threatened Species EPBC Act

- ◆ Common Blue-tongue Skink
Critically Endangered
- Northern Quoll
Endangered
- Merten's Water Monitor
Endangered
- ▲ Northern Masked Owl
Vulnerable

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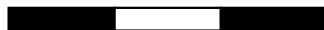
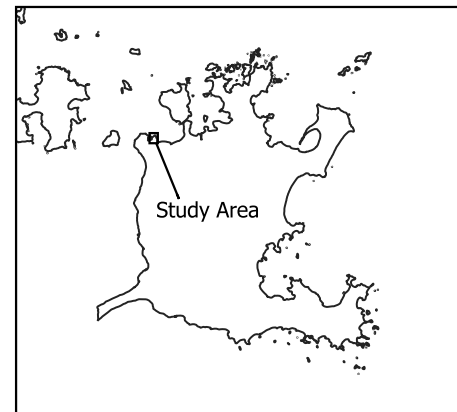


FIGURE 7 Little Paradise
Lease 1 and 2 + Marina Precinct
EPBC Act Threatened
Terrestrial Species 2021-2022

4.7 CAMERA TRAPPING RESULTS

Camera trapping across the three survey phases recorded approximately 740,000 images from 247,000 trigger events, with 5.6 % containing images of identifiable wildlife. Camera traps recorded 54 vertebrate species, including 16 mammal, 26 bird and 12 reptile species.

The northern quoll (endangered, EPBC Act) was widespread in the Little Paradise area, with images captured at most camera trap stations in a range of habitats, including sandstone escarpment shrubland, open eucalypt forest, *Melaleuca* swamp forest and closed monsoon forest (Figure 7). Northern quoll were detected in Lease 1 and 2 and at the proposed marina site (EMS 2023).

The northern blue-tongued skink (critically endangered, EPBC Act) was detected at two locations in sandstone woodland to the west of Lease 1 and 2 on camera traps.

Several threatened species that were targeted with camera traps during the surveys, including the brush-tailed rabbit-rat, northern hopping-mouse and northern brushtailed possum, were not detected (EMS 2023).

4.8 BAT SURVEY RESULTS

Fixed acoustic recorders recorded approximately 395,000 files at locations within the Little Paradise study area, with at least twelve species of bat identified from these acoustic recordings (EMS 2023). Species of conservation significance detected include the ghost bat (vulnerable, EPBC Act) and orange diamond-faced bat (near threatened, TPWC Act) (Specialised Zoological 2022). However, neither of these species were detected in Lease 1 and 2 or at the marina area (EMS 2023).

Other threatened species that potentially occur in the east Arnhem region, including the bare-rumped sheath-tailed bat (Vulnerable, EPBC Act) and northern leaf-nosed bat (near threatened, TPWC Act; vulnerable, IUCN Red List), were not detected in the acoustic data despite the application of specific analysis routines designed to identify these species (EMS 2023).

5.0 Discussion: Significant Fauna Species

5.1 EPBC LISTED THREATENED FAUNA SPECIES

Five EPBC Act listed threatened fauna species, the Mertens' water monitor (endangered, EPBC Act), northern blue-tongue skink (critically endangered, EPBC Act), ghost bat (vulnerable, EPBC Act), northern masked owl (vulnerable, EPBC Act) and northern quoll (endangered, EPBC Act), were recorded within terrestrial habitats within the Project Area and surrounding areas.

Several EPBC Act listed migratory and threatened bird species were associated with tidal and marine habitats to the Project Area.

5.1.1 Northern Masked Owl

Status: Vulnerable (EPBC Act)

Distribution: The northern masked owl occurs across Northern Australia from the Kimberley region to the Roper River area of the Northern Territory.

Groote Archipelago: Surveys have located northern masked owls at numerous sites across Groote Eylandt (DEPWS 2023; Barden, unpublished data).

Little Paradise: Northern masked owls were detected across Little Paradise peninsula using call broadcast and acoustic recording units (ARUs) (Figure 7). Based on estimated home range areas of northern masked owls on Groote Eylandt (Barden, unpublished data), it is expected that the Little Paradise area would support components of a home range for one and possibly two pairs of masked owls. A small component of the range area of one masked owl pair falls within the Lease 1 and Lease 2 Project Area. Acoustic recordings and observations indicate that there are northern masked owl roost and nest sites the Little Paradise peninsula, however none were identified within Lease 1 or Lease 2 or terrestrial components of the Marina Precinct (EMS 2023). Dense monsoon vine forest on the margins of Lease 1 and 2 and the terrestrial component of the Marina Precinct could act as daytime roost sites for this species.

Northern masked owls rely on large habitat trees supporting large hollows as roost and nest sites and patches of dense vegetation and possibly sandstone rock formations are also used for daytime roosting. Potential northern masked owl roost/nest trees were identified to the south of the Lease 1 and 2 Project Area, with a cluster of these trees present in Lease 3 and 4. An area of dense *Callitris intratropica* vegetation in Lease 5 was also identified as a masked owl roost site during the study.

5.1.2 Northern Quoll

Status: Endangered (EPBC Act)

Distribution: The northern quoll occurs in areas of the Pilbara, Kimberley, north-west Northern Territory, north-east Queensland and some islands in the Gulf of Carpentaria (Oakwood *et al.* 2016). However, it is now absent from large areas of its former range, particularly in the Northern Territory and Queensland where fire regimes and cane toads have impacted populations (Ujvari 2013; Oakwood 2008; Woinarski *et al.* 2008).

Groote Archipelago: The northern quoll is widespread on Groote Eylandt and is known from several smaller satellite islands.

Little Paradise: The northern quoll was found to be widespread in the Little Paradise area during the current survey and was detected at all camera trap grids and most camera trap stations (Figure 7). Tracks were also observed in mangrove habitats at the proposed Marina Precinct and individuals were observed crossing the access road during spotlight surveys.

5.1.3 Ghost Bat

Status: Vulnerable (EPBC Act)

Distribution: Ghost bats occur across the northern Australian monsoonal tropics from the Pilbara region of Western Australia to Rockhampton in Queensland.

Groote Archipelago: Ghost bats are widespread on Groote Eylandt and are known from several smaller satellite islands in the Groote archipelago.

Little Paradise: Ghost bats were detected at two localities in the Little Paradise area, and there is one known nocturnal visitation site known at one (cave site 1 in Lease 9). Ghost bat roosts have not been detected in the vicinity of Lease 1 and 2 or the Marina Precinct. Based on the known habitat preferences of this species and its distribution on Groote Eylandt, it is considered likely that ghost bats would forage across a variety of habitats in the Little Paradise area.

Table 5.1 Threatened Fauna Species: Little Paradise Study Area (EMS 2023)

Common Name	Scientific Name	Status EPBC	Status NT	Record Date	EMS 2023 Surveys	Maximum Count	Record Location/s	Broad Habitat	Little Paradise Status (EMS 2023 and Existing Data)
Northern Masked Owl	<i>Tyto novaehollandiae kimberli</i>	Vulnerable	Vulnerable	2021/2022	X	3	Lowland areas of the Little Paradise Leases, Telstra Hill	Open woodland and forest, <i>Callitris intratropica</i> thickets. Monsoon closed forests	Widespread in the Little Paradise low elevation Leases, occasional at Telstra Hill. One nesting area identified and several daytime roosts associated with <i>Callitris intratropica</i> thickets
Lesser Sand Plover	<i>Charadrius mongolus</i>	Endangered	Vulnerable	2021	X	12	Tidal flats east of study area	Marine mudflats, saltpans and tidal flats	Small numbers on tidal flats east of study area
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Vulnerable	Vulnerable	2021	X	6	Tidal flats east of study area	Marine mudflats, saltpans and tidal flats	Small numbers on tidal flats east of Project Area
Eastern Curlew	<i>Numenius madagascariensis</i>	Critically Endangered	Vulnerable	2021	X	6	Tidal flats east of study area	Marine mudflats, saltpans and tidal flats	Small numbers on salt pans east of study area
Common Greenshank	<i>Tringa nebularia</i>	Endangered	Endangered	2021	X	1	Tidal flats east of study area	Marine mudflats, saltpans and tidal flats	Small numbers on salt pans east of study area
Northern Quoll	<i>Dasyurus hallucatus</i>	Endangered	Critically Endangered	2021/2022	X	1	Widespread	Wide range of habitats	Widespread in the Little Paradise area, including lowland habitats and elevated escarpment
Ghost Bat	<i>Macroderma gigas</i>	Vulnerable	Not Listed	2021/2022	X	2	Lease 9 and sandstone areas south of Lease 8	Nocturnal, occasional roost in sandstone escarpment, forage in various habitats	Detected at a cave site at Lease 9, one other acoustic detection in sandstone near Telstra Hill
Mertens' Water Monitor	<i>Varanus mertensi</i>	Endangered	Vulnerable	2021	X	1	Old quarry pit north of Little Paradise Road, swamp forest at Deception Bay	Creeks and riparian forest, drains and artificial water bodies	Sighted at several locations outside the current development footprint in drainage areas and swamp forest habitat
Northern Blue-tongued Skink	<i>Tiliqua scincoides intermedia</i>	Critically Endangered		2022	X	1	Sandstone areas to the west of Lease 1 and 2	Open forest, woodland, swamp forest, sandstone woodland	Sighted at several locations and likely to occur in open forest and woodland habitats

5.1.4 Lesser Sand Plover

Status: Endangered (EPBC Act)

Distribution: Breeds in Siberia and summers in the southern hemisphere. Widespread in Australian coastal regions during the Austral summer, on the northern and eastern coastlines.

Groote Archipelago: Scattered records on the coast of Groote Eylandt.

Little Paradise: Small numbers on coastal tidal saline flats to the east of the Project Area (Figure 6). Maximum count of twelve individuals. Not recorded within the Project Area footprint or at the Marina Precinct. This species may be impacted by changed feeding conditions in saline areas from aquaculture discharge.

5.1.5 Greater Sand Plover

Status: Vulnerable (EPBC Act)

Distribution: Breeds in central Asia and summers in the southern hemisphere. Widespread in Australian coastal regions during the Austral summer, with greatest numbers in the north and north-west.

Groote Archipelago: Records from coastal areas of Groote Eylandt.

Little Paradise: Small numbers on coastal tidal flats east of the Project Area (Figure 6). A maximum count of six individuals. Not recorded within the Project Area footprint or at the Marina Precinct. This species may be impacted by changed feeding conditions in saline areas from aquaculture discharge.

5.1.6 Eastern Curlew

Status: Critically Endangered (EPBC Act)

Distribution: Breeds in Siberia and northern China and summers in the southern hemisphere. Widespread in Australian coastal regions during the Austral (southern hemisphere) summer.

Groote Archipelago: Limited number of records from coastal areas of Groote Eylandt.

Little Paradise: Regularly observed on saline flats to the east of the Project Area during the southern hemisphere summer (wet season), with up to six individuals present (Figure 6). There is no preferred habitat for this species within the current disturbance footprint, including the Marina Precinct. This species may be impacted by changed feeding conditions in saline areas from aquaculture discharge.

5.1.7 Common Greenshank

Status: Endangered (EPBC Act)

Distribution: Breeds in Siberia and northern China and summers in the southern hemisphere. Widespread in Australian coastal regions during the Austral (southern hemisphere) summer.

Groote Archipelago: Limited number of records from coastal areas of Groote Eylandt.

Little Paradise: Observed on saline flats to the east of the Project Area during the southern hemisphere summer (wet season), with a maximum count of one bird (Figure 6). There is no preferred habitat for this species within the current disturbance footprint, including the proposed Marina Precinct. This species may be impacted by changed feeding conditions in saline areas from aquaculture discharge.

5.1.8 Mertens' Water Monitor

Status: Endangered (EPBC Act)

Distribution: The Mertens' water monitor is a semi-aquatic species which occurs across the monsoonal tropical regions of northern Australia (Ward *et al.* 2012b). The primary threatening process for this species is lethal toxicity following consumption of cane toads. The species has suffered documented declines in areas where toads have invaded (Ward *et al.* 2012b).

Groote Archipelago: Widespread on Groote Eylandt and some offshore islands in suitable riparian and wetland habitat (DEPWS 2021).

Little Paradise: Several observational records in the Little Paradise Project Area from 2021-2022 surveys (Figure 7). All records are associated with ephemeral drainage lines, flooded swamp forest and an historical water filled quarry pit. Suitable habitat is limited, as significant permanent creeks are absent. The species is sometimes present in minor seasonally inundated drainage lines and *Melaleuca* swamps. There are no locations within the current proposed development footprint and development areas exclude the low-lying swamps and drainage lines that are the key habitats for this species.

5.1.9 Northern Blue-tongued Skink

Status: Critically Endangered (EPBC Act)

Distribution: The northern blue-tongued skink is a comparatively large terrestrial skink species which occurs across the monsoonal tropical regions of northern Australia in a broad range of habitats. The primary threatening process for this species is lethal toxicity following consumption of cane toads. The species has suffered a marked decline in areas where toads have invaded (Ward *et al.* 2012b).

Groote Archipelago: Widespread on Groote Eylandt and some offshore islands in a range of habitat types, including open woodland and forest, wetlands and Melaleuca swamps, sandstone and coastal dune systems.

Little Paradise: Several camera trap records in the Little Paradise Project Area from 2021-2022 surveys (Figure 7). All records are associated with sandstone woodland to the west of Lease 1 and 2. These habitats may provide shelter from predators and fire. Suitable open forest and woodland habitat for this species also occurs within Lease 1 and 2.

5.2 OTHER MIGRATORY SPECIES

Migratory species recorded within the Project Area (EPBC Act, migratory bird treaties) based on DOE (2015c) are listed in Table 5.2 and sighting locations are included in Figure 6. Migratory species occurring within or adjacent to the Little Paradise area were reviewed with reference to the Referral guideline for 14 birds listed as migratory species under the EPBC Act (DOE 2015a), the Wildlife Conservation Plan for Migratory Shorebirds (DOE 2015b) and Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DOE 2015c).

5.2.1 Migratory Shorebird and Marine Species

Six listed migratory shorebirds and four other listed marine migratory species were recorded in coastal habitats in the Little Paradise area during January 2021, and several other migratory species are listed for the Deception Bay area in existing databases (EMS 2023). Migratory shorebird species were present in small numbers in coastal areas of the Little Paradise peninsula and Deception Bay in January 2021, with the main occupied areas located in tidal salt pan and mangrove habitats to the east of the study area (EMS 2023). The numbers of listed migratory birds observed during surveys was low, with a maximum count of approximately 30 migratory shorebirds on salt pans (EMS 2023). Small numbers of terns (<30) and several common sandpipers (*Actitis hypoleucos*) were observed roosting on the rocky shoreline near

the Marina Precinct (EMS 2023). The numbers present do not trigger significance criteria under the EPBC Act (DOE 2015b; 2015c).

5.2.2 Eastern Osprey

The eastern osprey was recorded in mangrove areas to the east of the study area (EMS 2023). There are no osprey nest sites within the Project footprint. The lower threshold for a significant impact to the eastern osprey, as defined by the DOE (2015b), is potential disturbance to 84 km of coastline or a potential loss of 24 individuals. Consequently, the current proposal does not constitute a significant impact on osprey populations under the guidelines for this species (DOE 2015b). There are likely to be only one or two pairs in local area, and development of the proposed landing facility will require disturbance of no more than 30-50 metres of coastal foreshore habitat.

Table 5.2 Listed Migratory Birds: Little Paradise Project Area and Surrounds (EMS 2023)

Highlighted rows = migratory shorebirds as defined in DOE 2015c

Common Name	Scientific Name	Status EPBC Act	EMS 2023	Landing Site	Maximum Count	Broad Habitat	Local Status (EMS 2023)
Arafura Fantail	<i>Rhipidura</i>	Migratory	Yes	No	1	Monsoon closed forest	Occasional in closed monsoon forest, mangroves
Lesser Sand Plover	<i>Charadrius mongolus</i>	Endangered/ Migratory	Yes	No	12	Tidal flats, mud flats, salt pans	Small numbers, tidal flats, salt pans
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Vulnerable/ Migratory	Yes	No	6	Tidal flats, mud flats, salt pans	Small numbers, tidal flats, salt pans
Eastern Curlew	<i>Numenius madagascariensis</i>	Critically Endangered/ Migratory	Yes	No	6	Tidal flats, mud flats, salt pans	Small numbers, tidal flats, salt pans
Whimbrel	<i>Numenius phaeopus</i>	Migratory	Yes	No	2	Tidal flats, mud flats, salt pans	Small numbers, tidal flats, salt pans
Common Greenshank	<i>Tringa nebularia</i>	Endangered/ Migratory	Yes	No	1	Tidal flats, mud flats, salt pans	Small numbers on tidal flats
Common Sandpiper	<i>Actitis hypoleucos</i>	Migratory	Yes	Yes	2	Rocky shores, mangroves, tidal flats	Small numbers, rocky shores and mangroves
Caspian Tern	<i>Hydroprogne caspia</i>	Migratory	Yes	Yes	2	Marine and coastal habitats, rocky shores	Small numbers, rocky shores
Greater Crested Tern	<i>Thalasseus bergii</i>	Migratory	Yes	Yes	25	Marine and coastal habitats, rocky shores	Small numbers, rocky shores
Little Tern	<i>Sternula albifrons</i>	Migratory	Yes	Yes	4	Marine and coastal habitats, rocky shores	Small numbers, rocky shores
Eastern Osprey	<i>Pandion haliaetus</i>	Migratory	Yes	Yes	2	Coastal marine, rocky shores	Uncommon on coastal fringe

6.0 MNES and Significant Impact Guidelines – EPBC Act Listed Species

Under the EPBC Act an action will require approval from the Commonwealth Minister if the action has, will have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES). A search of the Commonwealth Protected Matters Search Tool (PMST) (including a 5 km buffer) was undertaken for the Project in April 2024 (Appendix 1). A summary of the results of the PMST are provided in Table 6.1 and the PMST results are provided in Appendix 1. The MNES relevant to the Project include listed threatened species and listed migratory species. An assessment of the likelihood of these threatened and migratory species to occur on site was undertaken. This assessment omits marine species identified in the EPBC protected matters report.

Table 6.1 Matters of National Environmental Significance (5 km Buffer)

Matters of National Environmental Significance	Relevant	Description
World Heritage Properties	No	There are no world heritage properties near the Project Area. The closest national heritage place is Kakadu, approximately 370 km west of the Project Area.
National Heritage Properties	No	There are no national heritage places near the Project Area. The closest national heritage place is Kakadu, approximately 370 km west of the Project Area.
Wetlands of international importance/Ramsar wetlands	No	There are no wetlands of international importance / Ramsar wetlands near the Project Area. The closest Ramsar wetland is Kakadu, approximately 370 km west of the Project Area.
Great Barrier Reef Marine Park	No	The Project Area is not within the Great Barrier Reef Marine Park. The Project Area is located approximately 760 km west of the closest point of the Great Barrier Marine Park (north-eastern coast of Cape York).
Commonwealth Marine Area	No	The Project is not located within a Commonwealth marine area. The Commonwealth marine area is approximately 50 km east at the closest point.
Nationally Threatened Ecological Communities	No	Threatened ecological communities have not been identified in the Project Area and none are considered likely to occur.
Nationally Threatened Species	Yes	The protected matters report identified threatened species as potentially occurring within 5 km of the Project Area (refer to Table 6.2). The ecological survey and review of existing data determined 9 terrestrial threatened fauna species are known to occur or possibly occur within the Project Area. 5 marine turtle species potential occur in marine environments adjacent to the Project Area. EPBC listed threatened flora or threatened ecological communities were not identified on the Project Area.
Migratory Species	Yes	The Project Area is not listed on the Ramsar Convention, in which Australia has entered into international agreements to protect the breeding and summer grounds of migratory birds. A desktop study showed there were 19 migratory species with the potential to occur within 5 km of the Project Area (refer to Appendix 1). Survey and review of existing data determined that are 11 listed migratory species known to occur or possibly occurring within or adjacent to the Project Area.
Nuclear Actions (including Uranium Mining)	No	Note applicable
A water resource, in relation to coal seam gas development and large coal mining development	No	Note applicable

For each MNES identified as being relevant to the Project in Table 6.1, the corresponding section provides a table of assessment for species that have been identified within the Project footprint against the significant impact criteria for that matter based on the Significant Impact Guidelines 1.1 (Table 6.3).

6.1 NATIONALLY THREATENED SPECIES (INCLUDING MIGRATORY SPECIES)

Table 6.2 provides a list of threatened species (including migratory species) identified in the MNES Search and the likelihood of occurrence.

Table 6.2 Threatened Species Observed in or Surrounding Project Area

CE = Critically endangered; EN = Endangered; M = Migratory Species; VU = Vulnerable.

Common Name	Scientific Name	EPBC Status	Potential Occurrence			Species Summary
			Confirmed	High	Low	
Birds						
Red Knot, Knot	<i>Calidris canutus</i>	M, EN			✓	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the Project.
Curlew Sandpiper	<i>Calidris ferruginea</i>	M, EN			✓	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the Project.
Red Goshawk	<i>Erythrotriorchis radiatus</i>	VU			✓	No previous records on Groote Eylandt. Species not detected in extensive avian surveys in the Project Area.
Gouldian Finch	<i>Erythrura gouldiae</i>	EN			✓	Only one historical record on Groote dating to the early 1900s. Not detected in extensive avian surveys in the Project Area.
Bar-tailed Godwit (baueri)	<i>Limosa lapponica baueri</i>	VU			✓	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the Project.
Northern Siberian Bar-tailed Godwit	<i>Limosa lapponica menzbieri</i>	CE			✓	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the Project.
Sharp-tailed Sandpiper		CE			✓	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the Project.
Eastern Curlew	<i>Numenius madagascariensis</i>	M, CE	✓			Small numbers on saline tidal flats to the east of the Project, preferred habitat is not present in the Project footprint. Numbers do not trigger MNES significance levels (DOE 2015c)
Common Greenshank	<i>Tringa nebularia</i>	M, EN	✓			Small numbers on saline tidal flats to the east of the Project, preferred habitat is not present in the Project footprint. Numbers do not trigger MNES significance levels (DOE 2015c)
Lesser Sand Plover	<i>Charadrius mongolus</i>	M, EN	✓			Small numbers on saline tidal flats to the east of the Project, preferred habitat is not present in the Project footprint. Numbers do not trigger MNES significance levels (DOE 2015c)
Greater Sand Plover	<i>Charadrius leschenaultii</i>	M, VU	✓			Small numbers on saline tidal flats to the east of the Project, preferred habitat is not present in the Project footprint. Numbers do not trigger MNES significance levels (DOE 2015c)
Australian Painted Snipe	<i>Rostratula australis</i>	EN			✓	No previous records on Groote Eylandt, preferred habitat is not present in the Project footprint

Common Name	Scientific Name	EPBC Status	Potential Occurrence			Species Summary
			Confirmed	High	Low	
Northern Masked Owl	<i>Tyto novaehollandiae kimberli</i>	VU	✓			Northern masked owls forage across most of the lowland areas of the study area, with fewer records in elevated sandstone. Probably 1 or 2 pair ranges across the main Project Area, with one nesting area and one roost area identified and avoided during design (250 m buffer)
Mammals						
Brush-tailed Rabbit-rat	<i>Conilurus penicillatus</i>	VU			✓	Extensive camera trapping in the Project Area has not detected this species. The nearest records are 12 km to the east (based on data from Anindilyakwa Land and Sea Rangers monitoring 2022).
Northern Quoll	<i>Dasyurus hallucatus</i>	EN	✓			Common across the study area. Based on Heiniger et al. 2021, the Project clearance footprint, 10.21ha would impact home range areas approximating 7 northern quolls (based on a density estimate of 0.33 quolls/ha)
Ghost Bat	<i>Macroderma gigas</i>	VU	✓			Not detected in the Lease 1 and 2 project footprint, but detected in the surrounding area (EMS 2023)
Northern Hopping-mouse	<i>Notomys aequus</i>	VU			✓	No historical records close to the Project footprint, not detected in detailed targeted surveys in the Project footprint
Bare-rumped Sheath-tailed Bat	<i>Saccolaimus saccolaimus nudiclunatus</i>	VU			✓	No previous records on Groote Eylandt, not detected in habitat tree assessments or acoustic recording with targeted analysis routines to detect this species (EMS 2023)
Water Mouse	<i>Xeromys myoides</i>	VU			✓	No previous records on Groote Eylandt, preferred habitat (mangroves and adjacent wetland habitat) is not present in the Project footprint
Reptiles						
Plains Death Adder	<i>Acanthophis hawkei</i>	VU			✓	No previous records on Groote Eylandt, preferred habitat is not present in the Project footprint
Merten's Water Monitor	<i>Varanus mertensi</i>	EN		✓		Potentially occurs in flooded areas and drainage lines in the wet season in the Area surrounding Lease 1 and 2. Project impacts are expected to be low.
Northern Blue-tongued Skink	<i>Tiliqua scincoides intermedia</i>	CE	✓			Recorded in the area adjacent to the Lease 1 and 2 area. Potential habitat for this species is present in Lease 1 and 2.
Loggerhead Turtle	<i>Caretta caretta</i>	M, EN			✓	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the Project footprint. May occur in offshore marine habitats.
Green Turtle	<i>Chelonia mydas</i>	M, VU			✓	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the Project footprint. May occur in offshore marine habitats.
Leatherback Turtle	<i>Dermochelys coriacea</i>	M, EN			✓	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the Project footprint. May occur in offshore marine habitats.
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	M, VU			✓	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the Project footprint. May occur in offshore marine habitats.
Olive Ridley Turtle	<i>Lepidochelys olivacea</i>	M, EN			✓	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the Project footprint. May occur in offshore marine habitats.
Flatback Turtle	<i>Natator depressus</i>	M, VU			✓	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the Project footprint. May occur in offshore marine habitats.

The field survey program completed in 2021 and 2022 established the baseline environmental conditions and species occurrence in the Project Area (EMS 2023). Several EPBC Act threatened fauna species occur in habitats within the Project Area and adjacent coastal areas. The main terrestrial species recorded in the local area include northern masked owl, northern quoll, Merten's water monitor, northern blue-tongue skink and ghost bat. Low numbers of listed threatened (critically endangered, endangered and vulnerable) and migratory shorebirds were detected on the south-western side of Bartalumba Bay, in the intertidal zone adjacent to the Project (south of the Marina Precinct and east of Lease 1 and 2). Important habitats for these shorebird species as determined by DOE (2015c) were not present within or immediately adjacent the Project Area. The following assesses each of the detected species against the relevant Significant Impact Guidelines 1.1 criteria.

6.2 DETECTED THREATENED SPECIES

Based on the field surveys there are three threatened species that are considered highly relevant to the Project, including the northern masked owl, northern quoll and northern blue-tongued skink. The presence of migratory shorebirds listed as critically endangered, endangered and vulnerable under the EPBC Act in areas adjacent to the project area presents MNES issues related to the proposed discharge from the aquaculture facility. Table 6.3 provides an assessment of the Project against the significant impact criteria for the three EPBC threatened fauna species known to occur within the Project Area, in accordance with the Significant Impact Guidelines 1.1 (DOE 2013).

Table 6.3 Assessment Against Significant Impact Criteria: Threatened Species

Common Name	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink	Threatened and Migratory Shorebirds
Scientific Name	<i>Tyto novaehollandiae kimberli</i>	<i>Dasyurus hallucatus</i>	<i>Tiliqua scincoides intermedia</i>	Various Species
EPBC Status	Vulnerable	Endangered	Critically Endangered	Critically Endangered/ Endangered/Vulnerable/ Migratory
Significance of individuals detected	1 to 2 pairs with territories overlapping the Project Area. 1 pair with an identified nest site and daytime roost sites identified to the south of the Lease 1 and 2 Project Area	Northern quolls were detected across the Project footprint. Estimated 7 range areas fall within the Project clearance footprint.	Several camera trap detections in the area west of Lease 1 and 2. Not detected in Lease 1 and 2 but may occur there in low numbers.	Low numbers detected on tidal salt pans and mangroves to the east of Lease 1 and 2, several species sighted on rocky shores at the terrestrial margin of the Marina Precinct.
Lead to a long-term decrease in the size of a population for endangered species or important population for vulnerable species	The project will require clearing of a small area of one northern masked owl foraging/range territory (2 – 4 %). Observations on Groote Eylandt indicate that masked owls continue to hunt on the margins of cleared roads, facilities and urban areas. The absence of potential nesting sites indicates that the Project will prevent a local decline of the masked owl population. The protection of significant monsoon forest in the design phase of the project will minimise impacts on potential daytime roost sites.	The proposed clearance will reduce the local carrying capacity by an estimated 7 northern quoll range areas. The Project will result in a small decrease in the local northern quoll population. There is a risk of increased roadkill due to traffic movements, particularly at night. However, in the context of the Groote Eylandt northern quoll population, the numbers are relatively small.	The current knowledge of this species in the northern Little Paradise area indicates that they are associated with sandstone areas that will not be disturbed for the project.	The small numbers of individuals detected adjacent to the project area indicate that any potential project related impacts will not lead to a significant population decline.

Common Name	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink	Threatened and Migratory Shorebirds
Scientific Name	<i>Tyto novaehollandiae kimberli</i>	<i>Dasyurus hallucatus</i>	<i>Tiliqua scincoides intermedia</i>	Various Species
EPBC Status	Vulnerable	Endangered	Critically Endangered	Critically Endangered/ Endangered/Vulnerable/ Migratory
Reduce the area of occupancy of the species for endangered or important population for vulnerable	The project will require of somewhere between 2 and 4 % of one northern masked owl foraging territory. The Project will protect roost and nest sites in the design and clear a limited area of foraging habitat. The area of occupancy (AOO) will not be reduced by the project.	The Project will reduce the local northern quoll population by an estimated 7 range areas. However, the removal of habitat will not reduce the area of occupancy (AOO) for northern quolls.	Based on current knowledge of the local distribution of this species, the project will not reduce the area of occupancy of this species.	Based on current knowledge of the local distribution of these species, the project will not significantly reduce the area of occupancy of these species. If there are changes in habitat as a result of aquaculture discharges into salt pan and mudflat habitat to the east of the project area, small areas of habitat may become less suitable as foraging sites.
Fragment an existing population into two or more populations.	The Project requires the clearance of separate components of the existing northern masked owl range area. These areas will be surrounded by intact vegetation. The design will not fragment local masked owl populations.	The Project requires the clearance of separate components and the construction of several new access roads and easements. However, the design will not fragment local northern quoll populations.	The design will not fragment local northern blue-tongue skink populations.	The design will not fragment local migratory shorebird populations.

Common Name		Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink	Threatened and Migratory Shorebirds
Scientific Name		<i>Tyto novaehollandiae kimberli</i>	<i>Dasyurus hallucatus</i>	<i>Tiliqua scincoides intermedia</i>	Various Species
EPBC Status		Vulnerable	Endangered	Critically Endangered	Critically Endangered/ Endangered/Vulnerable/ Migratory
Adversely affect habitat critical to the survival of a species.	For activities such as foraging, breeding, roosting, or dispersal	Key northern masked owl nest and roost sites have been identified and protected during the assessment of the broader Little Paradise Development Precinct. It is expected that the local masked owl pair will continue to forage and nest in the local area as the Project progresses.	Critical habitat for northern quolls has not been identified within the Project clearance footprint. The loss of a limited number of northern quoll range areas is unlikely to impact the long-term maintenance of the species on Groote Eylandt.	There are no identified critical habitats for northern blue-tongue skinks within the study area/project footprint. The current Project does not pose a risk to the long-term survival and genetic diversity of the local northern blue-tongued skink population.	There are no identified critical habitats for migratory shorebirds within the study area/project footprint or adjacent areas. The current Project does not pose a risk to the long-term survival and genetic diversity of the local migratory shorebird populations.
	For the long-term maintenance of the species (including the maintenance of species essential to the survival of the species)	The current Project does not pose a risk to the long-term survival and genetic diversity of the local northern masked owl population.			
	To maintain genetic diversity and long-term evolutionary development	Nesting locations to the south of the Project Area have been identified and protected (250 m exclusion area).			
	For the reintroduction of populations or recovery of the species or ecological community				

Common Name	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink	Threatened and Migratory Shorebirds
Scientific Name	<i>Tyto novaehollandiae kimberli</i>	<i>Dasyurus hallucatus</i>	<i>Tiliqua scincoides intermedia</i>	Various Species
EPBC Status	Vulnerable	Endangered	Critically Endangered	Critically Endangered/ Endangered/Vulnerable/ Migratory
Disrupt the breeding cycle of a population.	Nesting locations to the south of the Project Area have been identified and protected (250 m exclusion area).	It is unlikely that the Project will significantly interrupt local northern quoll breeding.	It is unlikely that the Project will significantly interrupt northern blue-tongued skink breeding.	Migratory shorebirds breed in the northern hemisphere.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	The project will require clearing of somewhere between 2 and 4 % of one northern masked owl foraging/range territory. This is unlikely to cause a decline of the local northern masked owl population.	The Project requires the clearance of separate small components of up to 10.21ha (~7 northern quoll range areas). The Project will result in a small decline in the local northern quoll population commensurate with the area cleared.	The project will require clearing of approximately 10.21 ha of northern blue-tongued skink habitat. This is unlikely to cause a decline of the local northern blue-tongued skink population.	The project will not remove or physically disturb feeding sites for migratory shorebirds. There is a potential for the project to alter the quality of foraging areas due to discharge from the proposed aquaculture facility. The small area of habitat and the small number of birds indicates that any changes will not lead to significant declines of any one species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	There are currently no invasive species that are harmful to masked owl in the Project Area, other than feral cats. Feral cats may occasionally predate northern masked owls while they are feeding on the ground. The project has a dedicated quarantine plan to prevent introduction of additional invasive species.	Feral cats may occasionally predate northern quolls. The project has a dedicated quarantine plan to prevent introduction of additional invasive species. This plan specifically covers cane toads, major risk factor for northern quolls in the Groote Archipelago.	There are currently no invasive species that are harmful to northern blue-tongued skink in the Project Area. The project has a dedicated quarantine plan to prevent introduction of additional invasive species.	There are currently no invasive species that are harmful to migratory shorebirds in the Project Area, other than feral cats. Feral cats may occasionally predate migratory shorebirds. The project has a dedicated quarantine plan to prevent introduction of additional invasive species.

Common Name	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink	Threatened and Migratory Shorebirds
Scientific Name	<i>Tyto novaehollandiae kimberli</i>	<i>Dasyurus hallucatus</i>	<i>Tiliqua scincoides intermedia</i>	Various Species
EPBC Status	Vulnerable	Endangered	Critically Endangered	Critically Endangered/ Endangered/Vulnerable/ Migratory
Introduce disease that may cause the species to decline.	The project is unlikely to introduce disease that might cause the species to decline. The quarantine protocols for the project are designed to minimise associated risks.	The project is unlikely to introduce disease that might cause the species to decline. The quarantine protocols for the project are designed to minimise associated risks.	The project is unlikely to introduce disease that might cause the species to decline. The quarantine protocols for the project are designed to minimise associated risks.	The project is unlikely to introduce disease that might cause the species to decline. The quarantine protocols for the project are designed to minimise associated risks.
Interfere with the recovery of the species	The project will occur within the range areas of 1 or 2 northern masked owl pairs. The surrounding area is within the Anindilyakwa Indigenous Protected Area, which is managed for the protection of biological resources and threatened species. The small amount of proposed clearing suggests that the Project will not interfere with the recovery of the species.	There are no overarching threats for northern quolls on Groote Eylandt other than the risk of introduction of cane toads to the islands and fire management. The project will not significantly interfere with the overall recovery of the northern quoll on Groote Eylandt.	There are no overarching threats for northern blue-tongued skink on Groote Eylandt other than the risk of introduction of cane toads to the islands and fire management. The project will not significantly interfere with the overall recovery of the northern blue-tongued skink on Groote Eylandt.	There are no overarching threats to migratory shorebirds that will prevent the recovery of the various species. The project will not significantly interfere with the overall recovery of shorebirds on Groote Eylandt.
Assessment of potential for significant residual impacts	The management of quarantine risks, minimal clearance area, protection of roost and nest sites, other measures to identify and manage habitat trees. There are minimal expected residual risks associated with the Project.	There are no residual risks other than those identified in this report. Management of cane toads and quarantine is priority for northern quoll management in the Groote Archipelago.	There are no residual risks other than those identified in this report. Management of cane toads and quarantine is priority for northern blue-tongued skink management in the Groote Archipelago.	There are no residual risks other than those identified in this report. Management of outflows from the aquaculture require assessment and management to minimise risks to migratory shorebirds adjacent to the project area.

6.3 MIGRATORY SPECIES

Under the EPBC Act, 'important habitat' is identified in EPBC Act Policy Statement 1.1 Significant Impact Guidelines—Matters of National Environmental Significance (DOE 2013). Important habitats in Australia for migratory shorebirds under the EPBC Act include those recognised as nationally or internationally important (DOE 2015c). Under the guidelines, habitat should be considered internationally important if it regularly supports:

- 1 percent of the individuals in a population of one species or subspecies of waterbird OR
- a total abundance of at least 20,000 waterbirds.

Nationally important habitat for migratory shorebirds can be defined using a similar approach to these international criteria, i.e., if it regularly supports:

- 0.1 per cent of the flyway population of a single species of migratory shorebird OR
- 2000 migratory shorebirds OR
- 15 migratory shorebird species.

Based on surveys conducted in the Little Paradise area in January 2021, the marine and tidal habitats surrounding the peninsula do not qualify as internationally or nationally significant for migratory shorebirds (EMS 2023). Migratory shorebirds were present at small numbers and none exceed thresholds for 1 % or 0.1 % of the flyway population. The number of migratory shorebird species as defined in DOE (2015c) (6 detected in this study plus two local records from existing data) and the total maximum count (~30 individuals) is below the MNES thresholds for species richness (15 species) and numbers (2000) at a location (DOE 2015c). However, note that this assessment only considers the status of these species as Listed Migratory EPBC ACT and additional MNES consideration is required in terms of migratory shorebirds listed as Critically Endangered, Endangered and Vulnerable under the EPBC Act.

There are no saline or tidal wetland habitats suitable for marine and shorebird migrants within the area proposed for infrastructure development at Little Paradise. A small area of rocky shoreline habitat may be disturbed for the refurbishment of the proposed landing site at the Marina Precinct. However, there is an existing rock groin and cleared area at this location and it is unlikely that upgrading this facility would prevent small numbers of shorebirds and terns from continuing to roost at on rocks at the location. The proposed Marina Precinct does not appear to support important shorebird feeding habitat and very few migratory birds were observed on the coastal fringe at this location, except for small numbers of common sandpiper. The proposed landing site appears to be less suitable as foraging habitat for shorebirds than areas to the south-east, where extensive tidal mudflats and salt pans occur adjacent to mangroves.

There is an area to the east of Lease 1 and 2 that is regularly used as a feeding area by listed migratory shorebirds, including species listed as Critically Endangered, Endangered and Vulnerable under the EPBC Act (EMS 2023). This area may be impacted by discharge from the proposed aquaculture facility at Lease 1 and 2. This will require further assessment and management intervention to prevent changes in the saline habitats at these sites that might impact shorebird feeding habitat.

7.0 Terrestrial Ecology: Impacts and Recommendations

7.1 GENERAL PROJECT IMPACTS AND RECOMMENDATIONS

7.1.1 Terrestrial Vegetation Clearing

The project will require clearing of approximately 20 hectares of vegetation for the construction of facilities and roads, not including areas of previously cleared land and non-terrestrial habitat. There are minor areas of significant habitats in the proposed clearing footprint area, including small areas of closed monsoon forest and mangrove habitat at the Marina Precinct (Figure 3; Figure 8).

Threatened plants have not been detected in the study area. Three listed threatened fauna species, the northern masked owl, northern quoll and northern blue-tongued skink, have been detected within or close to the terrestrial Project Area clearing footprint. Northern quolls may be vulnerable to destruction of den locations in open forest habitats, including loss of or disturbance of hollow logs, dead standing trees and termite mounds. Northern quolls may be vulnerable to increased traffic movements and new access roads (roadkill). Northern masked owls rely on large habitat trees with large hollows as roost and nest locations and use dense riparian, *Callitris intratropica* and monsoon forests as daytime roosting sites.

Recommendations

- Design of facilities and access at the Marina Precinct area should minimise and avoid clearing or disturbance to monsoon vine forest (VMU2) and mangrove closed forest (VMU1). These vegetation types should be avoided due to cultural and ecological significance. Monsoon vine forests could act as sites for daytime roosts for northern masked owls.
- No-go areas should be established and enforced to prevent over-clearing, to minimise the area of disturbance, minimise impacts on culturally and ecologically important habitat and minimise areas required to be rehabilitated.
- The use of spotter-catchers is recommended during clearing of terrestrial habitats to minimise impacts and mortality on quolls and northern blue-tongued skinks.

7.1.2 Proposed Marina Precinct

The proposed Marina Precinct will require disturbance of a small area of intertidal habitat and will occur near culturally and ecological significant mangrove and monsoon vine forest habitats.

Recommendations

- There are minor areas of closed monsoon forest within the development footprint at this location and mangroves occur adjacent to the site. Design and clearing controls should be applied to minimise impacts on these significant habitats.
- Minimise the extent of disturbance during construction of the landing facility.
- Employ sediment and other controls during construction and ensure that areas are stable and sedimentation and erosion is minimised.

7.1.3 Weeds

Several weed species occur in the Little Paradise area. There is a potential for works in the area to increase the local distribution of weeds or introduce additional species.

Recommendations:

- Clean all equipment prior to entering the site, including removal of soil, weed seeds or other potential sources of pathogens or biological material.
- Implement measures designed to minimise spread of weeds during construction activities.

7.1.4 EPBC Listed Threatened Fauna Species

Several EPBC Act threatened fauna species occur in habitats within the Project Area and adjacent coastal areas. The main species include migratory shorebirds (discussed in Section 7.1.5), northern masked owl, northern blue-tongued skink and the northern quoll.

The northern masked owl is vulnerable to disturbance of nesting sites (large habitat trees with large hollows). This species uses a broad range of vegetation classes as foraging habitat (particularly tall open woodland and forest habitats). The northern masked owl may also roost during the day within dense vegetation along drainage lines and monsoon vine forests. Minimising disturbance in these habitats will also reduce potential impacts on this species.

The northern quoll was detected at a broad range of locations within the study area. Based on an estimated density of 0.33 northern quolls per hectare on Groote Eylandt (Heiniger et al. 2021), an estimated 7 individuals would be

lost under the current proposed clearing footprint. Careful removal or avoidance of hollow logs, standing dead trees and large old growth trees with hollows is recommended. Retention of hollow logs and woody debris piles on the margin of the site might benefit this species by providing denning sites. Controls on vehicle movements, warning signs and traffic calming may be required to minimise roadkill, particularly where new access roads are constructed through intact habitat.

The main impact on the northern blue-tongued skink is likely to relate to loss of open woodland habitat and mortality during clearing. Spotter catchers are recommended during clearing to minimise mortality.

Recommendations

- Where possible, avoid removal or disturbance of hollow logs, standing dead trees and large hollow bearing habitat trees, as these provide potential denning sites for wildlife, including northern quolls and masked owls.
- Avoid clearing in dense vegetation along drainage lines, wetland areas, outer margins of sandstone habitats and monsoon forests (established buffer zones).
- Retain wildlife corridors to allow wildlife to move between development areas.
- Retain hollow logs and woody debris piles to provide den sites for northern quolls following clearing.
- Monitor access roads, introduce controls to minimise roadkill of northern quolls.
- Employ spotter catchers to minimise clearing impacts on critically endangered and endangered (EPC Act) fauna species.

7.1.5 EPBC Listed Threatened Shorebirds and Other Listed Migratory Species

Migratory species detected at Little Paradise are in marine coastal, mangrove and saltpan habitats that fall outside the proposed clearance footprint. Small numbers of the shorebird species listed as both threatened and migratory under the EPBC Act and other migratory species listed in the EPBC are associated with tidal salt pans to the east of the Project Area.

Listed (critically endangered, endangered and vulnerable) shorebirds were detected to the east of the Little Paradise Project Area in small numbers, but habitats for these species are not present within the areas of the Project Area where clearing is proposed. The small area of proposed disturbance at the proposed Marina Precinct was not identified as important shorebird habitat during the surveys. None of these sites trigger international or national significance criteria for shorebirds and migratory species under the EPBC Act. However, there potentially

project related MNES issues related to the presence of critically endangered, endangered and vulnerable EPBC Act species habitat in the propose aquaculture discharge area.

The areas of foraging habitat for critically endangered, endangered and vulnerable (EPBC Act) species to the east of Lease 1 and 2 may be impacted by aquaculture discharges. This requires characterization of discharges waters, including chemical components and volume, and measures to mitigate impacts on EPBC threatened species. This could include extension of the discharge pipe to avoid sensitive tidal salt pans and flats where shorebirds are feeding.

Recommendations

- Provide controls to minimise disturbance of sediment and runoff that might impact tidal and marine habitats and threatened/migratory shorebird feeding sites in the local area when constructing and operating the Marina Precinct.
- Minimise clearing and disturbance of key coastal habitats (such as mangrove closed forest) during construction of the Marina Precinct.
- Design intervention is required to prevent discharge from aquaculture facilities into sensitive tidal marine flats where threatened shorebirds are feeding.
- Monitor and prevent discharge impacts from the aquaculture facility on the adjacent saline flats to prevent impacts on migratory and threatened shorebird habitat.



- Project Area
- Sandstone Outcrops and Escarpment (Culturally Significant Site)
- Significant VMUs - Groote Eylandt (Cultural and Ecological Significance)

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 Base mapping layers supplied by AUSLIG;
 NTG herbarium VMU mapping

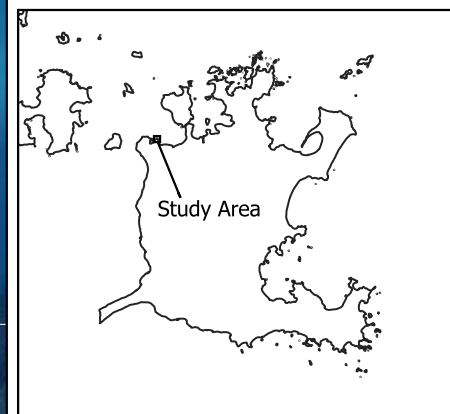


FIGURE 8 Little Paradise
 Lease 1 and 2 + Marina Precinct
 Significant Vegetation

8.0 Summary and Recommendations

- Several ecological constraints areas were identified in the Little Paradise surveys, including threatened and migratory fauna species and culturally and ecologically significant habitats.
- Important habitat types such as monsoon forest, mangroves and tidal salt pans are present within the broader local area. These habitats should be avoided where possible during the planning and design phase.
- Endangered and vulnerable plant species were not detected within the Project Area.
- Weeds are present in the local area and there is a risk that the project will increase their number and distribution. The risk of the project in relation to weeds will be minimised if appropriate controls are implemented.
- Three EPBC Act listed threatened fauna species, the northern blue-tongued skink, northern quoll and northern masked owl, were detected in terrestrial habitats within or adjacent to the Project Area footprint.
- The northern quoll was identified as occurring across the study area, with an estimated range of 7 individuals falling within the clearance footprint based on a density estimate by Heiniger et al. (2021).
- The proposed development area would require disturbance to a small percentage of the home range of one or two pairs of northern masked owl. Several locations were identified as supporting potential roost locations for this species within and adjacent to the study area (closed monsoon forest near the marina and Lease 1 and 2).
- Significant (listed) threatened and migratory bird species (DOE 2015c) were present in small numbers on the eastern coast of the Little Paradise peninsula. Several of these species are listed as critically endangered, endangered and vulnerable under the EPBC Act. This requires control and management of discharge from the proposed aquaculture facility to avoid impacts to sensitive marine tidal flats and salt pans where shorebirds feed to the east of Lease 1 and 2.
- Controls on disturbance in tidal areas, aquaculture discharge and sedimentation should be applied to minimise off-site impacts on marine and tidal habitats (threatened and migratory shorebirds).

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6 April 2024

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APPENDIX 1

EPBC Act Protected Matters Report



Australian Government

Department of Climate Change, Energy,
the Environment and Water

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 10-Apr-2024

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[Details](#)

[Matters of NES](#)

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Summary

Matters of National Environment Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	37
Listed Migratory Species:	46

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <https://www.dcceew.gov.au/parks-heritage/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	76
Whales and Other Cetaceans:	10
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	3

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	2
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	2
Key Ecological Features (Marine):	None
Biologically Important Areas:	3
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Listed Threatened Species	[Resource Information]
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Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Erythroriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area
Tyto novaehollandiae kimberli Masked Owl (northern) [26048]	Vulnerable	Species or species habitat likely to occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat may occur within area
MAMMAL		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Notomys aquilo Northern Hopping-mouse, Woorrentinta [123]	Endangered	Species or species habitat may occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Tiliqua scincoides intermedia Northern Blue-tongued Skink [89838]	Critically Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Varanus mertensi		
Mertens' Water Monitor, Mertens's Water Monitor [1568]	Endangered	Species or species habitat likely to occur within area
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Glyphis glyphis		
Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species	[Resource Information]	
Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa sahalensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat may occur within area overfly marine area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat may occur within area
Cecropis daurica as Hirundo daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area overfly marine area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area overfly marine area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area overfly marine area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area
Fish		
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribbioned Pipehorse, Ribbioned Seadragon [66226]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippichthys cyanospilos Blue-speckled Pipefish, Blue-spotted Pipefish [66228]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Reptile		

Scientific Name	Threatened Category	Presence Text
Aipysurus duboisii Dubois' Sea Snake, Dubois' Seasnake, Reef Shallows Sea Snake [1116]		Species or species habitat may occur within area
Aipysurus laevis Olive Sea Snake, Olive-brown Sea Snake [1120]		Species or species habitat may occur within area
Aipysurus mosaicus as Aipysurus eydouxii Mosaic Sea Snake [87261]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrelaps darwiniensis Port Darwin Sea Snake, Black-ringed Mangrove Sea Snake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Sea Snake [1101]		Species or species habitat may occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hydrophis hardwickii as Lapemis hardwickii Spine-bellied Sea Snake [93516]		Species or species habitat may occur within area
Hydrophis inornatus Plain Sea Snake [1107]		Species or species habitat may occur within area
Hydrophis kingii as Disteira kingii Spectacled Sea Snake [93511]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli MacDowell's Sea Snake, Small-headed Sea Snake, [75601]		Species or species habitat may occur within area
Hydrophis major as Disteira major Olive-headed Sea Snake [93512]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Sea Snake, Ornate Reef Sea Snake [1111]		Species or species habitat may occur within area
Hydrophis pacificus Pacific Sea Snake, Large-headed Sea Snake [1112]		Species or species habitat may occur within area
Hydrophis peronii as Acalyptophis peronii Horned Sea Snake [93509]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Hydrophis stokesii as Astrotia stokesii Stokes' Sea Snake [93510]		Species or species habitat may occur within area
Hydrophis zweiffei as Enhydrina schistosa Australian Beaked Sea Snake [93514]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Parahydrophis mertoni Arafura Smooth Sea Snake, Northern Mangrove Sea Snake [1090]		Species or species habitat may occur within area

Whales and Other Cetaceans		[Resource Information]
Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa sahalensis Australian Humpback Dolphin [87942]		Species or species habitat likely to occur within area

Current Scientific Name	Status	Type of Presence
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Habitat Critical to the Survival of Marine Turtles		[Resource Information]
Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	
Anindilyakwa	Indigenous Protected Area	NT	
Anindilyakwa	Indigenous Protected Area	NT	

EPBC Act Referrals			[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Acoustic and Resistivity Sub-Bottom Profiling Survey	2011/6116	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
Groote Eylandt Offshore Marine Surveys	2010/5643	Referral Decision	Completed

Biologically Important Areas		[Resource Information]	
Scientific Name		Behaviour	Presence
Marine Turtles			
Chelonia mydas			
Green Turtle [1765]		Internesting	Likely to occur
Eretmochelys imbricata			
Hawksbill Turtle [1766]		Internesting	Likely to occur
Natator depressus			
Flatback Turtle [59257]		Internesting	Likely to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc.).

In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact us](#) page.

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APPENDIX 2

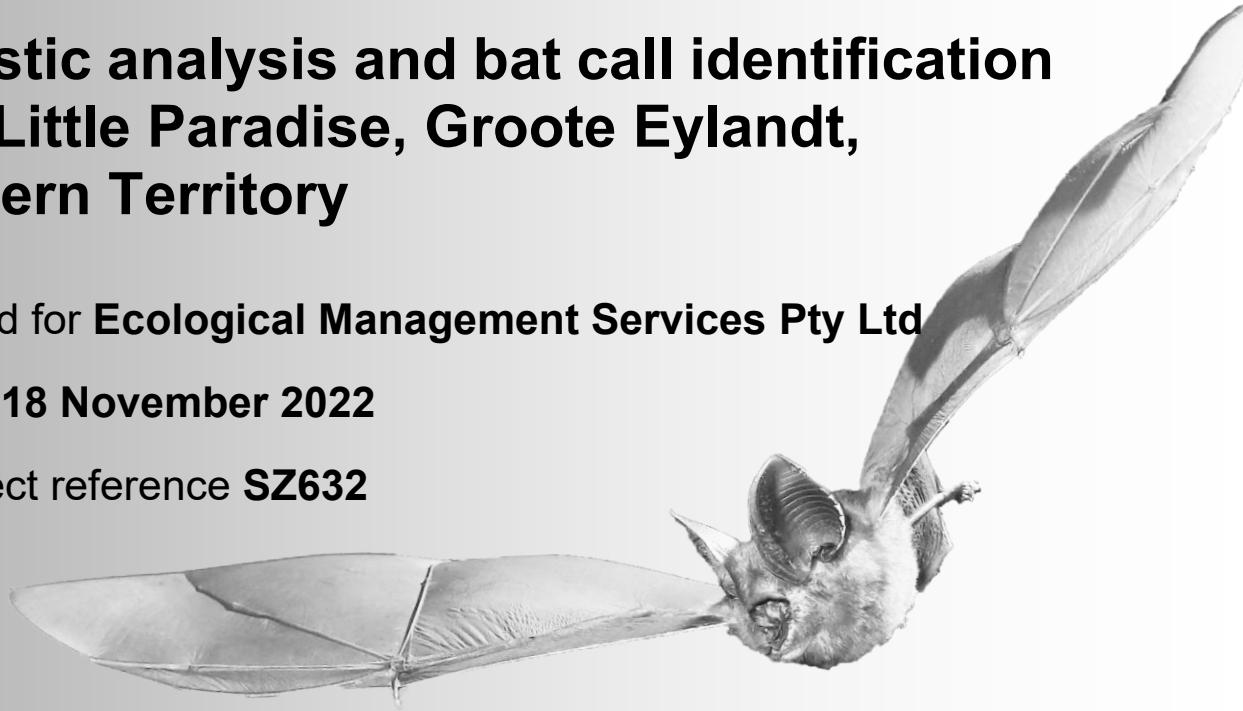
Specialised Zoological Bat Report 2022

Acoustic analysis and bat call identification from Little Paradise, Groote Eylandt, Northern Territory

Prepared for **Ecological Management Services Pty Ltd**

Version **18 November 2022**

SZ project reference **SZ632**



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This report should be included as an appendix in any larger submission to Government, and cited as:

Specialised Zoological (2022). Acoustic analysis and bat call identification from Little Paradise, Groote Eylandt, Northern Territory. Unpublished report by Specialised Zoological for Ecological Management Services Pty Ltd, 18 November 2022, project reference SZ632.

Summary

Bat identifications from acoustic recordings are provided from the Little Paradise area, north of Alyangula, Groote Eylandt, Northern Territory. A total of 395,469 WAV-format files from 264 survey nights was submitted for analysis (**Table 1**). The identification of bat species from full spectrum WAV-format recordings of their echolocation and social calls was based on measurements of characteristic frequency, observation of pulse shape, and the pattern of harmonics.

Particular attention was given to the detection of the following species given their conservation status under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), under the Northern Territory *Territory Parks and Wildlife Conservation Act 1976* (TPWC Act), the IUCN Red List (<https://www.iucnredlist.org/>), and based on the assessments in the 'Action Plan for Australian Mammals 2012' (APAM) by Woinarski et al. (2014):

- Ghost bat *Macroderma gigas* (Megadermatidae)— EPBC Act: Vulnerable; TPWC Act: Near Threatened; IUCN: Vulnerable; APAM: Vulnerable.
- Northern leaf-nosed bat *Hipposideros stenotis* (Hipposideridae)— EPBC Act: not listed; TPWC Act: not listed; IUCN: Vulnerable; APAM: Near Threatened.
- Bare-rumped sheath-tailed bat *Saccolaimus saccolaimus* (Emballonuridae)—EPBC Act: Vulnerable; TPWC Act: Near Threatened; IUCN: Least Concern; APAM: Near Threatened.

At least 12 species of bat from six families were identified as being present (**Tables 2 and 3**). The ghost bat was detected, but the bare-rumped sheath-tailed bat and northern leaf-nosed bat were not detected.

Representative echolocation calls for each identification are illustrated (**Figures 1 and 2**), as recommended by the Australasian Bat Society (ABS 2006). Further details are available should verification be required.

Methods

The data provided were recorded in full spectrum WAV format with Titley Scientific Anabat Chorus and Swift bat detectors (sampling rate 500 kHz, set to turn on automatically at sunset and off at sunrise).

A multi-step acoustic analysis procedure developed to process large full spectrum echolocation recording datasets from insectivorous bats (Armstrong et al. 2021a,b) was applied to the recordings made on the survey. Firstly, the WAV files were scanned for bat echolocation calls using several parameter sets in the software SCAN'R version 1.8.3 (Binary Acoustic Technology), which also provides measurements (SCAN'R parameters) from each putative bat pulse. The outputs were then used to determine if putative bat pulses measured in SCAN'R could be identified to species. This was done using a custom [R] language application that performed three tasks:

1. undertook a Discriminant Function Analysis on training data from representative calls in three datasets: from northern Australia (K.N. Armstrong unpublished data); from low-frequency-emitting (LFE) bats in northern Australia (Armstrong et al. 2021a); and from cave-roosting bats in northern Australia (K.N. Armstrong unpublished data).
2. from the measurements of each putative bat pulse from SCAN'R, calculated values for the first two Discriminant Functions that could separate the echolocation call types derived from the analysis of training data, and plotted these resulting coordinates over ellipses representing one standard deviation of the variation for the defined call types; and
3. facilitated an inspection in a spectrogram of multiple examples of each call type for each recording night by opening the original WAV files containing pulses of interest in Adobe Audition version 22.

Species were identified based on information in Milne (2002), Churchill (2008), Armstrong et al. (2021a) and the author's own unpublished material. Nomenclature follows Jackson and Groves (2015). Species identifications are reported per site from all sampling nights combined.

Comments on some identifications

Calls of the ghost bat *Macroderma gigas* were identified unambiguously from both echolocation and social calls.

Careful attention was paid to echolocation calls with a characteristic frequency below 30 kHz (low frequency emitting bats; LFE bats) to determine whether examples of the bare-rumped sheath-tailed bat were present. Calls of LFE bats were matched against the criteria in Armstrong et al. (2021a), which provides a guide for recognising calls of the bare-rumped sheath-tailed bat based on the pattern of harmonics, characteristic call frequency and details of pulse shape. The calls of the common sheath-tailed bat *Taphozous georgianus* were relatively straightforward to distinguish because their characteristic frequency on Groote Eylandt is 2 – 3 kHz higher than on the mainland (c. 28 kHz; P. Barden and K. Armstrong unpublished data). The calls of the northern free-tailed bat *Ozimops lumsdenae* were common in the dataset and identified based on their harmonic content and pattern of pulse shape across sequences. There were no clear examples of the bare-rumped sheath-tailed bat observed in the dataset.

Most other species were identified unambiguously, but some call types have more than one possibility for their source.

Calls with a characteristic frequency between c. 35–41 kHz could have been derived from the hoary wattled bat *Chalinolobus nigrogriseus* or the little broad-nosed bat *Scotorepens greyii*.

Calls attributed to a species of long-eared bat *Nyctophilus* sp. could have derived from either the pallid long-eared bat *N. daedalus* or the Arnhem long-eared bat *N. arnhemensis*. Calls of the large-footed bat *Myotis macropus* can also be difficult to distinguish from those of long-eared bats.

Limitations

The identifications presented in this report have been made within the following context:

1. The identifications made herein were based on the ultrasonic acoustic data recorded and provided by a 'third party' (the client named on the front of this report).
2. The scope of this report extended to providing information on the identification of bat species in bulk ultrasonic recordings. Further comment on these species and the possible impacts of a planned project on bat species were not part of the scope.
3. In the case of the present report, the recording equipment was not set up and supplied by Specialised Zoological. The equipment was operated by the third party during the survey.
4. Other than the general location of the study area, Specialised Zoological has not been provided with detailed information of the survey area, has not made a visit to observe the habitats available for bats, nor have we visited the specific project areas on a previous occasion.
5. Specialised Zoological has had no input into the overall design and timing of this bat survey, recording site placement, nor the degree of recording site replication.
6. While Specialised Zoological has made identifications to the best of our ability given the available materials, and reserves the right to re-examine the data and revise any identification following a query, it is the client's and / or proponent's responsibility to provide supporting evidence for any identification, which might require follow-up trapping effort or non-invasive methods such as video recordings. Specialised Zoological bears no liability for any follow-up work that may be required to support an identification based initially on the analysis of acoustic recordings undertaken and reported on here.
7. There are a variety of factors that affect the 'detectability' of each bat species, given the frequency, power and shape characteristics of their calls. Further information on the analysis and the various factors that can impinge on the reliability of identifications can be provided upon request.
8. The analysis of ultrasonic recordings is one of several methods that can be used to survey for bats, and comprehensive surveys typically employ more than one method. If an identification in the present report is ambiguous or in question, a trapping programme would help to resolve the presence of the possibilities in the project area.
9. The most reliable way of detecting the ghost bat with bat detectors is to place the equipment with the microphone facing into a potential cave roosting site. The echolocation calls of this species are of low amplitude, and therefore most detectable when a ghost bat flies close to the bat detector as it exits the underground structure. If there is uncertainty about whether ghost bats are present in a cave, then video recordings can be a useful addition to the survey. The detection of ghost bats with bat detectors away from cave entrances is less reliable.
10. This version of the document supersedes any previous version. Previous drafts are not authorised by us for submission to the regulator or the public domain.

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Table 1. Summary of recording sites in the Little Paradise study area.

Site	Serial	First night	Last night	Nights	Coordinates
Little Paradise Acoustic Array June-July 2022	655072	21/07/2022	23/07/2022	4	13.776495 S, 136.496155 E, 15 m
Session1 Swift1 2021 Open Dam	583084	19/02/2021	21/02/2021	3	13.830603 S, 136.455128 E, 55 m
Session1 Swift2 LP Sandstone Edge	583079	22/01/2021	13/02/2021	23	13.826870 S, 136.455635 E, 26 m
Session1 Swift3 Open Forest	568046	22/01/2021	3/02/2021	13	13.835628 S, 136.453173 E, 22 m
Session2 SW1 Monsoon Forest Creek	583084	2/07/2021	1/08/2021	31	13.822495 S, 136.440557 E, 15 m
Session2 SW2 Camp Sandstone Margin	583079	29/06/2021	12/08/2021	45	13.831227 S, 136.433825 E, 23 m
Session2 SW3 Escarpment Cave Entrance	568046	27/06/2021	4/08/2021	40	13.817215 S, 136.436180 E, 39 m
Session3 SW2 Telstra Hill Sandstone	583079	18/06/2022	9/08/2022	53	13.840915 S, 136.436733 E, 25 m
Session3 SW3 Telstra Hill Sandstone	568046	18/06/2022	8/08/2022	52	13.839577 S, 136.435853 E, 53 m

Table 2. Species identified in the present survey from all sites combined.

MEGADERMATIDAE	
Ghost bat	<i>Macroderma gigas</i>
HIPPOSIDERIDAE	
Dusky leaf-nosed bat	<i>Hipposideros ater</i>
RHINONYCTERIDAE	
Orange diamond-faced bat	<i>Rhinonictis aurantia</i>
EMBALLONURIDAE	
Yellow-bellied sheath-tailed bat	<i>Saccolaimus flaviventris</i>
Common sheath-tailed bat	<i>Taphozous georgianus</i>
VESPERTILIONIDAE	
Large-footed bat	<i>Myotis macropus</i>
Northern Pipistrelle	<i>Pipistrellus westralis</i>
Finlayson's cave bat	<i>Vespadelus finlaysoni</i>
<i>Ambiguous identifications</i>	
Arnhem long-eared bat	<i>Nyctophilus arnhemensis</i>
and/or Pallid long-eared bat	and/or <i>Nyctophilus daedalus</i>
Hoary wattled bat /	<i>Chalinolobus nigrogriseus</i> /
and/or Little broad-nosed bat	and/or <i>Scotorepens greyii</i>
MOLOSSIDAE	
Greater northern free-tailed bat	<i>Chaerephon jobensis</i>
Northern free-tailed bat	<i>Ozimops lumsdenae</i>

Table 3. Species identifications per site, with the degree of confidence indicated by a code (see *Table 1* for site details, and *Table 2* for full species names).

	<i>C. jobensis</i>	<i>C. nigrogriseus / S. greyii</i>	<i>H. ater</i>	<i>Ma. gigas</i>	<i>My. macropus</i>	<i>Nyctophilus sp.</i>	<i>O. lumsdenae</i>	<i>P. westralis</i>	<i>R. aurantia</i>	<i>S. flaviventris</i>	<i>T. georgianus</i>	<i>V. finlaysoni</i>
Site												
Little Paradise Acoustic Array June-July 2022	.	NC	.	.	.	NC	.	.	.	.	X	.
Session1 Swift1 2021 Open Dam	.	NC	.	.	X	.	X	X	.	X	X	X
Session1 Swift2 LP Sandstone Edge	.	NC	.	.	.	NC	X	X	.	X	X	X
Session1 Swift3 Open Forest	.	NC	X	.	.	.	X	.	.	X	X	X
Session2 SW1 Monsoon Forest Creek	.	NC	X	.	.	NC	X	.	.	X	X	X
Session2 SW2 Camp Sandstone Margin	.	NC	.	.	.	NC	X	.	.	X	X	X
Session2 SW3 Escarpment Cave Entrance	NC	NC	X	X	.	.	X	.	X	X	X	X
Session3 SW2 Telstra Hill Sandstone	.	NC	.	.	.	NC	X	X	.	X	X	X
Session3 SW3 Telstra Hill Sandstone	.	NC	.	X	.	NC	X	.	.	X	X	X

Definition of confidence level codes

‘.’ Not detected.

X Unambiguous identification of the species at the site based on measured call characteristics and comparison with available reference material. Greater confidence in this ID would come only after capture and supported by morphological measurements or a DNA sequence.

NC Needs Confirmation. Either call quality was poor, or the species cannot be distinguished reliably from another that makes similar calls. Alternative identifications are indicated in the *Comments on identifications* section of this report. If this is a species of conservation significance, further survey work might be required to confirm the record.

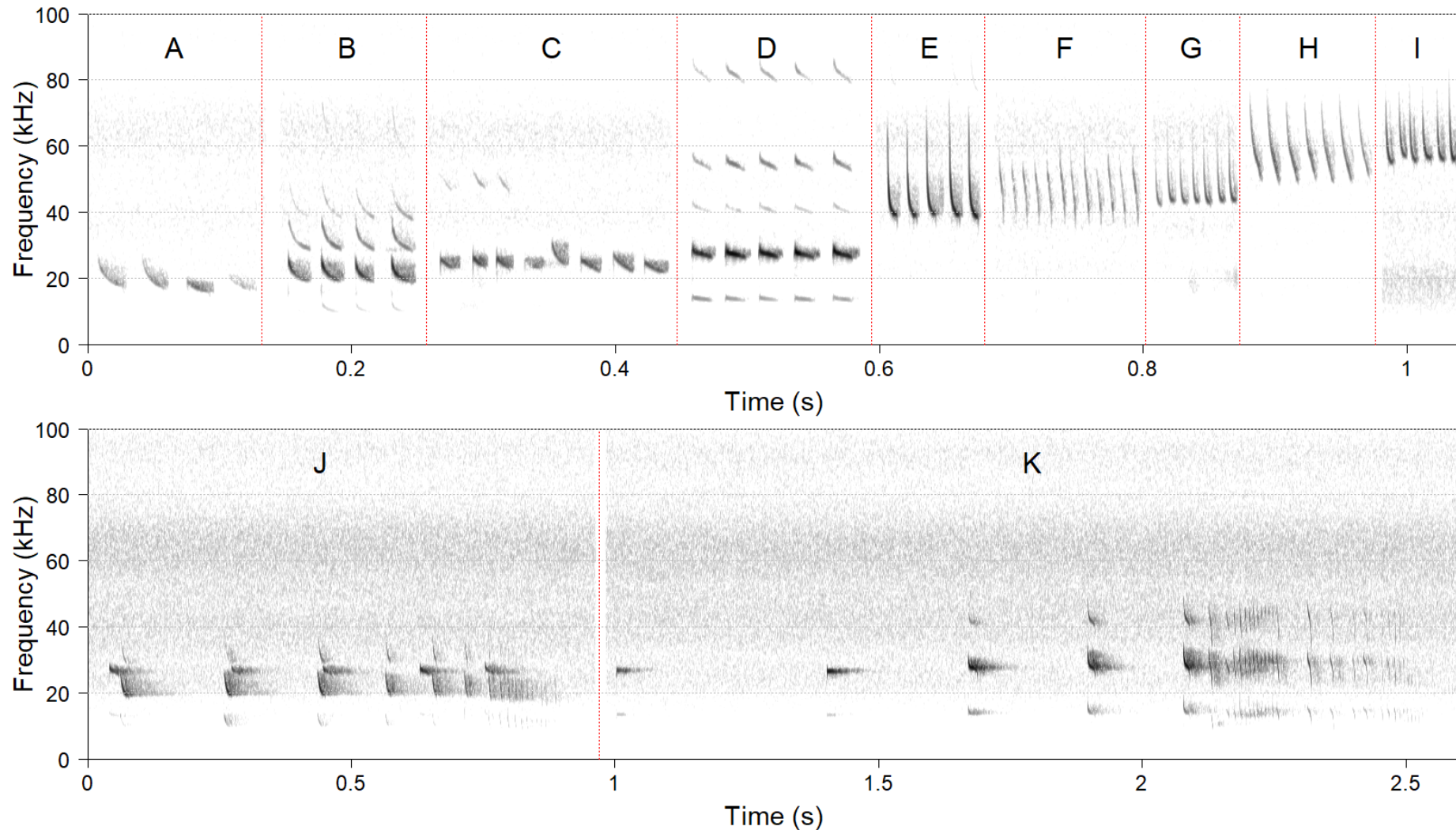


Figure 1. Representative echolocation call sequence portions of the species identified (time between pulses is compressed for examples A – I; **A:** *Chaerephon jobensis*; **B:** *Saccolaimus flaviventris*; **C:** *Ozimops lumsdenae*; **D:** *Taphozous georgianus* high frequency phonic type; **E:** *Chalinolobus nigrogriseus* / *Scotorepens greyii*; **F:** *Myotis macropus*; **G:** *Pipistrellus westralis*; **H:** *Nyctophilus* sp.; **I:** *Vespadelus finlaysoni*; **J:** feeding buzz of *Saccolaimus flaviventris*; **K:** feeding buzz of *Taphozous georgianus*).

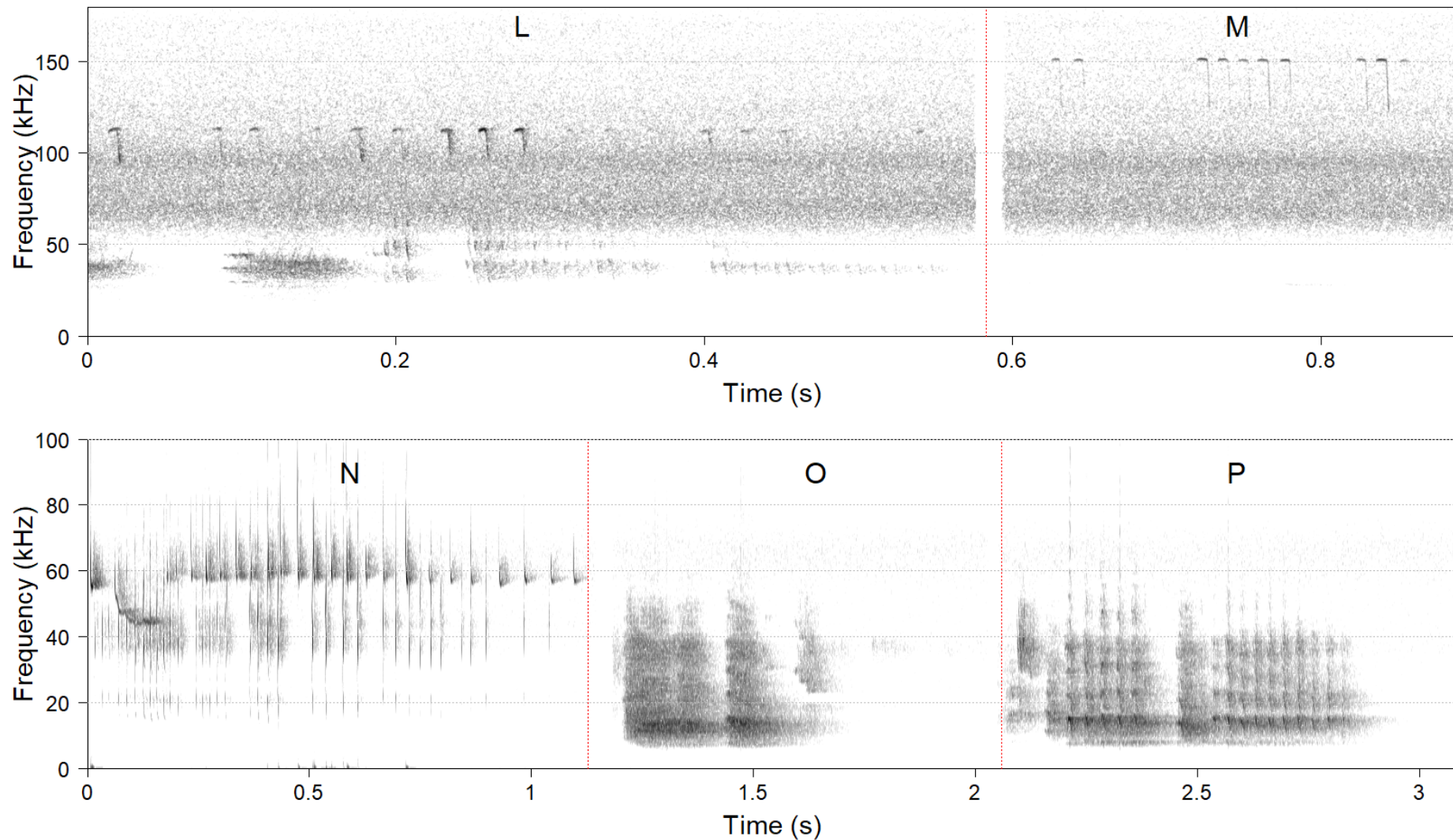
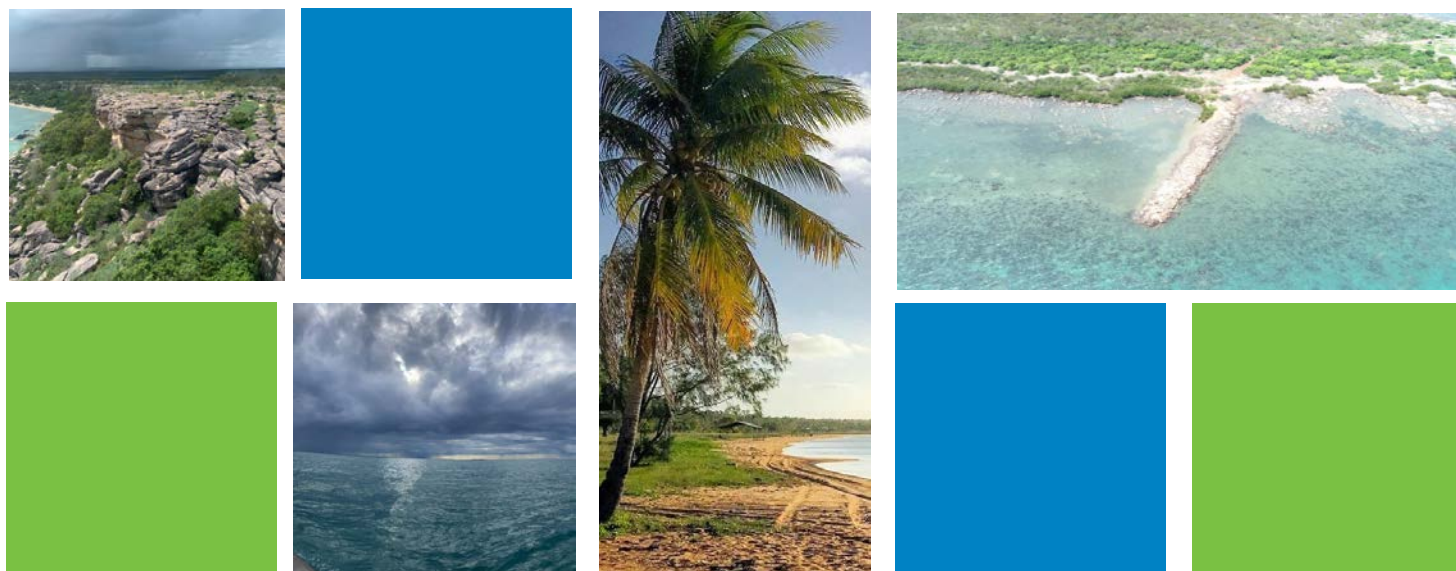


Figure 2. Representative echolocation call sequence portions of the species identified (**L:** *Rhynonicteris aurantia*; **M:** *Hipposideros ater*; **N:** echolocation calls of *Macroderma gigas* interspersed with those from *Vespadelus finlaysoni*; **O:** a 'chirp' type social call from *M. gigas*; **P:** a 'twitter' type social call from *M. gigas*).



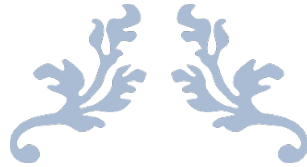
Appendix N

Anthropology Report

Groote Holdings Aboriginal Corporation

Little Paradise Development





CULTURAL SURVEY REPORT

Groote Holdings Aboriginal Corp (GHAC)
Consolidated Projects located North West of Groote
Eylandt (Little Paradise Logistic Basecamp): Leases
1-9, Pole 7A Workers Camp, Bio-security Areas X 2,
and Services Corridor.



MARCH 9, 2023

AUTHOR – HUGH BLAND (ANTHROPOLOGIST)
ANINDILYAKWA LAND COUNCIL

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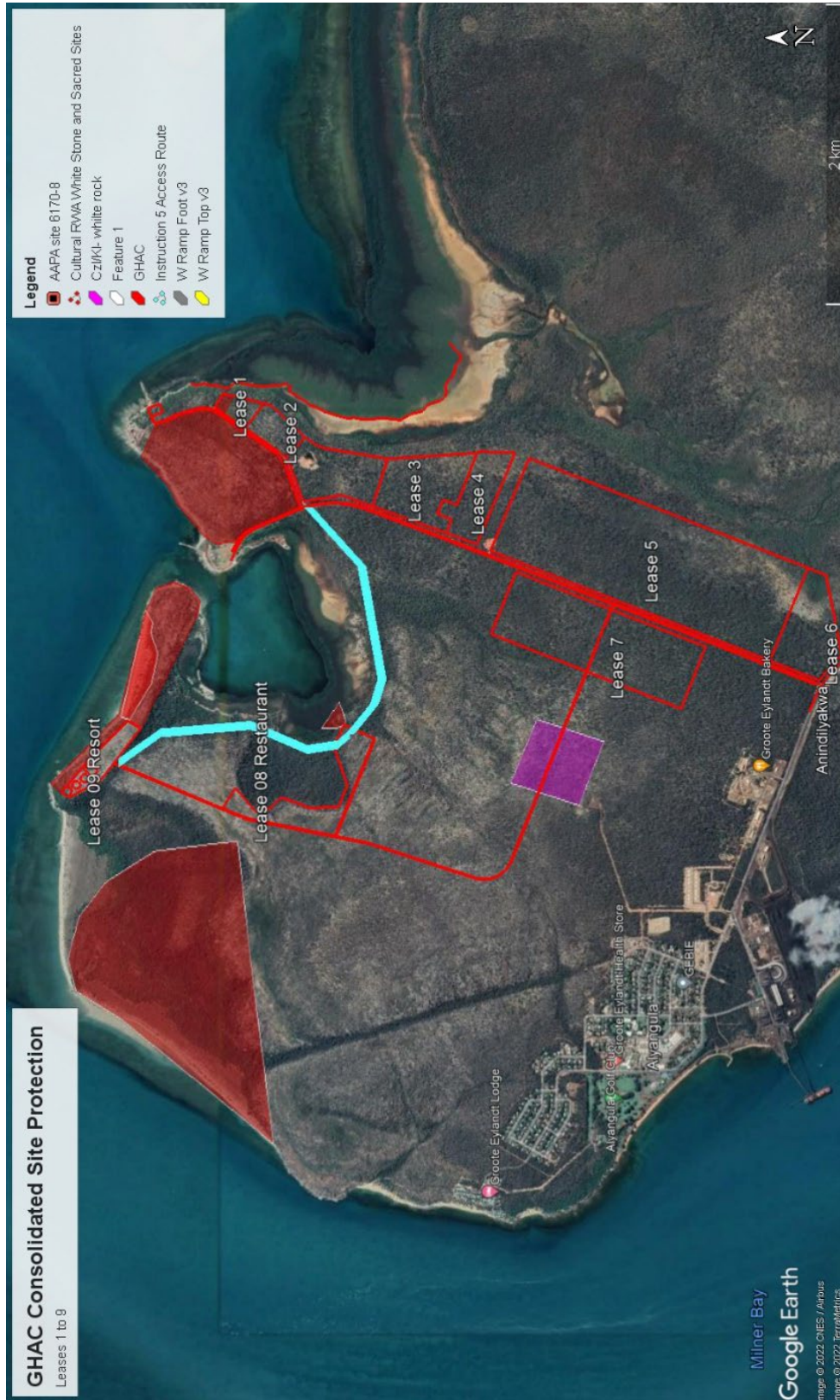
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INSTRUCTIONS

CONSOLIDATED INSTRUCTIONS LEASES 1 to 9

Map 5. Consolidated Site Protection regime for Leases 1-9.

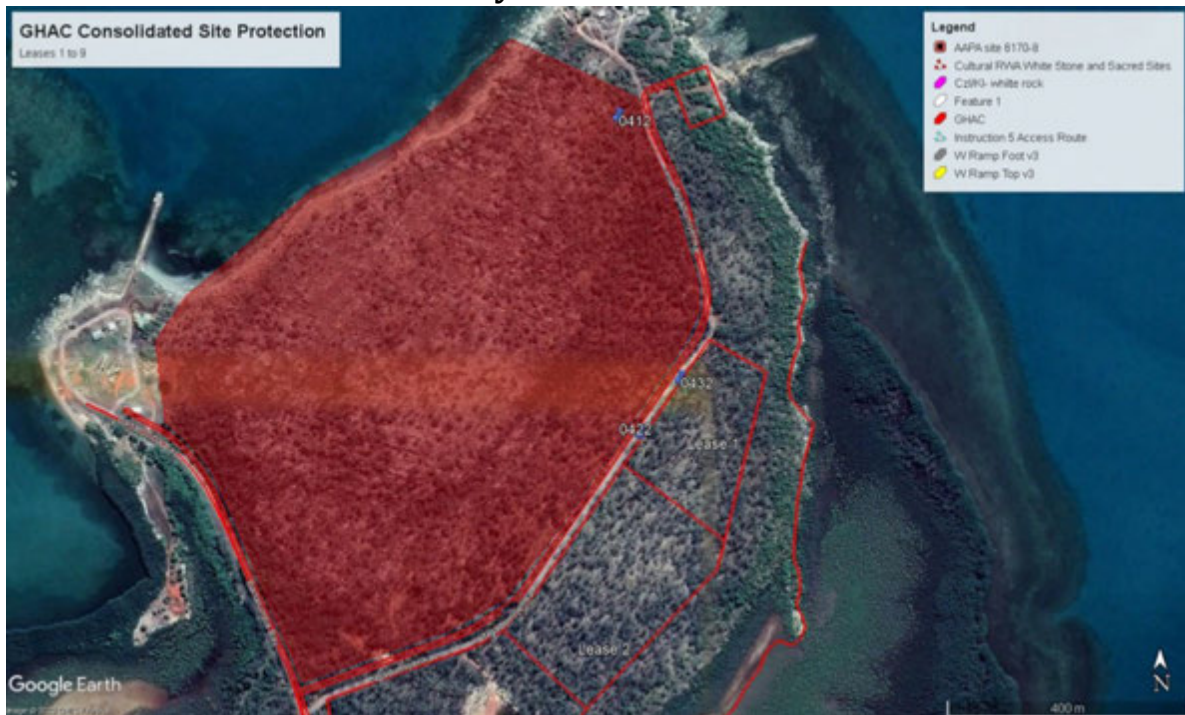


INSTRUCTIONS 1a.

FOR LEASES 1 - 7

1. No development works are authorised north of the Little Paradise Access Track (see Map 1 below).
2. No development works are authorised east of the ephemeral creek that crosses the Little Paradise Access Track at WP0432 and which is depicted by a red line on the map at Appendix B (see Map 2 below).
3. Access along the Little Paradise Access Track is only allowed for the purpose of accessing the jetty and boat ramp.

Map 1a. Site Protection regime for the coastal area between Little Paradise and Bartalumba Bay.



INSTRUCTION 1b
FOR LEASES 1 – 7 (cont.)

Map 1b. Site Protection regime for Lease 1.



INSTRUCTION 2 (NO MAP REQUIRED)

INSTRUCTIONS 2

ALC Information Meeting re S.19 Leases 16 Feb 2021

- 1. Re Project 1 (Winchelsea Island Quarry) - The meeting decided that further cultural research is required to confirm a culturally suitable project site (Note that this project is subject of a separate Anthropology Report).**
- 2. Project 6 (Resort Lodge) - The meeting decided that further cultural research is required to confirm an alternative project site (Note that this project had been proposed for the area near Little Paradise Community and is now subject of a separate Anthropology Report).**
- 3. Project 2 to 5 - were approved subject to the WM Workers Camp being located on the Southern Side of the Little Paradise access road and no development east of the ephemeral creek (see WP0432 at App B).**

INSTRUCTION 3
FOR LEASE 9 (see Map 2)

INSTRUCTIONS 3

1. The area of coastal plain and beach located immediately west of the coastal cliff (see EOI at App E) is free of sites of cultural significance and available for development of facilities servicing the resort development. Development should stay 100 metres from the southern cliff line. The red line (see App H) depicts the western extent of this available area.
2. The west side of Deception Bay is free of sites of cultural significance and is available for development of a workers camp.
3. The western end of the coastal ridge west of Deception Bay is free of sites of cultural significance and is available for the resort development.
4. Access to the beach between Lease 9 and the entrance to Deception Bay is restricted NB. Please note that this Instruction is superseded by Instruction 7 (see Map 5).
5. The corridor at the eastern end of the Area of Interest adjoining the Bartalumba Bay access road is free of culturally significant sites and is available for the construction of an access track.

Map 2. Site Protection regime for Lease 9.



INSTRUCTION 4
FOR LEASES 1-11 (NO MAP REQUIRED)

INSTRUCTIONS 4.

- 1. Lease 1 – Consent given**
- 2. Lease 2 – Consent given**
- 3. Lease 3 – Consent given**
- 4. Lease 4 – Consent given**
- 5. Lease 5 – Consent given**
- 6. Lease 6 – Consent given**
- 7. Lease 7 – Consent given**
- 8. Lease 8 - Provisional consent given subject to further site protection research by ALC Anthropologists and further identification of a T/O approved access route.**
- 9. Lease 9 – Provisional consent given subject to further site protection research by ALC Anthropologists and identification of an Access Route approved by T/Os.**
- 10. Note that the T/Os of Lease 9, the Wurrawilya Clan, were not at the meeting.**
- 11. No instructions received. This lease required further consultation with Malkala senior community members who were not at the meeting.**

INSTRUCTION 5 FOR LEASE 8

INSTRUCTIONS 5

1. Henry Nunggumajbarr advised Kenny Nunggumajbarr (by phone) that the access track could be realigned to pass between the site 6170-40 and the adjacent rocky white stone ridge
2. WP1002 marks a point 20 metres south of the white stone ridge which could mark the northern edge of the access track easement

Map 3. Site Protection regime for Lease 8 and the Access Track to Lease 9.



INSTRUCTION 6 FOR LEASE 8 (cont.)

INSTRUCTIONS 6

1. A series of waypoints were then taken to develop a Restricted Work Area buffer to protect the site.
2. WP1042 marks the western edge where the more open vegetation associated with site transitions to mangroves.
3. WP1052 marks the eastern edge where the more open vegetation associated with site transitions to woodland.
4. WP1062 marks the inland extent where the more open vegetation associated with site transitions to woodland.
5. These instructions have been mapped at Appendix L and below.

Map 4. Site Protection regime for AAPA Site 6170-40

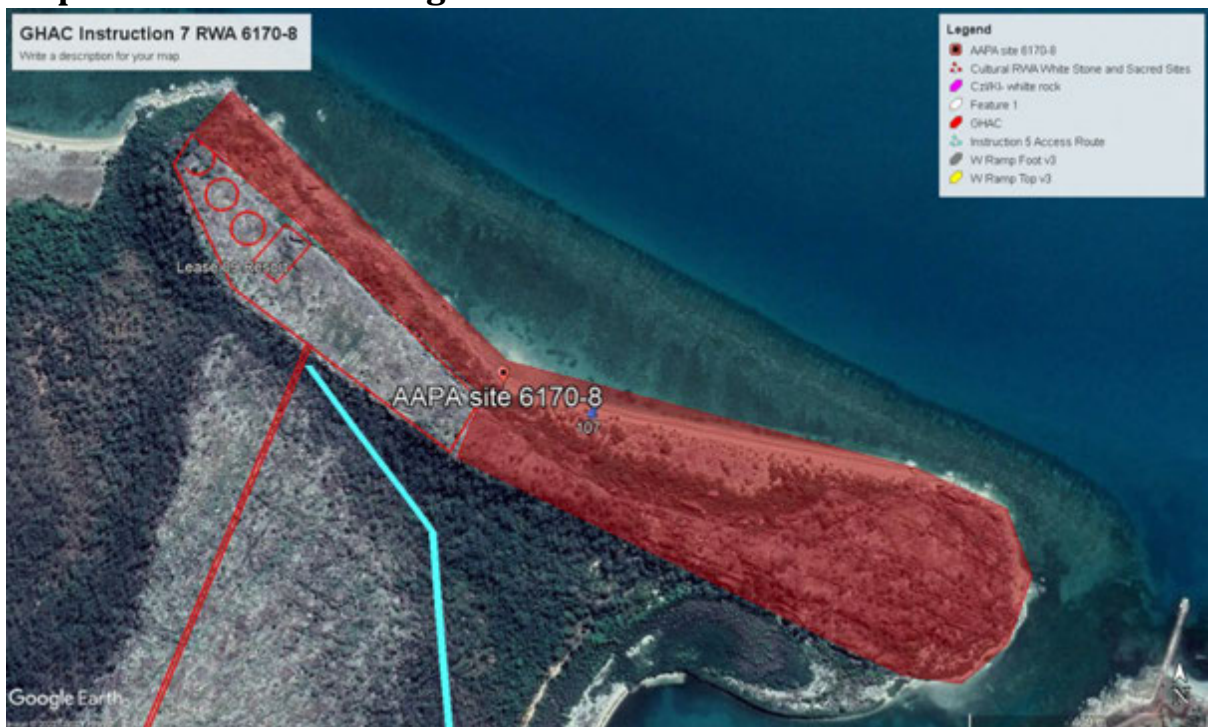


INSTRUCTION 7 FOR LEASE 9 (cont.)

INSTRUCTIONS 7

1. The beach at Yinungwakardamurramunja is to be closed but the resort development planned for the cliff to the south-west of the site can proceed.
1. Access to the reef in front of Yinungwakardamurramunja is not restricted.
2. Restricted Area signs should be erected at either end of the beach.

Map 5. Site Protection regime for AAPA Site 6170-8



INSTRUCTION 8 Services Corridor, Aquaculture Outlet Pipeline, Biosecurity Area, Laydown Area.

INSTRUCTIONS 8

1. There are no cultural sites that will be impacted by the proposed works.
2. The Services Corridor is allowed to traverse the RWA on the eastern end of Lease 1.
3. To traverse any watercourses cables and/or pipelines within the Services Corridor should be buried.
4. The rusting iron structure at the Little Paradise Jetty can be removed.

BACKGROUND

History and any previous relevant consultations

This development proposal has been amended a number of times in response to preliminary cultural and environmental research and this background section will seek to summarise these changes.

The initial proposal entailed a consolidated series of commercial and industrial developments along the Little Paradise Access Road. This was later amended to include aquaculture, hospitality, and worker accommodation developments in the area west of Deception Bay, including the construction of new access tracks.

On 28 Jan 2021 Lorna Martin (ALC Preserving Culture Dept Manager) relayed a request from ALC CEO Mark Hewitt for field consultations to be undertaken with relevant Traditional Owners and senior custodians regarding development proposals in the area of Little Paradise and Bartalumba Bay Communities. A draft plan of the proposed developments is at App. A.

There are 4 named projects depicted on the Master Plan at App A, and for clarity the fieldwork considered each as a separate project as each of the projects would require a S.19 lease.

1. Proposed Lodge and Art Centre
2. Winchelsea Workers Accommodation
 - a. During subsequent discussions with the proponent project 2 was revised to include a separate area for a Mechanical Workshop and Automotive Recycling Project.
3. Mine Infrastructure Compound
4. Solar Farm
 - a. During subsequent discussions with the proponent project 4 was advised to include a separate area for a Forestry Milling Project.

On 4 Feb 2021 correspondence was received from Ross McDonald (ALC Mining and Environment Manager) that aboriginal art had been identified by an ecology survey team in the area of sandstone boulders between the satellite communities of Bartalumba Bay and Little Paradise in an area that had been designated as the site for the Resort Lodge.

Fieldwork was scheduled for Friday 12 Feb 2021 and during the fieldwork Traditional Owners advised that the area of outcropping white stone was also culturally significant and so was not available for the Resort Lodge development. The field data and instructions received during this fieldwork is detailed below (see P.16).

On 26 Feb 2021 a revised application for a Cultural Survey over an area west of Deception Bay (see mapped plan at App B) was received from Bruce Marshall (GHAC Project Manager). In addition to the Resort Lodge the revised development proposal included a number of new elements described as follows:

*"In the large polygon we would like to access the beach to the West and the South East.
On the top of the ridge on the Western half we hope to build a resort.*

On the lower flat area to the west will be the admin and offices for the resort and a helipad and on the South East area will be a 50 man workers camp with mess, laundry and all required facilities.

I have put in two access routes, dry season / wet season to see how we go with the T/O's."

On 18 March 2021 a further development proposal was received from Paul Capon (ARAC Aquaculture Program) to establish an aquaculture hatchery in the bay immediately west of the Resort Lodge site (See map at Appendix C).

On 2 June 2021 the Development Proposal was further revised following informal discussions between ALC and GHAC and Bruce Marshall sent through a revised map of the Area of Interest on the western side of Deception Bay (See Appendix D).

On 6 June 2021 Bruce Marshall provided a revised schematic of the development proposals along the access roads to Bartalumba Bay and Little Paradise satellite communities (See Appendix E).

On 5 October 2021 Wayne Gabbert of Gabbert Design sent through a series of maps that further revised and consolidated the GHAC development proposals for the AOI (See Appendix F). Wayne has indicated that these plans are now final with the following:

"Please find attached the lease arrangements for Little Paradise Precinct and the Malkala community. Following the previous information, I sent you for cultural assessment we now have formalised the lease areas. Cross Solution surveyors have provided formalised lease areas with cadastral data which forms part of the lease applications. The embedded map below is the final masterplan outlining the lease arrangements."

On 10 March 2022 Mark Hautop (ALC Lawyer) requested further consultations with Traditional Owners about a discrete set of supplementary projects associated with the GHAC Leases along the Bartalumba Bay and Little Paradise access roads.

Following instructions from TOs, could you please undertake cultural clearance surveys for the following areas:

- 1. Biosecurity & Laydown (i.e. 2x areas comprising approx. 0.8ha as shown on first attached map) (See Appendix N).*
- 2. Aquaculture drainage pipe from Lease 2 (i.e. marked 'effluent line' from the southern edge of Lease 2 to the low water mark, approx. 5m wide and 110m long). Please contact Wayne if you need a KMZ file. I note the Lease 2 boundary has already been approved. (See Appendix P).*
- 3. Road / services corridor – in the interests of time, Jason and Wayne have asked me to produce a 'mud' map showing the proposed corridor. Proper plans are being prepared, but I trust this is easy enough to follow, as it predominantly sits between the existing roads and approved lease boundaries.(See Appendix Q).*

Requests to clear the future road to Leases 8 and 9 and quarry will be provided separately as soon as plans are prepared (probably in the coming weeks).

RELEVANT PREVIOUS ETHNOGRAPHIC RESEARCH

Waddy Map (1981)

CMS Linguist Julie Waddy undertook Clan Area mapping in connection with her anthro-ecological studies as part of her PhD thesis. Waddy's research produced a map that generally depicts clan boundaries with a dotted line (Waddy 1984:224). Since the passing of beneficial legislation empowering the return of country to T/Os upon satisfaction of legislatively prescribed requirements, maps depicting indigenous political boundaries have been examined in the courts, scrutinised by expert witnesses, and found to not represent indigenous understandings of their land tenure system. The map does however provide a useful starting point for identifying groups to be consulted about the protection of sites of cultural significance.

An extract of Waddy's Clan map is at Appendix H and an extract of her site map (that underpins Waddy's Clan map) is at Appendix I.

The sites and clan information collated in the Waddy map were recorded directly from informants during a boat survey however Waddy urges caution in relying on the inland clan boundaries depicted on the map with the following:

"The distribution of clan territories is shown but the boundaries indicated can NOT be taken as definitive. While the points on the coast can be agreed upon, the boundaries are by no means definite, firstly, because I have not had the opportunity to check them on land and secondly, because the focus of land ownership is centred on areas of totemic significance; the boundaries are not normally important. Having said that, it would appear from working with Nangurama that clan boundaries on the whole tend to follow watershed boundaries rather than creek boundaries, ... 'territories extend across geographical boundaries such as rivers'. The map is presented for the sake of completeness in allowing clarification and comparison of my data with those of previous workers." (1984:223)

Leeding Map (collated by Hall 2010)

Dr Velma Leeding began her research on Groote Eylandt in 1976 when she was employed as a linguist in Umbakumba. She later extended her area of research to include Angurugu at the request of the Anindilyakwa Land Council. A specific focus of some of her research included clan areas and site identification much of which she undertook remotely using printed maps to locate sites.

Dr Leeding's sites have been mapped by Ben Hall (2010). The map locates and attributes Clan ownership for sites in the west and north of the AOI but provides very little site data for the area east and south of the Angurugu to Umbakumba Road. An extract of Leeding's site map is at Appendix J.

Bland and Pyne 2017.

In 2017 ALC Anthropologists Leslie Pyne and Hugh Bland undertook fieldwork to locate and protect sites in the vicinity of GEMCO's Main Leases. During these consultations senior members of Jaragba Clan and Bara Clan stated that they shared responsibility for their respective estates on Groote Eylandt, including their respective estates on Winchelsea Island.

Palmer (1983 & 2007).

Due to the historical migration of senior Bara Clan members to Groote Eylandt an agreement was made between the Bara and Jaragba clans to share responsibility for country in the North-West of Groote Eylandt, an area that would have been previously associated exclusively with the Jaragba Clan. The circumstance of the migration is recorded by Palmer (2007:4-5) below:

"The area discussed in this Addendum was traditionally the territory of the Jaragba people, who also owned the land around Mukmunja on the northern peninsula of Groote Eylandt. The clan estate extended from the south-west corner of North-West Bay, round the coast, including Winchelsea Island, Bartalumba Bay and the present site

of Alyangula. Its southern boundary is marked by Andungwa Creek. The estate extended inland and probably included the range of hills to the south-east of Alyangula, though my informant was not exact about the location of the inland boundary.

According to tradition, however, many years ago the Jaragba people invited the Bara clansmen to come over from the eastern coast of Bickerton Island, where their estates lay, to help look after the land round Bartalumba Bay. According to this tradition there was one particular old Bara patriarch, who was living on Bickerton Island at this time. However, the food supply on Bickerton then was not very plentiful and the man had to subsist on ariwa, a creeper with a bulbous root (Cayratia trifolia see Levitt 1981:39, who records it as ariyuwa). The Jaragba hoped to provide a better diet for the old man and his family, though there was also an understanding that he would help them 'to look after' the estate. In one version of the story it was also explained that many of the Jaragba men had been killed in spear fights in earlier days, so that their clan was not as numerous as it might otherwise have been.

The descendant in the male line of this old Bara patriarch is Nanka Bara who today has undisputed rights over the whole estate, and in the absence of a strong presence from the Jaragba clan, is charged with the task of assuming a major share of the responsibility for the whole area." Palmer (1983-5, 83-4).

Palmer (2007) then summarises discussions between senior members of the two clans regarding authority over country in the north-west of Groote Eylandt with the following:

"At present it is agreed that the relationship between Jaragba and Bara is productive, friendly and inclusive. Jaragba recognise that if there is a decision to be made about the country then senior members of the Bara clan have to be included in any discussions relating to the reaching of such a decision. Senior men present emphasised that inclusiveness was a requirement of traditional practice. There was an endorsement of current practices in this regard and a desire to ensure that relations between senior Jaragba and Bara clansmen remained strong, as tradition requires them to be." (Palmer 2007:9).

Relevant AAPA Research

AAPA spatial data provided to the ALC shows 2 sites in the vicinity of the Subject Land (SL) (see App K). AAPA designation of the sites are 6170-40 Ceremony Ground and 6170-8 Burial Ground. Correspondence with AAPA established the relevant AAPA field report/s and arrangements were made for HB to inspect the report at the AAPA Darwin office

On 29/10/21 HB travelled to Darwin to view AAPA Report R2012/097 Thompson's Bay Gravel Pits and Access Road, authored by Kipley Nink.

Informants for R2012/097 were Alfred Mamarika, Bruce Wurrawilya, Charlie Bara, Donald Mamarika, Gregory Durilla, Murabuda Wurramarrba, Phillip Mamarika, Sampson Wurrawilya.

The gravel pits that are the subject of the report are located on the western side of the Thompson's Bay Access Road.

Information about Site 6170-40 was provided to Nink by Charlie Bara and the site is described as a "Ceremony Ground" on the western side of Bartalumba Bay. Charlie Bara also provided information about Site 6170-8 which is described as a Burial Ground. Neither site was visited.

The report is focussed on areas in the Central-North of Groote Eylandt and describes the site *Mandayakwamanja* which seems to be the large sandhill on the old road orientation near Umbakumba Airstrip that locals used to call Telstra Hill before the town got mobile coverage.

Thompson's Bay Community is named as *Mawilyumanja* and Nink records an account of the path travelled by *Tatua* the Rainbow Snake which travels from the mainland to Emerald River then up to Bartalumba Bay and on to Thompson's Bay. The billabong at the head of the river which flows into Thompson's Bay is named as *Abalmanja*

The site 6170-40 is also mentioned in the AAPA Report R2012/098 which considers the development of Pole 13, however no further information about the significance, location, or custodianship of the site is provided.

Traditional Ownership of the Research Area.

A review of previous research indicates that the Proposed Development Area is held by Jaragba, Bara and Wurrawilya Clans. Clan lists are at App N and the table below accords Traditional Ownership of the 10 Leases.

A significant portion of the Proposed Development Area is held jointly by the Jaragba Clan and the Bara Clan but there is a small area held by the Wurrawilya Clan that is focussed on the coastal cliff west of Deception Bay. This cliff is associated with the Sea Eagle ancestor and includes the site recorded by Waddy as Yinungwakardamurramanja (See App H & App I). Both Waddy and Leeding record a further site on this ridge named Malyalyungkuwiyida (see App I & App J).

Table 1. Leases and Traditional Owner Clan

Lease	Traditional Owner Clan
1	Bara and Jaragba
2	Bara and Jaragba
3	Bara and Jaragba
4	Bara and Jaragba
5	Bara and Jaragba
6	Bara and Jaragba
7	Bara and Jaragba
8	Bara and Jaragba
9	Wurrawilya
Bio-Security Areas	Bara and Jaragba
Services Corridor	Bara and Jaragba
Pole 7A	Bara and Jaragba

DETAILS OF CONSULTATIONS WITH TRADITIONAL OWNERS

12 Feb 2021. Little Paradise and Bartalumba Bay Project Sites

Traditional Owner Attendance: Silas Bara, David Nelson, Graham Nunggargarlu. **Note – Lionel Jaragba was unable to attend due to a death in Numbulwar.**

Non-Traditional Owner Attendance: Hugh Bland (ALC Anthropologist).

Initial discussions held at Little Paradise oriented the field team to the various projects listed at App A and the results of the field work at App G.

WP041.

The field team walked as far as the Closed Lands sign at WP041 (see App G). An old lady is reported to be buried in the vicinity of the sign. An assessment was made of the distance between the sign and the white stone that comprises the ridge between Ngadumiyerrka (Little Paradise area) and Ngadubartalumba (Bartalumba Bay area). The distance was found to be about 50 metres and the field team considered that a buffer zone of 100 metres should be established between the white stone and the GHAC projects.

WP042.

The field team returned to the Little Paradise access track to consider Project 2 (Winchelsea Mining Workers Camp) which had been proposed to be located on the north side of the access track. Consideration was given to the 100 buffer protecting the white stone and it was decided that the project should be relocated to the south side of the track.

WP043.

This waypoint marks the point at which a small ephemeral creek crosses the access track. In an effort to protect the privacy of the residents of Little Paradise Community that there should be no transit of residents or workers from Projects 2, 3, or 4 past this point. The only exception would be for persons accessing the Little Paradise Jetty.

The Anindilyakwa name for the Little Paradise area is Ngadumiyerrka.

The Anindilyakwa name for the Bartalumba Bay area is Ngadubartalumba.

There are a number of important Dreamings associated with the area of outcropping white stone boulders that is the proposed site of Project 6 (the Resort Lodge): Parrott Fish (Yembirrkwa), Whale, and Dog.

See Instructions 1a & 1b and Maps 1a & 1b above.

16 Feb 2021 ALC Information Meeting re S.19 Leases

Venue – ALC Alyangula Boardroom.

Traditional Owner Attendance: Bradley Bara, Mitchell Bara, Dale Bara, Wilfred Bara, Nigel Bara, Kwennethe Mamarika, Janet Bara, Helen Wurramarrba, Lynelle Wurramara, Catherine Mamarika, Saniva Jaragba, Josetta Jaragba, Margaret Wurramara, Gamarrga

Jaragba, Rita Bara, Sue Bara, Lionel Jaragba, Shaunita Nunggargarlu, Archie Jaragba, Jamie Jaragba, Roderick Bara,

Non Traditional Owner Attendance: Ross McDonald (ALC Mining and Environment Manager), Was Van Zanden (ALC Mining and Environment Project Officer), Hugh Bland (ALC Anthropologist), Bruce Marshall (Winchelsea Mining, Groote Holdings Aboriginal Corporation)

This meeting considered a number of project proposals as follows:

No.	Project	Proponent
1	White rock quarry on Bickerton Island	Winchelsea Mining
2	Winchelsea Mining Workers Camp	GHAC
3	Forestry and Plant Nursery Project	GHAC
4	Solar Farm	GHAC
5	Aquaculture (Trepang) Industrial Area	GHAC
6	Resort Lodge Development	GHAC

Bruce Marshall.

1. Indicates that the workers camp will be located on the southern side of the Little Paradise access road.
2. Says that GEMCO have agreed to buy any excess power from the solar farm.
3. An undersea cable is to go to Winchelsea Island to connect with another solar farm on Winchelsea Island.
4. The location of the Resort Development is within the stone country between Bartalumba Bay and Little Paradise.

Ross McDonald.

1. Speaks to the development proposals and provides images.
2. Advises that any decisions made at the meeting will be non-binding and the projects will be subject of further environmental and cultural surveys.

Hugh Bland briefed the meeting on the instructions received during fieldwork on 12 Feb 2021.

See Instructions 2 above.

3 March 2021. Meeting with Senior Wurrawilya Men.

Venue: Angurugu Aged Care.

T/O Attendance: Russell Wurrawilya, Ronald Wurrawilya, Matthew Wurrawilya.

Non-T/O Attendance: Hugh Bland (ALC Anthropologist).

Bara Clan and Jaragba Clan should be invited along to any meetings because the 3 clans share cultural songs.

The first meeting should just be Bara, Jaragba and Wurrawilya but the second meeting should include jungkayi (MF) and gagu (MM).

People required for further consultations to include: Alfred Mamarika, Graham Nunggargarlu, Henry Nunggamajbarr, Torrence Wurrawilya, Wayne Wurrawilya, Timeus Wurrawilya, Amison Wurrawilya, Roderick Mamarika, Kenny Nunggamajbarr, Jacob Murrungun, Matthew Amagula, Leonard Amagula, Eric Amagula, Abel Lalara, Archie Jaragba, Elliott Bara, Jacob Bara.

18 March 2021. Helicopter survey Re Leases 8 & 9.

T/O Attendance: Flight 1 - Russell Wurrawilya, Ronald Wurrawilya. Flight 2 – Silas Bara, Kenny Nunggamajbarr

Non T/O Attendance: Hugh Bland (ALC Anthropologist)

WP0622. Alabuwa (Parrott Fish).

This site is associated with Alabuwa (Parrott Fish) and the site is located at the western end of a north west facing bay completely enclosed by white stone cliffs. The name applies to the bay west of the clifftop site Yinungwakardamurramanja which is associated with the Sea Eagle. Waddy locates the site Alabuwa on the beach on the north side of the bay and the name is associated with the entire bay area. The area at the eastern end of this beach is considered to be the area most suitable for development.

The western end of the bay includes the outlet of a gorge that has been created by the Alabuwa (Parrott Fish) ancestor. This area is also close to known burial sites at Emingkirriyelukwa (Flat Rocks). The large teeth of the Alabuwa is said to have created the gorge when he ran into the rocks chasing mullet and shrimps. His momentum carried him across the stone escarpment and he then slid back down into sea at Yingiradinumanja creating the creekline that runs through the Alyangula Golf Course.

There is a site called Amakilyejirra located on the north east coast of Bickerton Island that is also associated with Alabuwa (refer Leeding site map at App F) and marks the path that the ancestor took on his journey from Windanga in Murrungun country. At this stage of the journey the Alabuwa were yimilyiyarra (young ones).

The path of the Alabuwa is important for Bara Clan funerals.

The yimilyiyarra Alabuwa travelled around Winchelsea and went past the old ceremony site Amalyikba at the mouth of the Edward River.

There is a big reef called Namawurra north of the site Amalyikba that is associated with the Dog Dreaming.

It is generally considered that the eastern end of the bay is available for development while the western end is to be protected. A line has been drawn on the map at Appendix M to depict this notional boundary.

The cliff line around the bay is considered to possibly contain burials so a 100 metre buffer applies to this cliff line.

The west side of Deception Bay is free of sites of cultural significance and is available for development of a workers camp.

Please note: Previous consultations on unrelated development proposals have indicated that the beach on the western shore of Deception Bay will be reserved for community use only.

The western end of the coastal ridge west of Deception Bay associated with the Sea Eagle (Yiningakarda) ancestor and upon which the site Yinungwakardamurramanja is located, is free of sites of cultural significance and is available for the resort development.

See Instructions 3 and Map 2 above.

19 March 2021. Meeting at Angurugu Mens Shed Re Leases 8 & 9.

T/O Attendance: Anthony Lalara, Gino Lalara, Eric Amagula, Abel Lalara, Lionel Jaragba (T/O and ALC CLO), Russell Wurrawilya, Ronald Wurrawilya.

Non T/O Attendance: Hugh Bland (ALC Anthropologist, Ian O'Malley (ALC Mens Shed Coordinator).

Hugh Bland and Lionel Jaragba provided an overview of the suite of developments proposed by GHAC for the areas east and west of Deception Bay. Ian O'Malley provided further details of the Forestry/Milling Project being proposed in the area designated as Solar Farm at Appendix A.

Wurrawilya and Jaragba share responsibility for the Sea Eagle Dreaming and they agreed that development of the western end of the clifftop site for a Lodge Resort would not damage the site Yinungwakardamurramanja.

The meeting agreed that the Area of Interest mapped at Appendix B is free of sites of cultural significance.

Access to the beach immediately below the northern cliffline of Lease 9 ridge should be restricted to protect the known burial sites at the eastern end of the beach.

The meeting suggested that the instructions be communicated to both Roderick Mamarika and Thomas Amagula who are important senior jungkayi.

See Instructions 3 and Map 2 above.

16 September 2021 Internal ALC Discussions AAPA Sites near Leases 8 & 9.

During discussions with Ross McDonald (ALC Mining & Environment Manager) and subsequent inspection of AAPA data files held by ALC, it became known that there were 2 AAPA recorded cultural sites in the vicinity of Leases 8 & 9 (see App M).

AAPA site 6170-40 (described as a ceremony ground) is situated within Lease 8, while site 6170-4 (a burial ground) is located immediately north of Lease 9 and had been identified during early fieldwork.

Initial consultations with senior ALC Anindilyakwa staff gave a range of views with Tony Wurramarrba saying his father had not told him about 6170-40 while Lionel Jaragba thought the site might be associated with the route of the Arawaltja Ceremony, a pre-mission ceremony indigenous to Groote Eylandt.

Further information would be required before the protection of 6170-40 could be assured and HB undertook to:

1. Inspect AAPA report R2012/097 which originally recorded site 6170-40
2. Undertake fieldwork with senior ceremony men to establish the nature of the site and to confirm the site parameters.
3. Access to Leases 8 & 9 was initially proposed to be via the sandstone plateau (see Appendix G) however T/Os asked that upgrading of existing access tracks be investigated so HB also undertook to draft an access route to Leases 8 & 9 which followed existing 4WD tracks around the southern shoreline of Bartalumba Bay.
4. HB to take instructions from T/Os and senior ceremony men about what measures might ensure the protection of the site in the context of developments

within Lease 8 on the escarpment above the site, including the establishment of an access route to Lease 8 and on to Lease 9.

29 September 2021. S.19 Information Meeting

A meeting was convened on 29/9/21 to provide information to relevant community members about the 10 GHAC Projects which would be subject of a S.19 Lease to GHAC. The table below and the accompanying notes record the outcome of the S.19 Information Meeting.

Instructions 4.

- 12. Lease 1 – Consent given**
- 13. Lease 2 – Consent given**
- 14. Lease 3 – Consent given**
- 15. Lease 4 – Consent given**
- 16. Lease 5 – Consent given**
- 17. Lease 6 – Consent given**
- 18. Lease 7 – Consent given**
- 19. Lease 8 - Provisional consent given subject to further site protection research by ALC Anthropologists and further identification of a T/O approved access route.**
- 20. Lease 9 – Provisional consent given subject to further site protection research by ALC Anthropologists and identification of an Access Route approved by T/Os.**
- 21. Note that the T/Os of Lease 9, the Wurrawilya Clan, were not at the meeting.**
- 22. No instructions received. This lease required further consultation with Malkala senior community members who were not at the meeting.**

- In response to enquiries about the upgrade of the access roads to the development sites RMCD advised that the meeting are able to make their consent conditional upon the upgrade of the roads to both Bartalumba Bay and Little Paradise Satellite Communities.
- This meeting agreed that the instructions listed above should be made conditional upon the upgrade of Access Roads to both the Bartalumba Bay and Little Paradise Satellite Communities.
- The above instructions were given by consensus.

14 October 2021. Field visit to Lease 8 to confirm location of AAPA site 6170-40.

Following discussions with Lionel Jaragba, Archie Jaragba and Silas Bara a field visit to Lease 8 was arranged, however Lionel Jaragba was unavailable on 14/10/21.

HB drove Silas Bara and Archie Jaragba to Bartalumba Bay initially to consult with senior community member Melva Wurramara (MWs recently deceased husband B Bara had been the senior T/O for the Bartalumba Bay Community).

Melva was initially sceptical but agreed that the confirmation of the site was necessary.

- This initial field visit was intended to establish the condition of the track and to scope whether there were any impediments to future field visits. The intention was to drive around to the western side of Deception Bay to the most northern part of the proposed Lease 8.
- The field party drove into **WP081** where the jungle vegetation transitions back to open eucalypt woodland, then returned to the drainage line at **WP082**, then back to WP083 which is located close to where the white stone ridge comes close to the shore of Deception Bay (see Map of Waypoints at Appendix N).
- Although **WP083** is close to the AAPA site 6170-40 and the white stone was clearly visible from the track Archie and Silas did not want to investigate the area until the AAPA Report R2012/097 had been assessed by HB.
- The track was in good condition despite some early wet season storms.

T/O Attendance: Silas Bara, Kenny Nunggumajbarr, Bradley Bara, Clint Bara.

Hugh Bland (ALC Anthropologist),

During pre-field briefing consultations Kenny Nunggumajbarr reviewed the AAPA mapping of site 6170-40. He then consulted his father Henry Nunggumajbarr by phone and related that there were 2 sites designated for use as ceremony sites near Deception Bay.

- The site 6170-40 has been mapped correctly
- A second site near Little Paradise Community was intended to be used but the senior man “got too weak” and the site was not used, however there is a Sacred Site sign erected to mark the area (see 0412 at Appendix B).
- Silas further advised that an important Mens Ceremony Dreaming associated with initiation rituals starts at the Allabuwa (Parrott Fish) site (See site 0622 at Appendix H), goes across to Connexion Island, then down to South Point. This Dreaming also manifests within Deception Bay as a white stone ridge that extends into the bay on the western side.

15 November 2021. Helicopter survey of all GHAC leases.

A series of 3 helicopter overflights were conducted to review 4 work programs in NW Groote Eylandt as follows:

- Dredging of the Alyangula Port Barge Landing
- Review of the 10 GHAC Project Leases
- Review of the sites proposed for the GHAC Aquaculture Program crayfish project
- Review of the Winchelsea Mining 2022 Work Plan

Traditional Owners consulted were: Elliott Bara, Nesman Bara, Silas Bara, Elvis Bara, Archie Jaragba.

No site protection issues were identified during the overflights of the GHAC Leases.

17 November 2021. Helicopter overflight of GHAC West Deception Bay projects (also of Winchelsea Mining proposed works).

A series of 2 helicopter overflights, following the same route as the 15/11/21 flights, were conducted to review 4 work programs in NW Groote Eylandt as follows:

- Dredging of the Alyangula Port Barge Landing
- Review of the 10 GHAC Project Leases
- Review of the sites proposed for the GHAC Aquaculture Program crayfish project
- Review of the Winchelsea Mining 2022 Work Plan

Traditional Owners consulted : Silas Bara, Kenny Nunggumajbarr, Bradley Bara, Clint Bara.

During pre-flight consults at Little Paradise Kenny Nunggumajbarr (grandson of Nengka/Nanga Bara and “caretaker” for the Deception Bay area) reviewed maps showing GHACs leases and then phoned his father Henry Nunggumajbarr to discuss Leases 8 & 9. Kenny provided the following information:

1. There are 2 significant sites in the vicinity of Deception Bay.
 - a. The site identified by Charlie Bara – 6170-40
 - b. The site close to Little Paradise Community which was intended to be used by the old men, however the senior man had become too weak.
 - c. There is a Dreaming Track associated with Circumcision Ceremony that travels from the site Allabuwa (Parrott Fish) (see waypoint 0622 at App H) cross to Connexion Island and then to South Point. This Dreaming also manifests inside Deception Bay as a white stone ridge that extends into the bay on the west side of Deception Bay.
 - d. A site visit to 6170-40 was requested and the following are to be invited to attend: Bradley Bara, Kenny Nunggumajbarr, Lionel Jaragba, Archie Jaragba, Silas Bara, Nesman Bara, Elliott Bara, Elvis Bara.

30 November 2021. 1st Field Trip to Ceremony Ground 6170-40.

T/O Attendance: Kenny Nunggumajbarr, Henry Nunggumajbarr (by phone), Grant Nundhirribala (by phone).

ALC Attendance: Hugh Bland.

KN and HB proceeded to 6170-40 as depicted on the AAPA report where phone contact was made with HN and GN.

WP0992 (see App L).

- The area is a sandbank adjacent to the mangroves, with very little vegetation and a couple of substantial paperbark trees.
- The site is an old Kunapipi Ground and access should be restricted to MEN ONLY.
- The trees should be fenced off and a sacred site sign erected between the access track and the site.
- The paperbark trees on the site are associated with the Dugong Dreaming.

- It is at this site that Mandiwala (central figure of the circumcision ritual) saw the Dugong.
- The sandbank on which the trees sit is part of the site.

See Instructions 5 and Map 3 above.

WP1002.

This marks the point 20 metres from the rocky ridge where the access track could be realigned to protect the site 6170-40.

1 December 2021. 2nd Field Trip to Ceremony Ground 6170-40.

T/O Attendance: Silas Bara, Kenny Nunggumajbarr, Bradley Bara, Lionel Jaragba, Elliott Bara, Henry Nunggumajbarr (by phone), Grant Nundhirribala (by phone).

ALC – Hugh Bland. GHAC – Mark Hewitt (Mark was not present when T/Os gave site protection instructions).

WP1012.

This waypoint marks the small grove of significant paperbarks that are the central feature of the site. The Songline that starts at this site can also start at the South Point site Murrungurru which is in Wurrawilya Clan country.

- The site should be fenced along the edge of the access track
- Sacred site signs should be erected.
- No development should take place north of the access track.

WP1022 marks a rock art site at the base of the rocky ridge.

WP1032 marks another rock art site at the base of the adjacent rocky ridge. Motifs include a small hand stencil, and a dolphin speared with a hook spear.

See Instructions 6 and Map 4 above.

15 February 2022. Helicopter Field Trip to Burial Ground 6170-8.

T/O Attendance: Silas Bara, Kenny Nunggumajbarr, Matthew Wurrawilya, Lionel Jaragba, Abel Lalara, Ronald Wurrawilya, Matthew McKenzie.

ALC – Hugh Bland. GHAC.

A series of 3 helicopter flights brought the field team to WP107 which is located on the western end of the beach near the site marked by AAPA as 6170-8.

The name of the beach is Yinungwakardamurramunja (consistent with App.H & App.I).

- At this beach the Stingray ancestor Yimaduwaya (generic young stingray) was looking for a place to stay but at this spot he heard the “Devil” Spirit which was carrying Dambul (ceremonial stick with feathered string) singing (a sound like thunder).
- Dambul had come from Ayawurra (Warnungwadabalangwa / Bara Clan site in north-west Bickerton).
- Bara and Mangurra Clans are closely related because they share country at Walker River.
- When Yimaduwaya left the Yinungwakardamurramunja area he travelled east and made the channel between Winchelsea Island and Groote Eylandt.
- There is a sacred cave close to WP107 that is associated with a “warrior” spirit. If a man was to spend too much time “smelling” the warrior spirit emanating from the cave then they would become “cranky” (angry).
- Warnamamalya (Aboriginal people from Groote Arch) use the beach but women should not go into the bush behind the beach.
- The rocky foreshore below the cliff encompassed by Lease 9 is associated with the ancestor Yantarnga (Central Hill). At this site the younger brother” of Yantarnga drifted out to the north to become Arrkarngka (Brady Rock).

See Instruction 7 and Map 5 above.

10 March 2022. Field Trip by 4WD to Inspect Marina Biosecurity Area, Laydown Area, Aquaculture Outlet Pipeline, and Services Corridor.

T/O Attendance: Kenny Nunggumajbarr, Lionel Jaragba (consulted at ALC Alyangula).

Attendance Notes: The recent death of a senior lawman and

Field team (KN and HB) stopped at the turn off from the Rowell Highway onto the Bartalumba Bay Access Road where the orientation (east side of the road only), purpose, impact, and extent of the proposed Services Corridor was discussed. We then proceeded to the Little Paradise turnoff and followed the road out to the Little Paradise Jetty. Enroute there was some discussion about the type of development that would be required to traverse the three small ephemeral watercourses that flow across the Service Corridor. Kenny considers the burial of pipelines and/cables to be the preferred option.

While travelling along the road adjacent to Lease 2 the proposed Aquaculture Project Outlet Pipeline was considered.

After passing Lease 1 we crossed the 2 small creeks and passed through the Little Paradise Community Gate. We stopped and considered the extent, impact, and purpose of the Laydown Area and then the Biosecurity Area. KN understands that these areas will need to be fenced and that community will not have access to these areas once the S.19 has been granted and the projects implemented.

At the jetty we discussed the works required to upgrade the jetty and we considered the rusting iron that is the remains of a wharf that the Kailis Prawn Factory had proposed.

The rusting iron appears to be in two sections and KN says the remains have no sentimental value for the community and can be removed.

Lionel Jaragba had been unable to attend the field trip due to travel arrangements to attend Royal Darwin Hospital to visit a senior lawman in the Palliative Care Unit (this man passed away overnight). Upon return to the ALC Alyangula Office the instructions given by Kenny Nunggumajbarr were reviewed by Lionel Jaragba and confirmed.

INSTRUCTIONS 8

- | |
|--|
| <ol style="list-style-type: none">5. There are no cultural sites that will be impacted by the proposed works.6. The Services Corridor is allowed to traverse the RWA on the eastern end of Lease 1.7. To traverse any watercourses cables and/or pipelines within the Services Corridor should be buried.8. The rusting iron structure at the Little Paradise Jetty can be removed. |
|--|

7 July 2022. Pole 7A Workers Camp.

On 7 July 2022 a request was received from GHAC Project Manager Brent Woods for a site protection survey over an area (see map at Appendix R) that was being considered as a site for a workers camp.

The following details of the project were provided:

- Clearing to be as minimal as possible leaving maximum vegetation where possible.
- Power supply proposed to be an extension of the feed into the ALC housing subdivision at pole 7
- Water supply tapped into existing water feed from Alyangula supply that feeds pole 7 .
- Proposed access to the site to be a continuation of Telstra hill road that links in with pole 7 development .
- The vision is a 2-hectare allotment within the boundaries depicted at Appendix R with the final site to be confirmed following a site assessment.

History and any previous relevant consultations

As detailed above, previous research indicates that the Bara Clan migrated from Bickerton Island to Groote Eylandt prior to the establishment of the CMS Mission at Emerald River in 1921, and that Jaragba Clan entered into an arrangement with the Bara Clan to share responsibility for country in the north-west of Groote, including the area of the proposed development at Pole 7A. This arrangement to share country continues to the present so Custodian/Traditional Owner consultations included senior members of both clans.

Details of Fieldwork

7 July 2022. Field trip to Pole 7A Development Site

Hugh Bland undertook consultations with Silas Bara, Scott Wurramarrba and Lionel Jaragba. Scott Wurramarrba was included in the field survey group to facilitate access to the Subject Land which required transit through a locked gate.

The map at App A was discussed with specific focus on the development area outlined in red and shaded in blue. There is a 50 metre buffer set aside between the proposed development and the existing ALC housing at Pole 7.

Specific discussions were held about the clearing of vegetation. Although the development proposal indicates minimal clearing there is a possibility that up to 2 hectares may need to be cleared. In addition to the possible impact upon sites of cultural significance, Custodians/ Traditional Owners were asked to consider both the extent of the veg clearing and whether specific tree species needed to be protected.

INSTRUCTIONS

The site is considered to be free of sites of cultural significance (including significant vegetation) and the development proposal is approved.

28 Feb 2023. Consent Agreement Meeting

Venue: Angurugu Police Station Community Meeting Room.

ALC Staff attendance: Hugh Bland (Anthropologist), Hannah Moody (Anthropologist), Cherie Forbes (Manager Preserving Culture Dept), Tracy Thompson (Operations Assistant), Kamila Gould (Executive Assistant).

Meeting started at 10.00 am.

Hugh Bland and Hannah Moody welcomed the attendees and explained the purpose of the meeting including how the Consent Agreement links the Cultural Survey Report with the AAPA Authority Certificate.

Although attendance was impacted by a funeral, which had been scheduled for 27 Feb but had been cancelled due to heavy rain, everyone agreed that attendance was sufficient to allow the meeting to proceed, and that ALC Anthropologists could consult absent senior people after the meeting.

Hugh Bland and Hannah Moody then spoke to a PowerPoint presentation that:

- a) located the parcels of land that GHAC wish to develop (the Subject Land),
- b) described the pre-fieldwork collation of existing ethnographic data relating to the Subject Land,
- c) detailed the conduct of site protection fieldwork and consultations with senior Custodians of the Subject Land,

- d) explained the role that AAPA play in protecting culturally significant sites and the function of the Consent Agreement, and
- e) depicted the site protection regime.

Following the PPT Custodians/Traditional Owners of the Subject Land were asked to consider whether the site protection regime was appropriate and if so, for relevant people to sign the Consent Agreement (see Appendix S).

After a short break senior people for the 3 clans then indicated that the meeting had supported the proposed site protection regime by consensus and the then clan members moved to the signing of the respective Consent Agreement signature panels.

REFERENCES

AAPA (2012). Report R2012/097 'Thompson's Bay Gravel Pits and Access Road', authored by Kipley Nink.

Bland, H., & Pyne, L. (2017). *ALC Cultural Heritage Survey of GEMCO Western Leases and SPLs*. Retrieved from Alyangula, Groote Eylandt:

Leeding, V.J., 2010. 'Groote Eylandt Geographical Names 1A'. Unpublished, ALC.

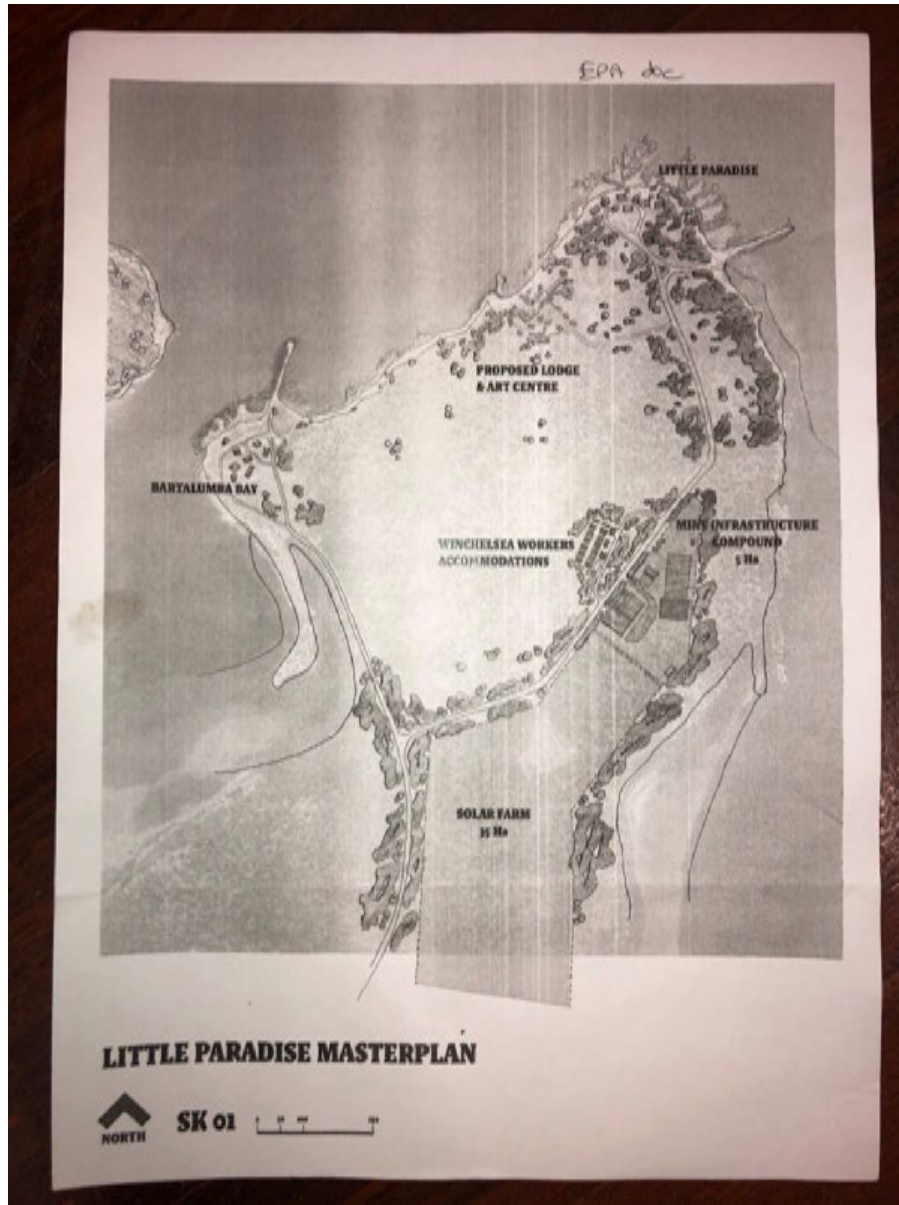
Palmer, Kingsley, 1983., 'A Report Prepared in support of an Application to Control Entry onto Seas Adjoining Aboriginal Land', prepared on behalf of the Umbakumba Aboriginal Community and Other Traditional Owners.

Palmer, Kingsley, 2007. 'Areas of Cultural Significance, Southern Groote Eylandt', ALC.

Waddy, Julie, 1981. 'Coastal Place Names of Groote Eylandt', Informants - Peter Nangurama Wurrawilya, Alec Narrijanga Bara Bara, and David Mamarika. Digitised by Ben Hall, Judy Lalara, and Sibella Herbert in 2012. ALC.

APPENDICES

Appendix A. Initial Development Proposal Masterplan for GHAC Resort.



Appendix B. Area of Interest as at 26 Feb 2021



Appendix C. Draft Proposed Hatchery Development Proposal (supplied by Paul Capon on 18 March 2021).



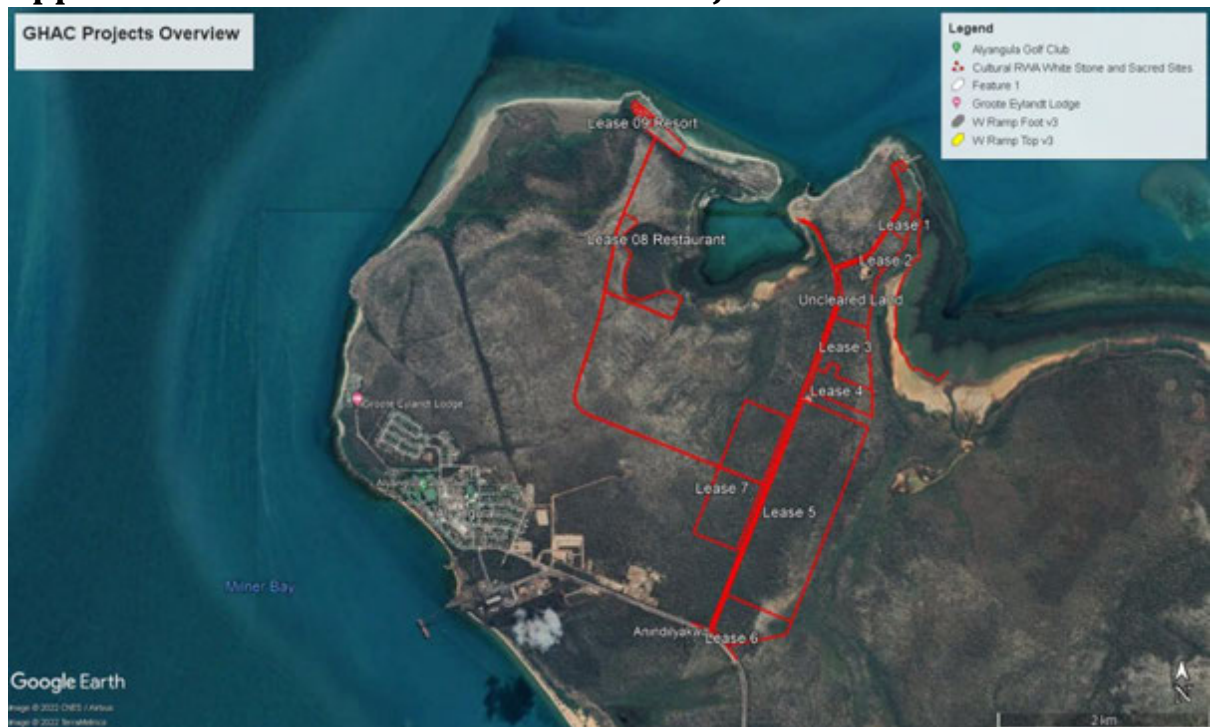
**Appendix D. Final Area of Interest as at 2 June 2021 (supplied by
Bruce Marshall).**



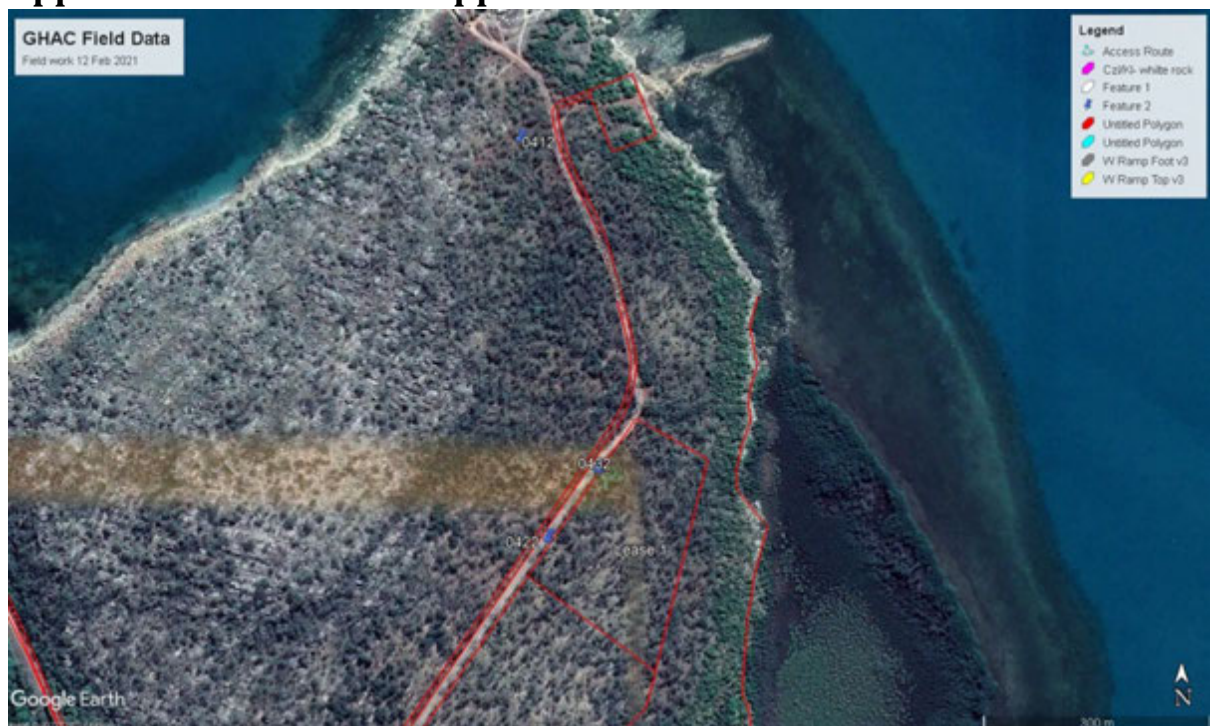
Appendix E. GHAC Development Plans along the access roads to Bartalumba Bay and Little Paradise satellite communities.



Appendix F. Final Consolidated GHAC Projects 5 October 2021.



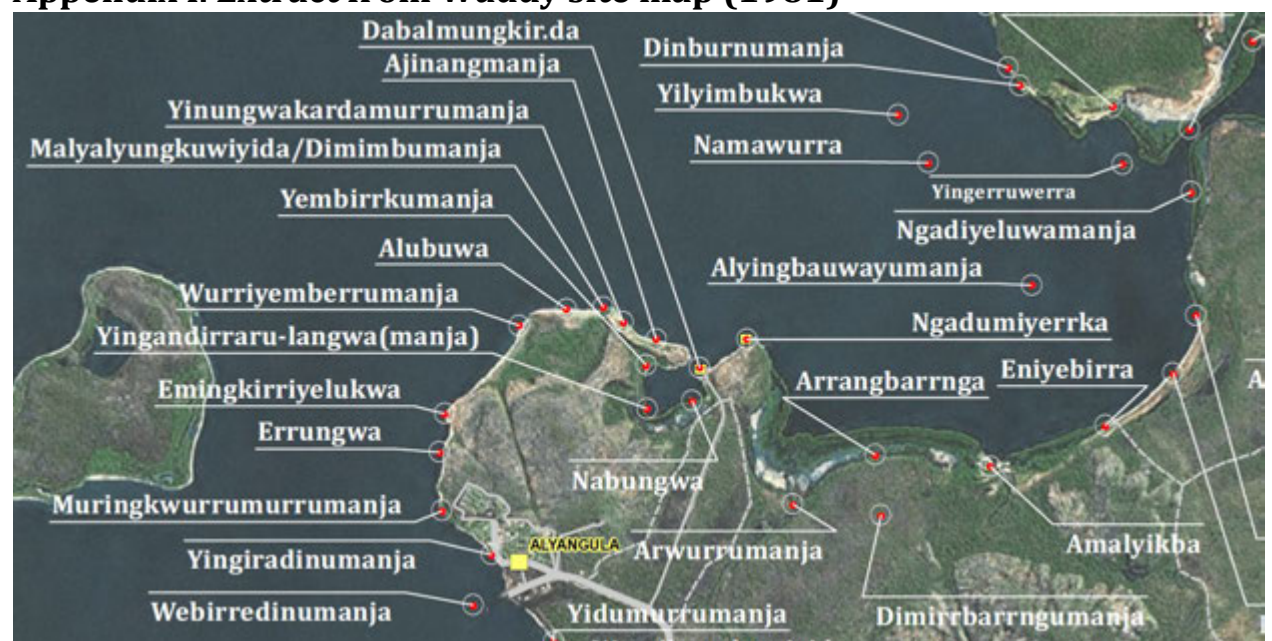
Appendix G. Field data mapped from 12 Feb 2021.



Appendix H. Extract from Waddy clan Map (1981).



Appendix I. Extract from Waddy site map (1981)



Appendix J. Extract from Leeding site map (1976-2010).



Appendix K. GHAC Projects Leases 8 & 9 showing AAPA Sites.

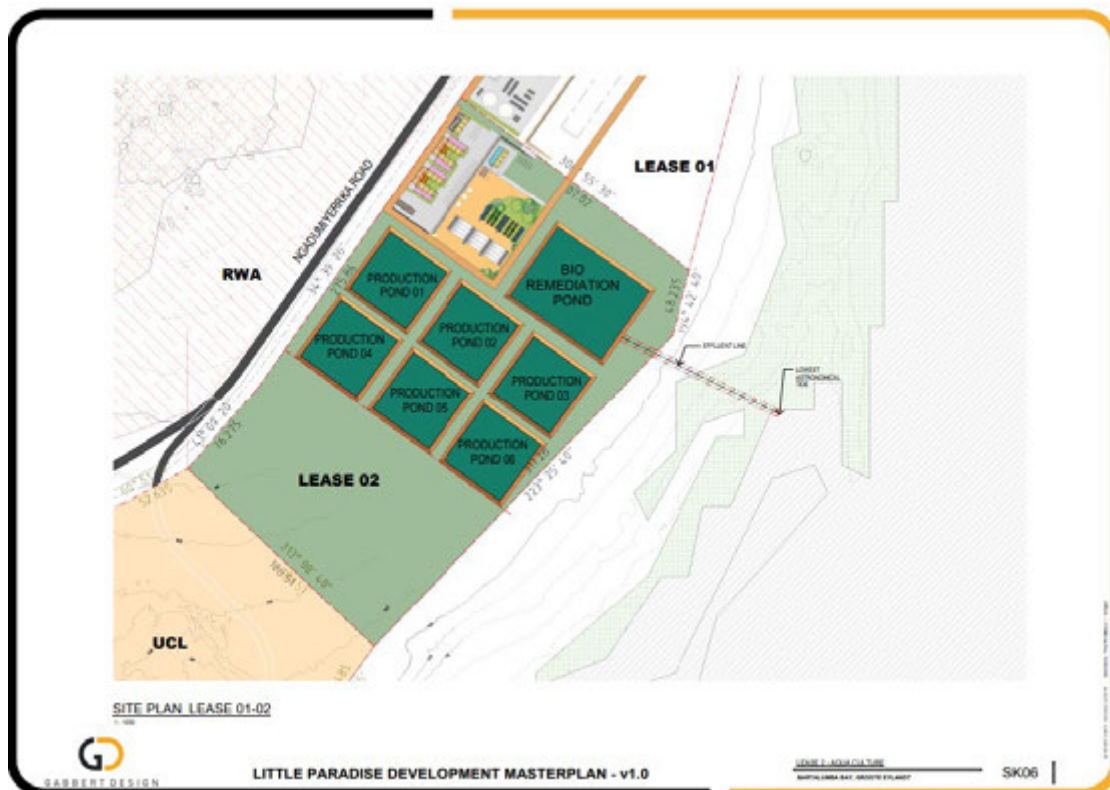


Appendix L. Field Survey Sites Deception Bay Oct 2021

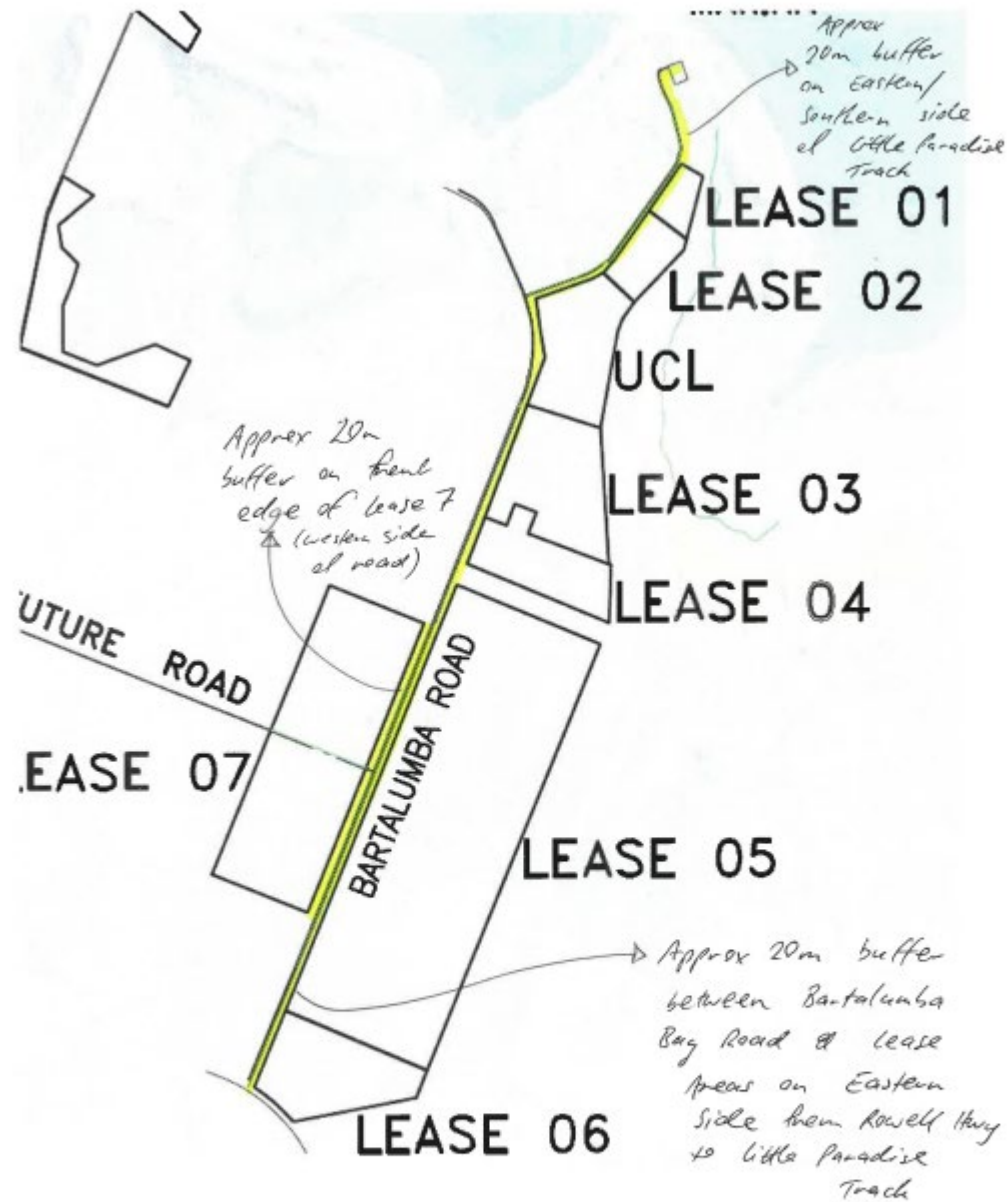


Appendix M. Mapped Field Data 18 March 2021.





Appendix Q. Map Services Corridor.



- Proposed Services Corridor - Mud Map
(road expansion/upgrades, access, cables, pipes, etc)

Appendix R. Map - Pole 7A Workers Camp



APPENDIX S. AAPA CONSENT AGREEMENT SIGNED BY CLAN MEMBERS.



**Custodian Consent Agreement under section 22(1)(b) of the
Northern Territory Aboriginal Sacred Sites Act 1989 (NT)
(the 'Sacred Sites Act')**

Applicant: Groote Holdings Aboriginal Corporation ('GHAC')

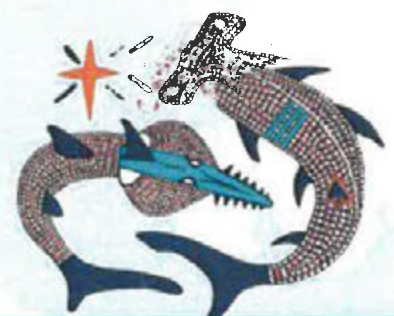
Project: GHAC Consolidated Projects: Leases 1-9, Pole 7A Workers Camp, Biosecurity Areas X 2, Services Corridor - located in the North West of Groote Eylandt ('Little Paradise Logistic Basecamp')

Project subject land: see Authority Certificate application subject land at *Attachment A*

Description of Project works in Authority Certificate application:

Development/ residential subdivision works comprising township development and expansion, including:

- residential area;
- community use area;
- service commercial area,
- open space area;
- utility purposes area;
- earthworks and site works;
- construction of new buildings, demolition, refurbishment or upgrade of existing buildings;
- power stations;
- sewerage ponds;
- bore fields;





- rubbish dumps;
- gravel pits;
- barge landing;
- aerodrome;
- reticulation of engineering and telecommunication services;
- roads, pathways, cycle ways and associated drainage, lighting and signage;
- vegetation management including land clearing, tree trimming, planting, streetscapes and landscaping;
- tree removal; and
- dams /watercourse upgrades, water use and access, drains, reserves.





Anindilyakwa Land Council ('ALC') Acknowledgement

ALC acknowledges and agrees;

- (a) that it has engaged research anthropologists to assist with the consultation requirements set out in section 19F of the Sacred Sites Act;
- (b) that it is the representative body for Custodians of Sacred Sites at substantive risk of damage or interference as a result of the proposed Project; and
- (c) that an agreement has been reached between the Applicant and the Custodians for this Project in accordance with section 22(1)(b) of the Sacred Sites Act.

Mr Mark Hewitt

ALC Chief Executive Officer

Signature:

Date: 23/02/2023

Witness Name:

Kamila Gould

Witness Signature:

Mobile Number:

0436 930 960

Date:

23/02/2023

ALC Research Anthropologist Acknowledgement

ALC Anthropologists acknowledge and agree that;

- (a) The people identified as custodians for the purpose of consultation are all people properly regarded as Aboriginal Custodians for those Sacred Sites at substantive risk of damage or interference as a result of the proposed Project.
- (b) the description of works contained in the Authority Certificate application for the Project have been described and explained to Custodians;
- (c) custodians have been consulted with about the protective conditions necessary to ensure sacred sites remain sufficiently protected while works for the proposed Project are undertaken;
- (d) the protective conditions recommended by custodians have been recorded in the attached Cultural Survey Report; and





- (e) the Cultural Survey Report has been prepared for the purpose of informing the development of Authority Certificate conditions for an Authority Certificate that will be issued in accordance with this agreement and the requirements of section 22(1)(b) of the Sacred Sites Act.

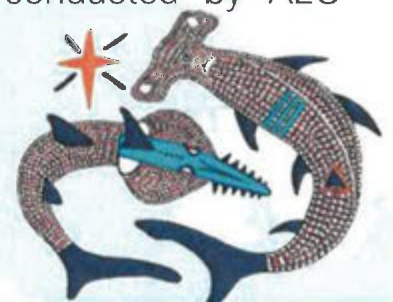
Date	Report presented by	Signature
7/3/23	HUGH BLAND	

Terms of Custodian Consent Agreement

We, the undersigned members of the **Bara Clan, Jaragba Clan** and **Wurrawilya Clan**, are both the Traditional Owners for the Project subject land and Custodians of Sacred Sites on and in the vicinity of the Project subject land.

The Project is the subject of an application under section 19B of the Sacred Sites Act, and we acknowledge and agree that:

- the ALC is the representative body for Traditional Owners of the Groote Archipelago.
- ALC is also the representative body for Custodians of Sacred Sites on or in the vicinity of the Project subject land at substantive risk of damage or interference as a result of the proposed Project;
- ALC has engaged anthropologists to consult with custodians and explain the effect of the works proposed for the Project application.
- Aboriginal Areas Protection Authority ('AAPA') and ALC have our consent for consultations on the proposed Project to be conducted by ALC





anthropologists for the purpose of satisfying consultation requirements under section 19F of the Sacred Sites Act.

- the site protection arrangements recorded and mapped in the Cultural Survey Report for this Project are consistent with the instructions we have given to the ALC.
- the site protection conditions recorded and mapped in the Cultural Survey Report would be sufficient to protect those sacred sites at substantive risk of damage or interference as a result of the proposed Project.
- the Cultural Survey Report will be lodged with AAPA for the purpose of assessing whether it contains sufficient information to issue an Authority Certificate for the proposed Project application.
- all people properly regarded as Aboriginal Custodians for the Sacred Sites substantively at risk of damage or interference as a result of the proposed Project, have understood and assented to this agreement.
- Once AAPA is satisfied, it will issue an Authority Certificate under section 22(1)(b) of the Sacred Sites Act that permits the Applicant to proceed with the description of works proposed in the Authority Certificate application for the Project.





JARAGBA CLAN MEMBERS

Date	NAME	SIGNATURE
28/2/23	Deanne Jaragba	Deanne Jaragba
28.2.23	JoSetta Jaragba	JoSetta Jaragba
28.2.23	Candice Jaragba	candice Jaragba
28.2.23	Archie Jaragba	Archie Jaragba
28.2.23	Lionel Jaragba	Lionel Jaragba
28.2.23	Trinisha Jaragba	Trinisha Jaragba
28.2.23	Neilda Jaragba	NJ





WURRAWILYA CLAN MEMBERS

Date	NAME	SIGNATURE
28/3/2023	Karlynne Wurrawilya	Karlynne Wurrawilya
28.2.2023	Vanessa Wurrawilya	Vanessa Wurrawilya
28.2.2023	ELSIE Wurrawilya	ELSIE Wurrawilya
28-2-2023	Russell Wurrawilya	Russell Wurrawilya
28.2.2023	Matthew WURRAWILYA	Matthew Wurrawilya
28.2.2023	Amisol WURRAWILYA	Amisol WURRAWILYA
28.2.2023	SAMMY WURRAWILYA	SAMMY WURRAWILYA
28-2-2023	LORETTA WURRAWILYA	Loretta Wurrawilya
28.2.2023	JULIA Wurramariba	JULIA Wurramariba
28.2.2023	Reonita Amagula	
28/3/2023	Darryl Bawa	D. Bawa
28/3/2023	Carlos Bawa	C. Bawa
1/3/23	Menni Mamingamanja	M Mamingamanja

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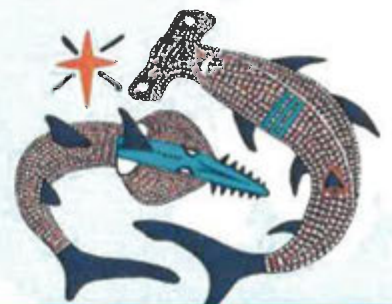
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BARA CLAN MEMBERS

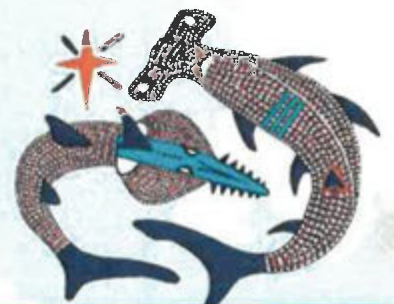
Date	NAME	SIGNATURE
28/2/24	Roderick	Bara
28/2/23	Janet	Bara
28/2/23	JEAN	BARA
28/2/23	Kenneth mamamika	mamamika
28/2/23	Rita Bara	Rita Bara
28/2/23	MARZARA BARA	MARZARA
28/2/23	Edith Bara	Edith Bara
28/2/23	Kakiene Bara	Kakiene Bara
28/2/23	Karena Bara	Karena Bara
28/2/23	DAVID NELSON	DAVID NELSON
28/2/2023	JOANN NELSON	JOANN NELSON
1/3/23	ELVIS Bara	E Bara
1/3/23	SILAS Bara	S Bara





JARAGBA CLAN MEMBERS

Date	NAME	SIGNATURE
2/8/23	Basil Bawa	Basil Bawa
2/3/23	Nelson Bawa	





BARA CLAN MEMBERS

Date	NAME	SIGNATURE
28/3/2023	Sue Bara	Sue Bara
28/3/2023	Edna Bara	E. Bara
28/3/2023	Karlson Bara	K. Bara
28/3/2023	RACHEL BARA	R. BARA
Stanley	SBARA Stanley	SBara
28/2/23 David	David Wilson David Wilson	D Nelson
28/2/23	Kaklene Bara	K Bara
28/2/23	Karena Bara	KB
28/2	JOANNE NELSON	JN
28/2/23	Elcrista Bara	E Bara
28/2/23	MARZARA BARA	MB
28/2/23	Russell Bara	RB
28/2/23	Camille Bara	CB
28/2/23	Freda Wurramarba	FW



CLAN LISTS FOR JARAGBA CLAN, BARA CLAN & WURRAWILYA CLAN.

Note: The names of senior Clan members who will be important decision makers are shown in **bold font**. Efforts should be made to advise meeting details to these people.

Note of caution - Names of children are shown indented below their respective parents, some of whom are deceased (shown in strikethrough font). Cultural protocol dictates that if it is necessary to speak the names of deceased people reverent tones should be used ie. **spoken softly**.

This TOID list may incorrectly show the names of deceased persons as living and may not include some lower generation clan members.

These lists have been compiled for the purpose of these specific consultations and are **not intended to be complete clan lists**.

A patrilineal connection to country is through the namira (father's father / FF).

A matrilineal connection to country is usually through the jenjenja (mother's father / MF) but may also be reckoned through classificatory or ceremonial links. Usually called jungkayi.

CLAN: Jaragba

Name	Community	Connection to Country
Lawrence Jaragba (Dec'd)		
Muriel Jaragba (Deceased)		
Gyselle Amagula		Matrilineal / Jungkayi
Terrence John Mamarika		Matrilineal / Jungkayi
Lionel Jaragba	Alyangula	Patrilineal (FF)
Lucina Jaragba	Angurugu	
Jestinal Jaragba	Numbulwar	
Louisa Ann Jaragba		
Mervin Jaragba		
Wilma Jaragba	Angurugu	Patrilineal (FF)
Priscelle Roberts		Matrilineal / Jungkayi
Relton Roberts		Matrilineal / Jungkayi
Jolene Roberts		Matrilineal / Jungkayi
Elaine Jaragba (Deceased)		
Campbell Wurramarrba		Matrilineal / Jungkayi
Jamieson Wurramarrba		Matrilineal / Jungkayi
Elisiah Nawari		Matrilineal / Jungkayi
Steven Wasagi		Matrilineal / Jungkayi
Saniva Jaragba		
Tanya White		
Vanessa White		
Jayden White		
Renay White		

Damiya Jaragba (Deceased)		
Thomas Amagula	Alyangula	Jungkayi for Jaragba and Wurrawilya
Saniva Jaragba	Angurugu	Patrilineal (FF)
Lillian Jaragba	Yenbakwa / Angurugu	Patrilineal (FF)
Nenunwurnda Jaragba (Dec'd)		
Archie Jaragba	Umbakumba	Patrilineal (FF)
Annette-Lorraine		Patrilineal (FF)
Josetta Jaragba		Patrilineal (FF)
Candice Jaragba		Patrilineal (FF)
Jeosephat Jaragba		Patrilineal (FF)
Trinesha Jaragba		Patrilineal (FF)
Cedric Jaragba	Umbakumba	Patrilineal (FF)
Jamie Jaragba	Umbakumba	Patrilineal (FF)
Deanne Jaragba		
Keiran Jaragba	Umbakumba	Patrilineal (FF)
Walter Jaragba (Dec'd)		
Doreen Jaragba	Gove	Patrilineal (FF)
Glen Jaragba	Umbakumba	Patrilineal (FF)
Shannen Walter Jaragba		Patrilineal (FF)
Junior Jaragba		Patrilineal (FF)
Lynnisha Jaragba	Umbakumba	Patrilineal (FF)
Gregory Jaragba	Umbakumba	Patrilineal (FF)
Antonia Jaragba		Patrilineal (FF)
Lorna Jaragba		Patrilineal (FF)

CLAN:Bara

Name	Community	Connection to Country
Brian Bara (Deceased)	Bartalumba Bay	Patrilineal
Nathan Bara		Patrilineal
Roy Bara		Patrilineal
Desley Amagula		Patrilineal
Randall Bara		Patrilineal
Raydin Bara		Patrilineal (DOB 10/2/2003)
Torenzio Bara		Patrilineal (DOB 23/2/2005)
Rickaylah Bara		Patrilineal (DOB 4/4/2011)
Silas Bara **	Malkala	Patrilineal
Sebastian Bara		Patrilineal
Krystal Bara		Patrilineal
Nikolai Bara		Patrilineal
Abraham Bara		Patrilineal
Jezeniah Bara		Patrilineal
Travis Jo Bara		Patrilineal
Jonathon Bara		Patrilineal
Lynette Bara		Patrilineal
Jessica Bara		Patrilineal
Steven Bara		Patrilineal

Elliot Bara	Angurugu	Patrilineal
Karena Bara		Patrilineal (DOB 8/4/1997)
Steven Jake Bara		Patrilineal (DOB 13/12/2000)
Keenan Bara		Patrilineal (DOB 6/12/2002)
Justina Bara		Patrilineal (DOB 25/5/1988)
Kaklene Bara		Patrilineal (DOB 25/2/1993)
Elvis Bara	Milyakburra	Patrilineal
Curtis Bara		
Mason Bara		Patrilineal (DOB 4/5/2014)
Lettichia Bara		Patrilineal
Jaraziah Mamarika		Matrilineal
Leanne Neasa Bara		Patrilineal
Juisa Durilla		Matrilineal (DOB 7/5/1990)
Serena Bara	Angurugu	Patrilineal
Jaydrian Mamarika		Matrilineal
Lorenzo Mamarika		Matrilineal
Lester Bara	Angurugu	Patrilineal
Nathaniel Bara		Patrilineal (DOB 18/6/2009)
Nesman Bara	Umbakumba	Patrilineal
Colin Bara (Dec'd)		Patrilineal
Miriam Bara		Patrilineal
Eliezer Mamarika		Matrilineal (DOB 23/4/1982)
Enoch Mamarika		Matrilineal
Daniel Bara		Patrilineal
Samuel Bara		Patrilineal (DOB 28/3/2003)
Jacob Bara		Patrilineal
Shadrach Yantarnga		Patrilineal
Nadia Manggurra		Patrilineal
Esau Bara		Patrilineal
Aloah Bara (Dec'd)		Patrilineal
Winston Bara (Dec'd)		Patrilineal
Drew Bara		Patrilineal (DOB 5/7/1990)
Courtney Bara		Patrilineal (DOB 6/10/1992)
Winston Bara		Patrilineal (DOB 18/7/1996)
Sophie Anne Bara		Patrilineal
Dion Mamarika		Matrilineal (DOB 15/10/1983)
Bernuel Mamarika		Matrilineal (DOB 25/1/1987)
Timius Mamarika		Matrilineal (DOB 22/1/1991)
Jesselyn Mamarika		Matrilineal (DOB 24/12/1995)
Judy Esther Bara		Patrilineal
Gideon Mamarika		Matrilineal (DOB 18/9/1996)
Eric Mamarika		Matrilineal (DOB 14/2/1998)
Jessikiah Mamarika		Matrilineal (DOB 7/1/2002)
Emmanuel Mamarika		Matrilineal (DOB 11/3/1985)
Maren Ann Mamarika		Matrilineal
Benjamin Bara (Dec'd)		Patrilineal
Sandra Levin Bara		Patrilineal

Terriceda Bara		Patrilineal
Jacinta Bara		Patrilineal
Katurah Roberts		Matrilineal (DOB 9/9/2017)
Nelson Bara (Dec'd)		Patrilineal
Rachael Bara		Patrilineal
Doris Bara		Patrilineal
Dianne Bara (Dec'd)		Patrilineal
Andrea Mamarika		Matrilineal
Bethuel Bara		Patrilineal
Jenny Bara (sick one)	Umbakumba	Patrilineal
Jedda Mamarika		Matrilineal
Bessie Bara (Dec'd)		Patrilineal
Victor Mamarika		Matrilineal
James Mamarika		Matrilineal
Joanne Mamrika		Matrilineal
Rita Bara (speaks for Jenny)	Umbakumba	Patrilineal
Georgina Mamarika		Matrilineal
Carlson Mamarika		Matrilineal
Sue Bara	Umbakumba	Patrilineal
Ashley Herbert		Matrilineal
Troy Herbert		Matrilineal
Cameron Herbert		Matrilineal
Lucy Bara	Umbakumba	Patrilineal
Anisa Mamarika		
Janelle Mamarika		
Candid Mamarika		
Angeline Bara	Angurugu	Patrilineal
Leishana Nunggumajbarr		Matrilineal
Trixon Nunggumajbarr		Matrilineal
Ernie Bara	Angurugu	Patrilineal
James Bara	Angurugu	Patrilineal
Owen Bara (Dec'd)		Patrilineal
Phyllis Bara		Patrilineal
Maxina Bara		Patrilineal
Brianna Bara		Patrilineal
Henrietta Bara		Patrilineal
Shaun Bara		Patrilineal
Suzanne Bara (Dec'd)		Patrilineal
Fred John Durilla		Matrilineal
Gregory Durilla		Matrilineal
Margaret Durilla		Matrilineal
Lazarus Durilla		Matrilineal
Verity Durilla		Matrilineal
Kenneth Durilla		Matrilineal
Bessie Bara (Dec'd)		Patrilineal
Gracey Bell Durilla		Matrilineal
Melanie Durilla		Matrilineal
Marcus Durilla		Matrilineal

Leo Durilla		Matrilineal
Lewis Durilla		Matrilineal
Roger Bara		Patrilineal
Melissa Bara		Patrilineal
Stefan Bara		Patrilineal
Charlie Bara (Dec'd)		Patrilineal
Michelle Bara		Patrilineal
Mary Jane Bara		Patrilineal
Gregory Jaragba		Patrilineal
Antonia Jaragba		Patrilineal
Lorna Jaragba		Patrilineal
Jarrood Jaragba		Patrilineal
Davian Bara		Patrilineal
Peter Bara (Dec'd)		Patrilineal
Macreena Bara		Patrilineal
David Mamarika		Matrilineal (DOB 1/9/2004)
Leroy Mamarika		Matrilineal (DOB 30/6/1994)
Irene Mamarika		Matrilineal (DOB 7/6/1999)
Lena Mamarika		Matrilineal (DOB 30/1/2008)
Steve Bara		Patrilineal
Peter Bara		Patrilineal (DOB 24/1/2001)
Hayden Bara		Patrilineal (DOB 15/12/2005)
Donny Bara		Patrilineal
Prescott Bara		Patrilineal
Jillian Bara	Malkala	Patrilineal
Davey Durilla		Matrilineal
Chris Durilla		Matrilineal
Lyle Thompson		Matrilineal
Douglas Bara (Dec'd)		Patrilineal
Adrian Dick		Patrilineal
Danica Bara		Patrilineal
Cherelsa Bara		Patrilineal
Rose Wurrakwakwa		Patrilineal
Alana Jean		Matrilineal
Colin Roger		Matrilineal
June Bara		Matrilineal
Doris Bara (Dec'd)		Patrilineal
Bernadette Wurramara		Matrilineal
Jean Bara		Patrilineal
Veanne Wurramara		Matrilineal
Tricia Wurramara		Matrilineal
Naamon Bara	Angurugu	Patrilineal
Sadie Bara		Patrilineal
Shaun Wurramara		Matrilineal
Aloma Bara		Patrilineal
Nelissa Wurramara		Matrilineal (DOB 10/7/1998)
Albert Wurramara		Matrilineal (DOB 2003)
Clayton Bara		Matrilineal (DOB 14/2/1989)

Moses Bara	Angurugu	Patrilineal
Carlos Bara		Patrilineal (DOB 24/4/1997)
Brettalonus Bara		Patrilineal (DOB 18/7/2004)
Breelana Bara		Patrilineal (DOB 19/5/2006)
Neville Bara	Umbakumba	Patrilineal
Riley Bara		Patrilineal (DOB 17/1/2016)
Kayden Bara		Patrilineal (DOB 2/10/2016)
Kyshawn Bara		Patrilineal (DOB 2/10/2016)
Katerina Bara	Umbakumba	Patrilineal
Jermaine Wurramarrba		Matrilineal
Tyreese Wurramarrba		Matrilineal
Iris Wurramarrba		Matrilineal
Nickisha Munungurr		Matrilineal
Justin Bara	Umbakumba	Patrilineal
Bradley Bara	Umbakumba	Patrilineal
Gordon Bara (Dec'd)		Patrilineal
Elizabeth Bara		Patrilineal
Neil Mamarika		Matrilineal
Shannon Wurramara		Matrilineal
Maria Bara (Dec'd)		Patrilineal
Bronson Wurramara		Matrilineal
Keith Bara (Dec'd)		Patrilineal
Jack Bara		Patrilineal (DOB 1/1/1995)
Rionel Jeffrey Bara		Patrilineal (DOB 25/8/1998)
Trephiana Bara		Patrilineal (DOB 26/11/2000)
Kriselda Bara		Patrilineal (DOB 3/4/1987))
Renelda Durilla		Matrilineal (DOB 11/5/2005)
Margaret Durilla		Matrilineal (DOB post-2005)
Roderick Bara		Patrilineal
Antoinette Bara		Patrilineal
Duwayne Harris		Matrilineal (DOB 12/1/2012)
Sharnette Harris		Matrilineal (DOB 23/2/2014)
Don Tony Bara (Dec'd)		Patrilineal
Susan Bara (Dec'd)		Patrilineal
Betsy Mamarika		Matrilineal
Beverley Mamarika		Matrilineal
Dinah Bara	Darwin	Patrilineal
Rita No.2 Bara (Dec'd)		Patrilineal
Alvistin Mamarika		Matrilineal
Alpheus Mamarika		Matrilineal
Esma Mamarika		Matrilineal
Clarence Mamarika		Matrilineal
Josiah Mamarika		Matrilineal
Colin Bara (Dec'd)		Patrilineal
Basil Bara		Patrilineal
Terrence Bara		Patrilineal
Kaklene Bara		Patrilineal (DOB 25/2/1993)
Elroy Bara		Patrilineal (DOB 30/3/1994)
Lucasta Bara		Patrilineal (DOB 11/9/1996)

Renalda Bara		Patrilineal (DOB 2002)
Lachlan Bara		Patrilineal (DOB 2003)
Kenny Nunggumajbarr	Angurugu	Matrilineal

CLAN: Wurrawilya

Name	Community	Connection to Country
Jack Wurrawilya (Dec'd)		Patrilineal (FF)
Bruce Wurrawilya (Dec'd)		Patrilineal (FF)
Richard Wurrawilya	Umbakumba	Patrilineal (FF)
Clifton Wurrawilya	Umbakumba	Patrilineal (FF)
Lesley Wurrawilya (Dec'd)	Umbakumba	Patrilineal (FF)
Phillip Wurrawilya (Dec'd)		Patrilineal (FF)
Betty Wurrawilya	Umbakumba	Patrilineal (FF)
Clive Wurrawilya	Umbakumba	Patrilineal (FF)
Simeon Wurrawilya	Umbakumba	Patrilineal (FF)
Russell Wurrawilya	Angurugu	Patrilineal (FF)
Sarita Wurrawilya	Angurugu	Patrilineal (FF)
Isa Wurrawilya	Angurugu	Patrilineal (FF)
Karlynn Wurrawilya	Angurugu	Patrilineal (FF)
Alviston Wurrawilya		Patrilineal (FF)
Kaliza Wurrawilya	Angurugu	Patrilineal (FF)
Torrence Wurrawilya		Patrilineal (FF)
Melva Wurrawilya (Deceased)		Patrilineal (FF)
Shirleen Watson	Darwin	Matrilineal (MF)
Merlene Kerr	Darwin	Matrilineal (MF)
Ross Wurrawilya (Deceased)		Patrilineal (FF)
Wayne Wurrawilya	Angurugu	Patrilineal (FF)
Anson Wurrawilya		Patrilineal (FF)
Lancen Wurrawilya		Patrilineal (FF)
Gina Wurrawilya		Patrilineal (FF)
Matthew Wurrawilya	Angurugu	Patrilineal (FF)
Amison Wurrawilya	Angurugu	Patrilineal (FF)
Loretta Wurrawilya		Patrilineal (FF)
Susie Wurrawilya (Deceased)		Patrilineal (FF)
Jessica Mamarika	Umbakumba	Matrilineal (MF)
Roderick Mamarika	Yedikba	Matrilineal (MF)
Linda Mamarika	Yedikba	Matrilineal (MF))
Lorissa Mamarika	Angurugu	Matrilineal (MF)
Vanessa Mamarika	Yedikba	Matrilineal (MF)
Hilda Wurrawilya		Patrilineal (FF)
Chester Munungurr	Angurugu	Matrilineal (MF)
Antonia Wurramara		Matrilineal (MF)
Ronald Wurrawilya (Dec'd)	Angurugu	Patrilineal (FF)
Vanessa Wurrawilya		Patrilineal (FF)
Timeus Wurrawilya	Angurugu	Patrilineal (FF)
Cherelle Wurrawilya	Angurugu	Patrilineal (FF)
Lydia Wurrawilya	Darwin	Patrilineal (FF)
Youngson Wurramara	Angurugu	Matrilineal (MF)

Mitchell Wurramara		Matrilineal (MF)
Leron		Matrilineal (MF)
Leifonstan		Matrilineal (MF)
Glenys Wurrawilya (Dec'd)	Angurugu	Patrilineal (FF)
Leon Wurramarrba (Dec'd)		Matrilineal (MF)
Laban Wurrawilya	Darwin	Patrilineal (FF)
Enosh Snobach Wurramara		Patrilineal (FF)
Ivy Wurrawilya	Darwin	Patrilineal (FF)
Glorianne Wurrawilya		Matrilineal (MF)
Doreena Wurrawilya	Darwin	Patrilineal (FF)
Gertrisha Wurrawilya		Matrilineal (MF)
Luccain		Matrilineal (MF)

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Aquaculture Stage 2

NT EPA Self-Assessment



PREPARED FOR:

Groote Aqua Aboriginal Corporation

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Section 1 Development Overview

The establishment of an aquaculture industry capable of replacing Groote’s current reliance on mining income is imperative to the future of the Groote Archipelago economy. Groote Aqua Aboriginal Corporation (GAAC) has been established by the Anindilyakwa Land Council (ALC) and senior traditional owners of Groote Eylandt to facilitate and manage the aquaculture venture.

A pilot-scale aquaculture facility (Stage 1) has been developed adjacent and directly abutting the existing Groote Holdings Aboriginal Corporation (GHAC) logistics and base camp. Expansion of the pilot-scale facility is now planned to facilitate commercially relevant trails through Stage 2.

A Business Plan for Trepang (sea cucumber), blacklip oyster and seaweed was developed in June 2021 and is now undergoing revisions using accumulated data from various trials over the past 5 years (updated document available ~July 2026). Research and development programs are being conducted to provide clarity on potential commercialisation issues such as survival rates, growth rates, harvest value and scaling up potential.

The proposed aquaculture operation on Groote Eylandt is anticipated to provide a sustainable economy via the production of premium seafood whilst offering the people of Groote Eylandt training and employment opportunities. An illustration design is provided in Figure 1-1. The current infrastructure consists of recirculating aquaculture systems made of tanks and raceways under dome structures, individual species labs, a live feed lab, and microalgae and laboratory containers. The aquaculture facility is now planned to evolve in a commercial research scale (stages 2) and provide for additional aquaculture operation (development of flow through system and earthen ponds. The purpose of this assessment is to review the addition of a flow-through system, on-land ponds, bioremediation facilities and a blacklip oyster hatchery.

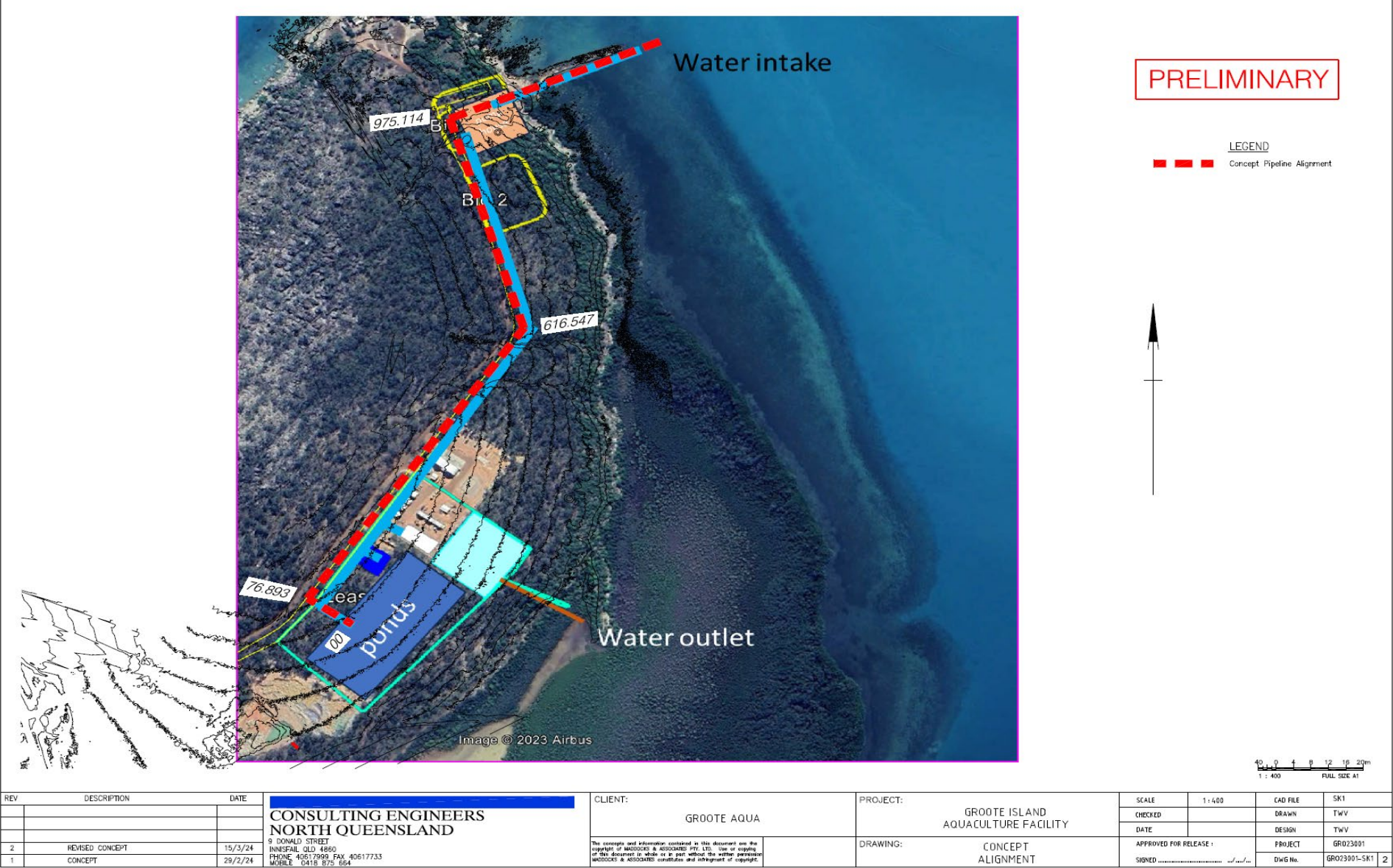


Figure 1-1 Aquaculture Facility Layout

Section 2 Staging

Stage 1: Completed

In Stage 1, key species were identified that could be grown together to mimic a natural ecosystem. Novel protocols for their domestication and culture were developed alongside continuous data collection to monitor both operational performance and environmental interactions. This foundational stage was essential not only for selecting candidate species for later expansion but also for assessing the facility's operational dynamics and potential environmental impacts before scaling up. The initial target organisms—saltwater species such as the sandfish (*Holothuria scabra*), seaweed (mostly *Caulerpa* spp.), rabbitfish (*Siganus lineatus*)—were collected under an approved Special Permit (Section 17 of the *Fisheries Act*) for early trials and under Aquaculture Licence C1/558 (approved in September 2023). Subsequent research has allowed an estimate of their survival and growth rates post-capture.

The facility operates with two robust Recirculating Aquaculture Systems (RAS) housed between shipping containers (hatchery), connected to undercover tanks and/or raceways (production and bioremediation). Seawater is collected from the jetty at Bartalumba Bay. The water, transported by trucks to a holding tank at is then filtered through 1 µm filters and sterilized using ultraviolet (UV) light before being used in the RAS. Each system comprised five 500-L tanks (inside the shipping containers) and six 3,000-L raceways or round tanks beneath protective domes. The infrastructure included an integrated biofilter, four bag filters, a UV filter, a protein skimmer, a heat exchanger and three water pumps for each system. Importantly, the design allowed individual tanks and raceways to be isolated in the event of a disease outbreak, and wild organisms were initially quarantined to verify their health before integration into the main system.

Any water discharged from the RAS—whether from biofilter backwash or routine exchanges—is directed into a dedicated bioremediation system. This integrated setup comprised a closed holding tank (ranging from 20,000 L to 30,000 L), a sand filter, holding extractive species (seaweed, oysters, and sea cucumber) to remove remaining nutrients and particulate solids. These measures provided both mechanical and biological filtration, significantly reducing total suspended solids (TSS), total nitrogen (TN), and total phosphorous (TP) before the water was either recirculated or discharged. This system ensured that returned water met or exceeded the quality of the intake seawater. To this day GAAC only discharge 10,000L since the start of operations on lease 2 (July 2023). This is thanks to the implementation of best aquaculture practices that included the use of multiple species and bioremediation, which resulted in GAAC's ability to reuse close to 100% of its water. However, for biosecurity reasons, the new blacklip oyster hatchery cannot rely solely on recirculated water. Additionally, to obtain commercially relevant data to feed in the business plan, GAAC needs to be operated larger system closer to commercial scale than the current RAS. This thus requires a flow through system, which is the purpose of this assessment. The same level of water quality scrutiny will apply for stage 2.

Stage 2: Subject of this Self-Assessment

With Stage 1 complete, the insights gained now inform the project next steps. Stage 1 provided the capacity to develop novel protocols and breed and propagate marine species (sea cucumber, rabbitfish, seaweed, blacklip oyster). However, because GAAC is only running limited amount of tanks and raceway, it need additional space to grow the juvenile rabbitfish and sea cucumber it produced in its hatchery. There is thus now the need for additional production capacity (ponds) albeit still semi-commercial level, and additional water supply needs that cannot be met by carting seawater 4000L at a time. This is Stage 2.

Stage 2 will scale up operations from an R&D using RAS to larger R&D facility with small ponds (2500m², as opposed to traditional 1ha ponds used in commercial aquaculture) and is the subject of this self-assessment. This phase will explore on-growing techniques for animals, macroalgae, and plants within Lease 2. A state-of-the-art, climate-controlled, biosafe hatchery facility will be constructed to produce quality blacklip oyster spats to provide seeds for the growing blacklip oyster industry in the Northern Territory. Development of Stage 2 will require construction of a pipeline to facilitate the intake of seawater to the site and the release of treated water to the adjacent estuary located to the east of the facility.

Seawater will be sourced from the Little Paradise jetty. This will be achieved via an intake line, which will extend 10-20 meters beyond the breakwater's limit. The intake line will be installed in a cut-and-cover trench, approximately 1 meter deep, excavated using a barge-mounted excavator. No dredging will be required and any dredging in that area should be avoided due to the presence of GAAC's R&D oyster lease.

The intake line will reach deeper water by extending 10-20 meters beyond the breakwater. It will connect to a pump station situated on an excavated pad (Figure 2-1). From the pump station, a pipeline will be laid, running approximately 800 meters, parallel to Ngadumyerrka Road. This pipeline will transport saltwater to the proposed aquaculture facility (Figure 1-1).

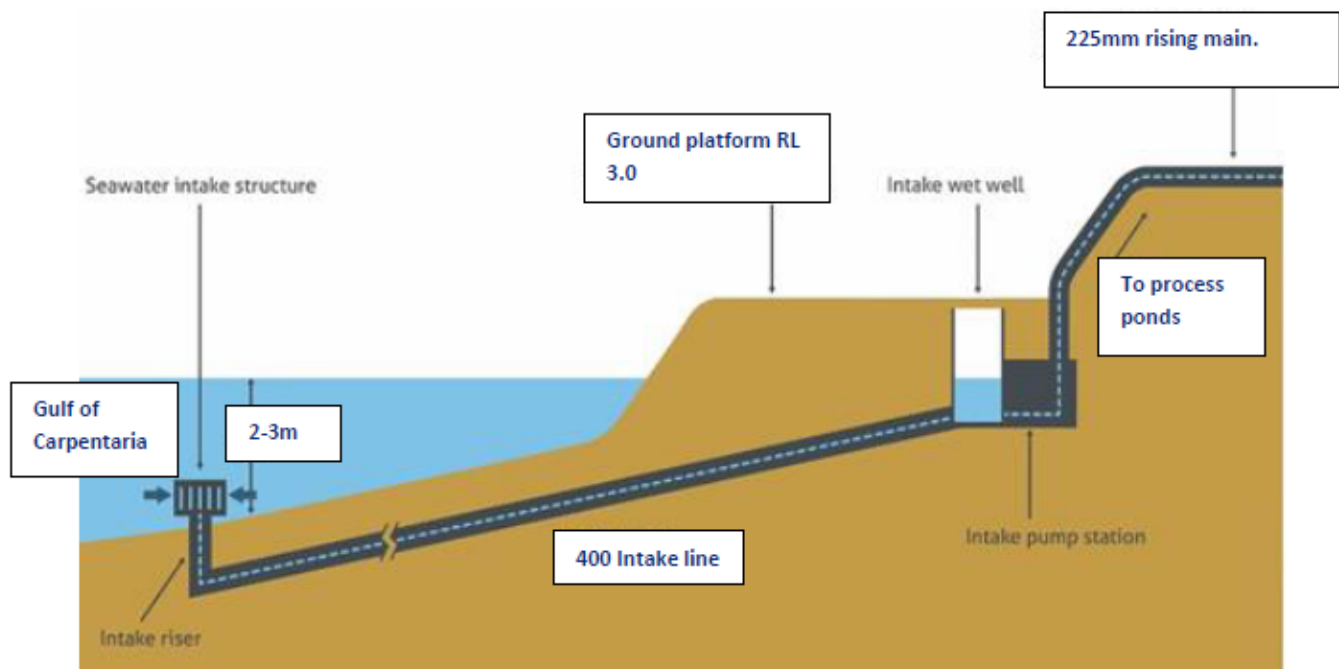


Figure 2-1 Intake arrangement

The discharge point is proposed to be located in the intertidal mangroves of Bartalumba Bay, located 100 m to the east of the facility, using a direct small diameter pipe positioning aboveground (Figure 1-1). The water quality parameters of the collected water, within the systems, and prior to discharge will be monitored daily or when collection, or prior to discharge. This will be done using Senect monitors/controllers, YSI Pro and Horiba U-50 water quality meters, Hannah spectrophotometer, and API water quality kits. If after testing the water quality does not match that of the collected water (or the water in the wild) then it will be held in the bioremediation pond and in storage tanks, if needed (30,000L tanks), for further filtration to reduce suspended solids and dissolved nutrients. Although it is unlikely that it will be necessary based on the low stocking density and feed intake, addition of Aqua 'PURE' may be necessary if nitrogenous waste are too high as this product neutralises ammonia and has no effect of marine salts, and is safe for use with marine organisms. The water to be discharged will be of similar or better quality than the water to be collected from that site (Figure 2-2). The main reason to replace the water in the RAS is not to dilute nitrogenous or phosphorous wastes but to replenish micronutrients (e.g., minerals and metals), which may become the limiting factor for the optimal health and growth of the target organisms in those systems.

Chemicals such as betadine, chlorine, soaps, and ethanol will be used daily for cleaning and disinfection purposes. These chemicals are likely to be present in the washdown water used to clean tanks and floors inside the shipping containers and will be neutralised prior to be treated at the site wastewater treatment plant. Culture water and wash down water will never mix, reducing the risk of chemical residue in culture water which could harm the cultured organism and the environment post release.

Based on the volume of the Stage 1 facility (<50,000 L), up to 30% per day (up to 15,000 L/day) was the requirement when we first applied for the EPL. However, during normal operation, and based on the previous 3 yrs of operation, the required water exchange has been sitting between 0% to 1% per week (up to 500 L/week). For Stage 2, the proposed ponds are substantially smaller than conventional commercial aquaculture ponds and will support low trophic extractive species, which require little water renewal. Based on the stage 1 operations since mid-2023, the estimate water renewal rate is between 1-5% (as opposed to 15-30% in traditional fed aquaculture). This equates to 100m³-500m³ per day for the ponds. The hatchery will require less than 20m³ per day but to be safe GAAC will request 20,000L per day allocation bringing the total water requirement to 120m³ to 520m³ per day. This represents a maximum of 520m³/day or 360L per min flow rate, which may be required at certain times of the year (wet season to compensate for rainwater input or high temperature) however the normal operating flow is likely to be closer to a quarter of that (90L per minute).

Based on the alignment of the proposed water quality criteria with existing extraction seawater quality and low volumes of water proposed to be discharge, adverse environmental impacts on the receiving environment are considered unlikely. Note that the animals (rabbitfish, sea cucumber, seaweed and oysters) to be grown in the ponds under Stage 2 are all extractive species (unfed) thus nothing will be added to the water that will be piped from Little Paradise Jetty to the site. Nevertheless, in alignment with the values of GAAC, a comprehensive environmental health monitoring program will be proposed.

Figure 2-3 presents a conceptual model for the proposed water discharge arrangement for Stage 2.

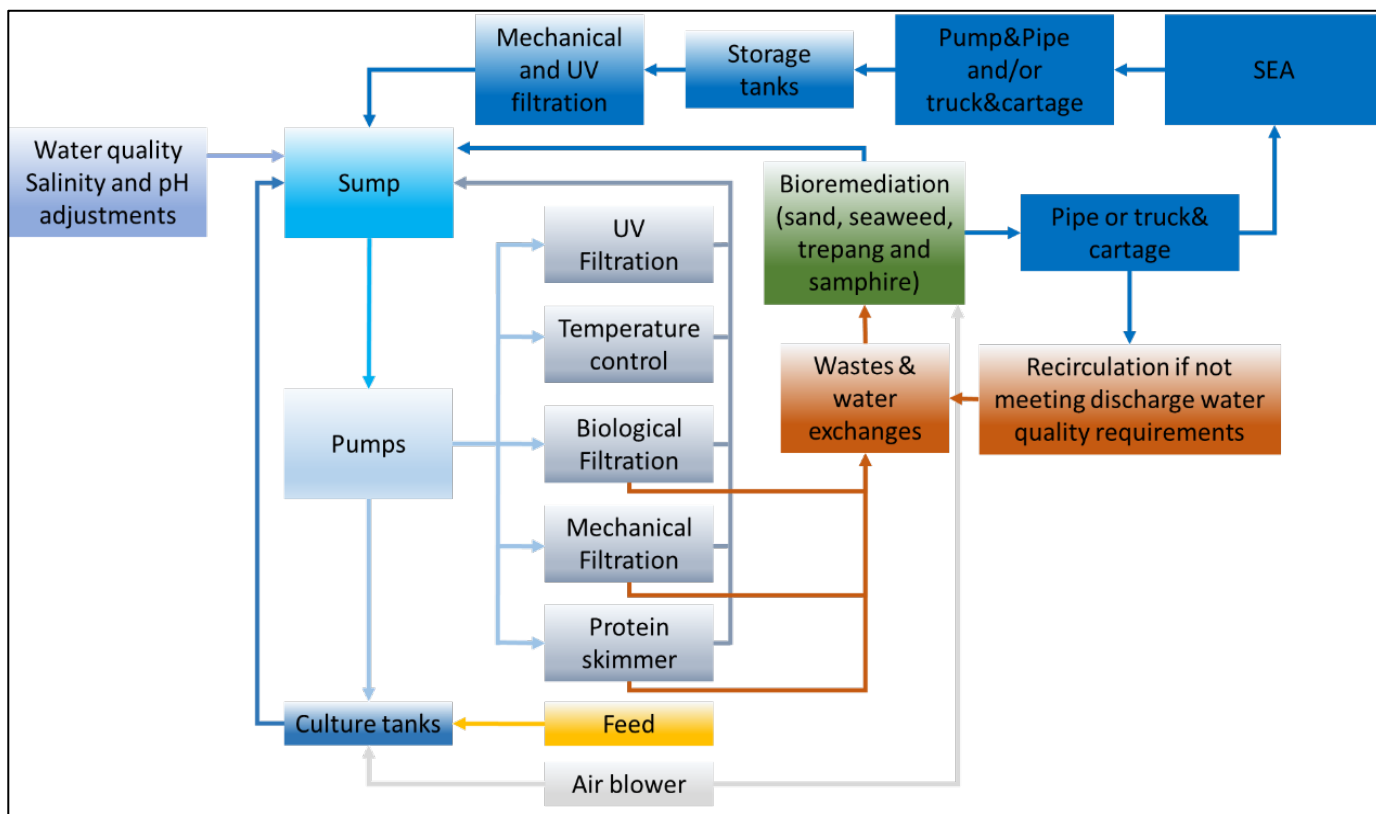


Figure 2-2 Aquaculture Facility Water Flows

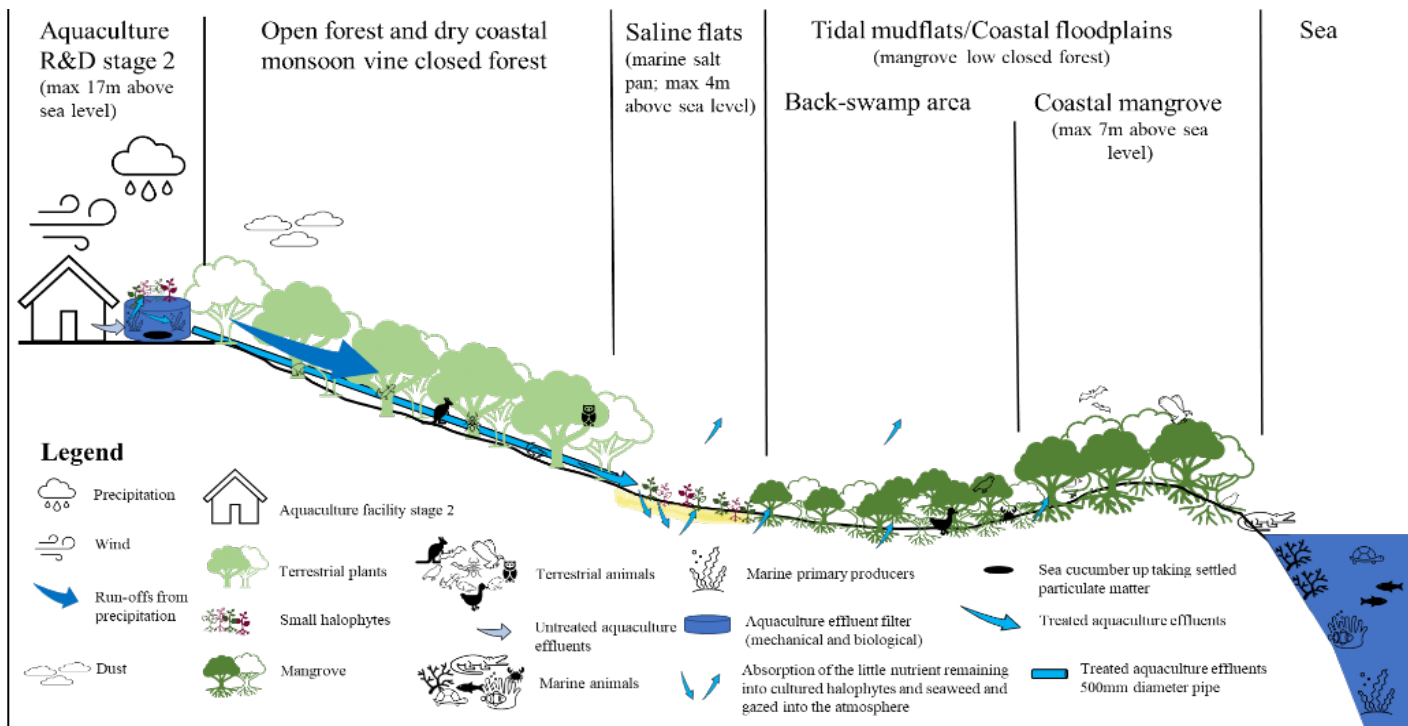


Figure 2-3 Stage 2 Aquaculture Location Setting and Discharge Arrangement

2.1 Biosecurity

Biosecurity is of outmost importance to both protect organisms in the systems from external pathogens or parasites and to prevent introduction of pests or pathogens from the facility to the surrounding environment. Operational checks such as the use of decontamination foot baths, handwash/disinfection stations, dedicated staffs, and standard operating protocols will also be implemented to minimise biosecurity risks. Regular bacterial plating of intake, system and holding water prior to discharge will be done to assess presence and overall density of potentially pathogenic bacteria (e.g., *Vibrio spp.*).

Prior to the discharge of any water from the facility back to the environment, water quality measurements and bacterial plating will have to return results within normal environmental range (comparable to the quality of the extraction water). As an additional measure, the water to be discharged will go through an ozone treatment as an extra sterilisation step. If the quality of the water to be discharge does not match that of the water at the collection point, then it will be held for additional filtration until it does. Beyond the biosecurity control measures described above, the facility will follow management measures and controls as described in GAAC's Biosecurity Management Plan. Since the start of the aquaculture activities (Pole 12) GAAC has had no biosecurity issues including disease outbreaks. GAAC's management team works very closely with the NTFisheries team including its Aquatic Biosecurity Manager and Veterinary Diagnostician and so far the only issue that we have encounter was gas bubble disease in our rabbitfish caused by too much oxygen and saturated gas (too well aerated) in the system which was easily resolved through reduced aeration regime.

2.2 Clearing Extent

The Lease 2 aquaculture facility will be located adjacent to Little Paradise Road and will require internal access road, hatchery (to be build on current stage 1 land, no clearing needed for that one), production ponds, bioremediation ponds and a treated water outfall. The aquaculture facility with all necessary infrastructure is mapped as covering a total of 6.21 ha. For the purpose of this self-assessment it is assumed clearing will encompass the entire 6.21 ha consisting of homogenous open eucalypt forest (VMU40a) (refer to Figure 2-4). However, it is the desire from the GAAC team including directors and operators to retain significant amount of vegetation to allow for a cooler and more shaded environment. The treated water outfall is proposed to intersect monsoon forest (VMU2), however there will be no clearing associated with the outfall pipe.

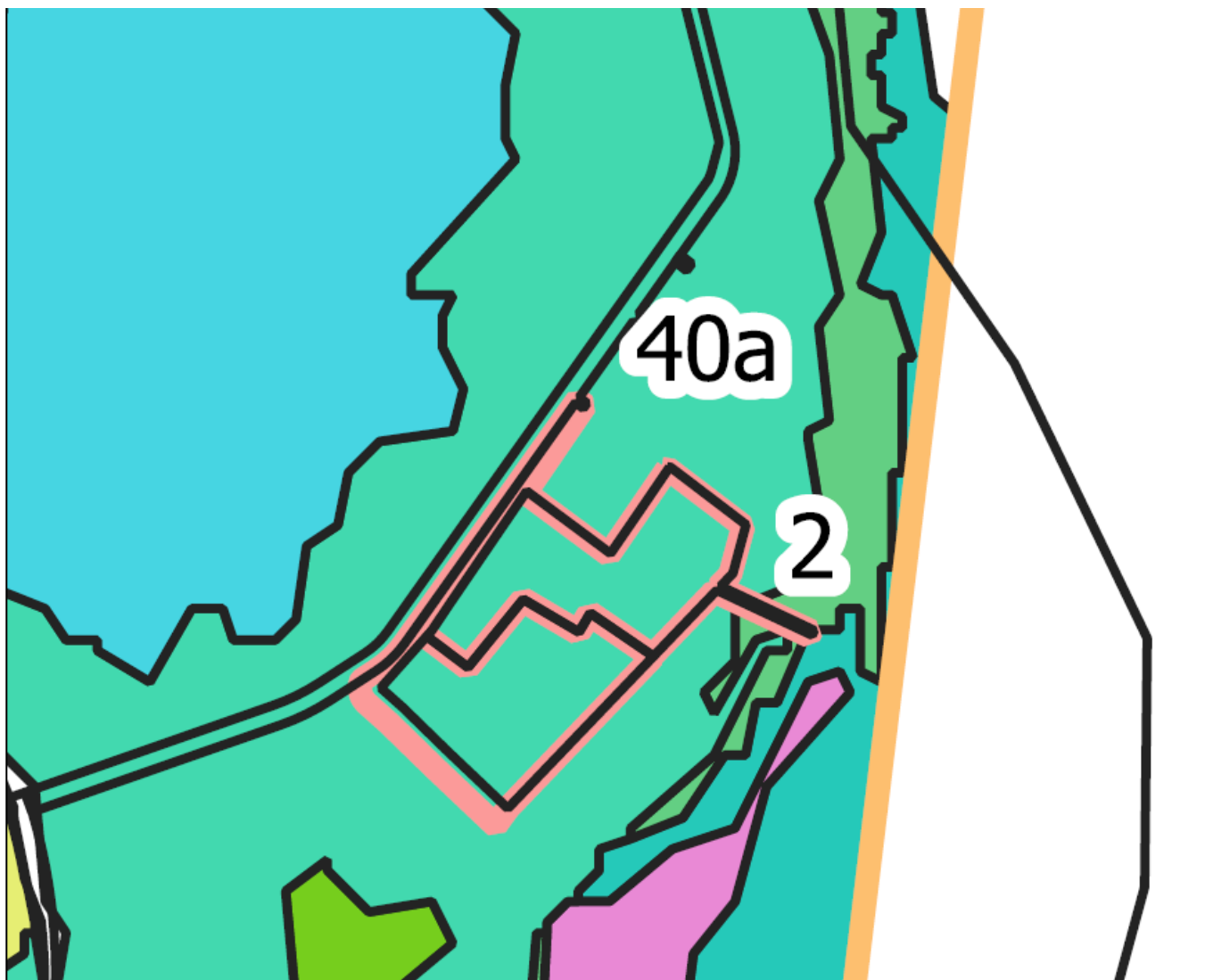


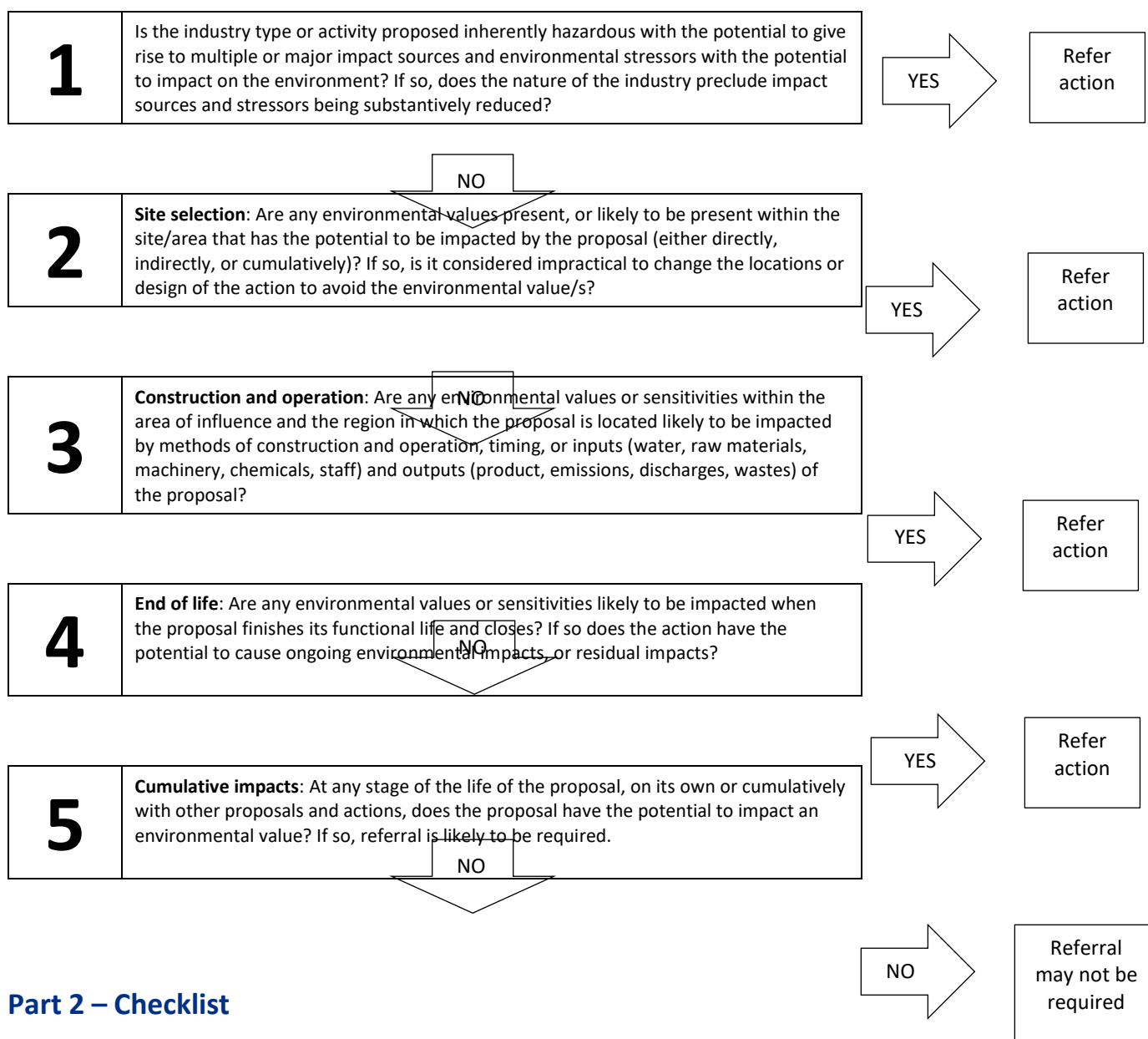
Figure 2-4 Vegetation type in Aquaculture Facility Footprint

Section 3 Northern Territory – Screening Tool

The Northern Territory Environmental Protection Authority (NTEPA) has developed a screening tool to assist proponents in determining whether a proposed action requires formal referral (NTEPA, 2021a).

The screening tool is comprised of two parts namely, Part 1 (Screening questions) and Part 2 (Checklist). Part 1 and Part 2 have been completed below in the context of the Stage 2 development of the Groote Aqua Research and Development Aquaculture facility Alyangula on Groote Eylandt.

Part 1 – General Screening Questions



Part 2 – Checklist

Table 1-3-1 has been adapted from the NT EPA Pre-referral screening tool checklist (NTEPA, 2021a). It provides a preliminary evaluation of whether the aquaculture facility has the potential to result in a significant impact on the environment and if formal referral to the NTEPA is necessary. Table 1-3-1 has been reviewed within the context and framework of the NT EPA's environmental factors and objectives (NTEPA, 2021b).

The scope of the development in the context of the NT EPA guidelines is:

- Installation of an intake line in the marine environment and discharge of treated aquaculture effluent water to the intertidal and marine environment of Bartalumba Bay.

To undertake a preliminary evaluation of impacts on the NT EPA factors and objectives of the proposed development, it is important to understand the definition of ‘significant impact’. Refer to Section 2.3 for the definition of a ‘significant impact’ in relation to the Northern Territory *Environment Protection Act 2019* (EP Act) and the NT EPA’s contemporary guidance.

Explanation: Use questions 1-5 from part 1 of the screening tool. Indicate answer to questions 1-5 in corresponding checkbox. The table below gives an indication of the possible environmental values for each environmental factor that should be considered when addressing each question. If the answer to a question is ‘yes’, it is possible that the proposal may have the potential to have a significant impact on the environment and the proponent should consider, justify, and/or assess the significance of the impact. If there is potential for significant impact the proponent must refer the proposal to the NT EPA (NTEPA, 2021a).

Table 1-3-1 NTEPA Pre-referral screening tool Part 2 Checklist for the GAAC Aquaculture Facility (adapted from NTEPA, 2021a)

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
LAND	1) Landforms <u>Objective:</u> Conserve the variety and integrity of distinctive physical landforms.	- distinctive features in the landscape, either geological or anthropogenic - subterranean karstic terrain and faults - craters, gorges, ranges, caves, massifs, escarpments, plateaus - monuments - tourism related to landforms	The project is in a coastal environment which can be considered scenic. However, this landform is widespread in the Groote Archipelago and is not distinctive. The site is not in close proximity to National Parks nor high tourism areas.	N/A	N/A	N/A	N/A	N/A	Potential impacts are not considered significant. - No key environmental landforms relevant to the development for the NTEPA 'Landforms' factor. - The landform is widespread and not considered distinctive. - The aquaculture facility is setback from Bartalumba Bay and will be visibly screened by vegetation.
	2) Terrestrial environmental quality <u>Objective:</u> Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	- good quality soils, including chemical, physical, biological and aesthetic qualities that support life - the biological processes that depend on soil quality	Soils within development area is consistent with the broader coastal environment of the Groote Archipelago and consists primarily of bare rock and shallow lithosols. The subsoils are relatively uniform, predominately sand and are not of high productive quality. There are no known areas of contaminated soils within the development area as it has not been previously developed. There has been previous disturbance to the area, from historic quarrying in the west of the project area and in generally from site investigations and access through the area. While the area is not mapped as being an area at risk for Acid Sulfate Soils (ASS) these may occur due to the low elevation adjacent to the marine environment.	N/A	No	Yes (refer to eval)	No	No	Potential impacts are not considered significant. - Potential for interaction with ASS is considered low and only minor excavation is necessary for the development. However, the potential for intercepting ASS at this location must be proactively managed. As such, the management and controls section specify the requirement for ASS management to be incorporated into a site-specific ESCP that must be developed prior to disturbance. - The treated outflow pipe is proposed to be placed on top of the soil without trenching or clearing. Thus, the outflow pipe is not considered likely to have any significant impact to TEQ (note – impacts to the marine environment are address below). - The development type is not inherently hazardous and will not contain activities or chemicals that would degrade soil quality. Small volumes of packaged chemicals may be stored onsite similar to any standard development. Standard manufacture maintenance procedures are sufficient to maintain a low risk of impacts from site plant and equipment. - There is no known presence of contamination that could be mobilised to air or water during land clearing and construction. - There are no watercourses or significant drainage lines identified in the development area. Standard ESC and stormwater management infrastructure can prevent degradation of environmental values during construction and operation. - Activity is indefinite; however, there are no known end of life risks to TEQ values should the development be decommissioned with standard controls.
	3) Terrestrial ecosystems <u>Objective:</u> Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	'sensitive or significant' vegetation or buffers (as defined in the NT Land Clearing Guidelines) - vegetation that provides an important ecological function - listed threatened species and their habitat (NT and Commonwealth) - listed migratory species and their habitat (Commonwealth) - listed threatened ecological communities (Commonwealth) - locally endemic species or species	- The development area is outside mapped mangroves and rainforests as per NR Maps and ecological field surveys. - The development area is outside mapped 'significant vegetation' as per NR Maps. - There have been no protected flora species identified in the area from field surveys (January 2021, EMS 2021). - Northern Quoll was record at six camera trap locations across the site during the January 2021 EMS survey and more broadly in the wider area. - A single Northern Masked Owl was sighted	N/A	No (refer to eval)	No	No	No	Potential impacts are not considered significant. - No threatened flora species have been identified in the area during field surveys. - The development area constitutes habitat for approximately 2.05 Northern Quoll and would provide a minor portion of one or two Northern Masked Owl home ranges (approximately 3% of the range). Given the widespread occurrence of the species this extent of disturbance is unlikely to be significant. - The development area has been positioned to

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
		- with restricted habitat - species of social, cultural, livelihood and/or economic significance - species that are data deficient and their status is unknown - protected area or reserve, including Indigenous Protected Area - existing conservation and management activities - introduced species and/or invasive species - integrity of terrestrial ecosystems and the ecological services they provide - biological and functional diversity - provision of refuge - food supply	approximately 100m to the south-west of the project area. None were recorded onsite. - The ecological surveys identified a single low quality/poor hollow on the site (this single hollow would be removed as part of the development). Area surveys identified the area as non-critical habitat to the Northern Masked Owl. - Listed Migratory species under the EPBC Act have been sighted adjacent to the development area (including the Common Sandpiper, Lesser Sand Plover, Greater Sand Plover); but the environment of the 6.21 ha development area is not suitable to migratory species. - Introduced plants were observed at several locations within the study area during the 2021 surveys. The most commonly observed species at these locations were hyptis (<i>Hyptis suaveolens</i>) and white snake-weed (<i>Stachytarpheta australis</i>). Several other species have been previously recorded in the Little Paradise area or were observed during the current survey, including annual mission grass (<i>Cenchrus pedicellatus</i>), red natal grass (<i>Melinis repens</i>), Guinea grass (<i>Megathyrsus maximus</i>) and caltrop (<i>Tribulus cistoides</i>) (DEPWS 2021). - Several threatened fauna species listed under the <i>Territory Parks and Wildlife Conservation Act 2001</i> (NT) (TPWC Act) are known to occur with others having potential to occur within the area and surrounds (EMS 2021): - Northern Quoll – the 6.21 ha constitutes habitat for the species. - Northern Masked Owl – the 6.21 ha constitutes non-critical habitat for the species. - Ghost Bat – the 6.21 ha constitutes foraging habitat for the species. - Several Northern Blue-tongue Skink (EPBC Act-Critically Endangered) were recorded on camera traps at sites to the north-west of the proposed aquaculture facility in low dissected sandstone. No skinks were identified onsite. - No protected areas or reserves occur within the vicinity of the development area. - No nominated, provisional or declared heritage places located within, or directly adjacent to, the development area although there is a Traditional Owner Restricted Work Area to the west.						avoid sensitive vegetation (sandstone woodland, mangroves, monsoon vine forest, melaleuca woodland and wetlands) within which threatened species have been recorded and the important areas for the Northern-masked Owl roosting which occurs further south. - While Northern Blue-tongue Skink were recorded to the north in sandstone habitat, the habitat in the aquaculture facility is not considered critical habitat. - Potential for increase in dust, noise and light emissions during construction, which may indirectly effect fauna within the area. - General construction environmental management controls will be developed and include controls for introduced species (weeds), dust, noise and artificial light. However, most impacts are temporary or can be managed through standard controls. - A single low quality hollow-bearing tree was identified in the proposal area. - Cumulatively, EMS (2023) estimated 24.5 Northern Quoll individual ranges occurring across the potential cumulative clearing area for developments in the north of Groote Eylandt over the next decade and a portion of the home range of one or two pairs of Northern Masked Owl. Similar to the direct impact assessment, this is unlikely to significantly impact the species on Groote Eylandt cumulatively.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
WATER	1) Hydrological processes <u>Objective:</u> Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	- the supply and quantity of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines - the supply and quantity of water in groundwater features including aquifers, aquitards and water tables - declared beneficial uses - present and future uses, and users of water - current or potential water supplies, including regional scale aquifers - culturally important water features or other features affected by water level	- There are no groundwater bores in the development area. There is a historic bore approximately 200m to the south-east that was drilled in the 1980s and exhibited a very low pump rate of 0.35 /l/s (NR Maps 2022) - In the mid 1980's, a groundwater investigation project was undertaken at Umbakumba and Marble Point to determine the groundwater potential in that vicinity. Several production bores were drilled during this time. In 1991-1992 the then Water Resources Division of Power and Water Authority embarked on a drilling program across the island to provide water supply to the outstations (Karp 1992). This project demonstrated that high yielding aquifers were found in early Cretaceous sediments and low yielding aquifers were encountered in weathered, fractured, jointed Proterozoic bedrock i.e. Dalumbu Sandstone. No permanent freshwater habitats exist in the development area or surrounds. - A desktop groundwater investigation was undertaken by TGS Consulting in early 2021 to assess prospective areas for a suitable aquifer/s on Groote Eylandt to support a borefield to supply water. Review of the mapping identified that the north-eastern region of the island (outside the development area) holds the greatest potential for groundwater supply. - The project anticipated potable water being trucked from the high reliability Emerald River water supply in Southern Groote Eylandt and aquaculture water being extracted from Bartalumba Bay. - The development area would only be subject to sheet flow during precipitation events. - The development area is not within a Water Control District, Water Allocation Plan Area, Water Plan Management Zone, Water Plan Protection Area and is outside the Groote Eylandt Beneficial Use Area.	N/A	No	No	No	No	Potential impacts are not considered significant. - No groundwater will be taken during construction activities. - The potable water supply for operation is proposed to be sourced from high reliability Emerald River supplies. Future potable water may come from groundwater following detailed investigations. Nevertheless, the facility will maintain less than 10 onsite staff with minimal potable water demand. - No groundwater will be taken during construction activities, and any use of groundwater in the long-term for potable supplies will be following detailed investigations into a sustainable supply by GAAC. The potential risk to groundwater from this related but separate activity is unlikely to be significant. - No mapped groundwater dependent ecosystems or springs and ground-truthed ecological surveys support the mapping. - The development is outside all use and management control areas. - All activities will be undertaken in a limited disturbance footprint (6.21 ha) with limited scale and extent. There will be no significant changes to the surfaces and therefore low risk of significantly altering the existing hydrological regime. - General construction environmental management controls will be developed and implemented (including erosion and sediment controls).
	2) Inland water environmental quality <u>Objective:</u> Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.	- the quality of water in surface water features including rivers, lakes, wetlands, swamps, creeks, billabongs, intermittent streams, floodplains, mangroves and drainage lines - the quality of water in groundwater features including aquifers and water tables - declared beneficial uses - present and future uses and users of water - current or potential water supplies, including regional scale aquifers - potability / drinkability - culturally important water features	- Based on water quality issues in similar geologies on Groote Eylandt, there could be potential water quality issues in the area which may render the groundwater unpotable. The main constituents of concern are manganese and zinc. Iron may also be elevated (with regards to the Australian Drinking Water Guidelines (NHMRC 2011) (CDM Smith 2021) - No permanent freshwater habitats in or immediately surrounding the development area. - The closest surface water feature is an unnamed drainage line approximately 250 m north of the site. The drainage line is within a cultural heritage protection area and does not receive runoff from the site. All runoff from the site is overland flow that directs down slope to the west, towards the	N/A	No	No	No	No	Potential impacts are not considered significant. - No groundwater will be taken during construction activities and now new bores are proposed for the project. - Existing water supplies will be utilised for the operation (e.g., truck and tank from Emerald River), or hydrogeological investigation will be completed to confirm suitability of a new groundwater supply (quality, quantity and sustainable yield). - No permanent surface water features within the development area and immediate surrounds. - The development is outside all use and management control areas. - The proposal site is outside major flood hazard areas.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
			intertidal area of Bartalumba Bay. The site is outside areas susceptible to flooding although could experience overland sheet flow and some localised pooling during extreme rainfall events.						- There will be no large storage of hazardous chemicals and thus risks to water quality are primarily restricted to sediment runoff which can be prevented through implementation of standard ESC measures (refer to Section 4). - All activities will be undertaken in a limited disturbance footprint with limited scale and extent. There will be no significant changes to the surfaces and therefore no risk of significantly altering the existing hydrological regime. - General construction environmental management controls will be developed and implemented (including erosion and sediment controls).
	3) Aquatic ecosystems <u>Objective:</u> Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	- threatened species - the health of the biota in inland waterways - the habitats that support the lifecycle of aquatic biota - groundwater dependent ecosystems - Ramsar wetlands - species of social, cultural, livelihood and/or economic significance - integrity of aquatic ecosystems and the ecological services they provide - biological and functional diversity - provision of refuge	- No inland aquatic habitats (i.e. lakes, wetlands, creeks) present within the development area and immediate surrounds. - No groundwater dependent ecosystems present. - No Ramsar wetlands occur within the vicinity of the development area. - The closest surface water feature is a highly ephemeral drainage line approximately 250 m north of the site and outside the project catchment.	N/A	No	No	No	No	Potential impacts are not considered significant. - There are no inland aquatic environments within the boundaries of the development area or in close proximity. - With the implementation of standard construction and operational management controls there is little to no identifiable risk to downstream aquatic ecosystems values, should they occur in the surrounding environment.
SEA	1) Coastal processes <u>Objective:</u> Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained.	- processes that support marine ecosystems (see Marine Ecosystems Factor below) such as coral reefs, mangroves, salt marshes, seagrass meadows and sponge gardens - primary productivity - nutrient cycling - carbon storage - climate regulation - conservation significant low lying areas including tidal creeks, deltas and river mouths - storm surge protection - unique coastal landforms - cultural and aesthetic values - active or passive recreation	- Nearshore coastal ecosystems of Groote Eylandt are under the influence of a predominantly macrotidal regime supporting mangroves, intertidal flats and rock platforms. - The main development area is setback from the coast approximately 200 m. - The treated aquaculture water effluent pipeline intersects an area mapped as containing mangrove low forest/closed forest. - The aquaculture facility is within a small catchment with no major flooding potential.	N/A	Yes (refer to eval)	No	No	No	Potential impacts are not considered significant. - The treated aquaculture water outflow is proposed to discharge into the adjacent intertidal mangrove habitat. The treated outflow pipe is proposed to discharge into the adjacent intertidal habitat of Bartalumba Bay. If the location is retained, outflow water has the potential to scour and disturb intertidal soils/sediments potentially resulting in mobilisation of sediments into the marine environment. Scouring, mobilisation and deposition have the potential to alter the local hydrology of the intertidal zone. - The outflow pipeline will be placed in an area that becomes regularly inundated each day. The local ingress and egress of marine water throughout this area is unknown and there is uncertainty of whether the physical placement of the pipe will alter marine water movement (i.e., coastal processes) locally surrounding the pipe. - The development is proposing strict controls on effluent discharge quality. Strict controls would limit the likelihood of contaminants entering the environment and alteration of the nutrient cycle. These quality limits can be formalised through an Environmental Protection Licence (EPL) or Waste Discharge Licence (WDL) process which is mandatory for a discharge of this type.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
									- Discharge into the intertidal zone has potential to alter the hydrological regime/natural coastal processes occurring in this area (tidal inundation cycle). Discharged water may lead to greater sediment saturation and inundation outside of periods that would not normally be inundated. - The area of proposed discharge aligns with a conservation significant environment (high sensitivity) and the uncertainties regarding alteration of coastal processes in this environment are currently too high to justify 'no significant impact' without detailed further analysis.
	2) Marine Environmental Quality <u>Objective:</u> Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.	- quality of the water, sediment and biota - ecosystem health condition - physical parameters that support fishing and aquaculture - physical parameters that support recreation and aesthetics - industrial water supply - cultural and spiritual values	- Water quality within the adjacent Bartalumba Bay has not been quantified but is relatively undisturbed. - Large tidal movements and strong currents in Groote Archipelago naturally generate high turbidity, particularly during spring tides - The main development area is setback from the coast approximately 200 m. - The treated aquaculture water effluent pipeline intersects an area mapped as containing mangrove low forest/closed forest. - The area intersected by the aquaculture effluent water discharge pipeline is mapped as conservation significant vegetation (mangroves).	N/A	Yes (refer to eval)	No	No	No	Potential impacts are not considered significant. - The treated outflow pipe is proposed to be placed on top of the soil without trenching or clearing. Thus, the physical placement of outflow pipe at this location is not considered likely to have any significant impact to MEQ (excluding consideration of coastal processes addressed above). - The development type is not inherently hazardous and will not contain activities or chemicals that would degrade soil quality. Small volumes of packaged chemicals may be stored onsite similar to any standard development. Standard manufacture maintenance procedures are sufficient to maintain a low risk of impacts from site plant and equipment. - The development is proposing strict controls on effluent discharge quality. Strict controls would limit the likelihood of contaminants entering the environment and alteration of the nutrient cycle. These quality limits can be formalised through a EPL or WDL process which is mandatory for a discharge of this type. - The treated outflow pipe is proposed to discharge into the adjacent intertidal habitat of Bartalumba Bay. If the location is retained, outflow water has the potential to scour and disturb intertidal soils/sediments potentially resulting in mobilisation of sediments into the marine environment. While the location is currently natural with no known prior anthropogenic disturbance, naturally occurring metals in the sediment can be mobilised and resuspended. If there is ASS in the disturbed area this could be oxidised when exposed at low tides. Sediments could also smother surrounding intertidal plants. As such, based on the current design, there is potential for significant impact to MEQ if treated aquaculture effluent is discharged to the intertidal environment. - Discharge into the intertidal zone has potential to alter the hydrological regime/natural coastal processes occurring in this area (tidal inundation cycle). Discharged water may lead to greater

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
									sediment saturation and inundation outside of periods that would not normally be inundated. Alterations could lead to stress of vegetation in this sensitive habitat. The level of potential stress and impact is unknown (i.e., high uncertainty).
	3) Marine ecosystems <u>Objective:</u> Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.	- conservation significant marine and coastal fauna and critical habitat such as nesting, breeding or foraging habitat - conservation significant marine and coastal benthos, flora and vegetation (seagrass meadows, sponge gardens, coral reefs, mangrove communities and salt marshes) - groups of species (species richness and assemblages of species) - ecological functions and processes - species of social, cultural, livelihood and/or economic significance. - integrity of marine ecosystems and the ecological services they supply - biological diversity - functional diversity - provision of refuge - food supply	- The development area is adjacent to but does not intersect the tidal or intertidal area. - Conservation significant migratory species are known to utilise the adjacent shoreline based on NTG data (EMS 2021). These include: - Eastern Curlew - The primary habitats for listed migratory species do not occur in the development area (e.g. marine mudflats, salt pans and tidal flats).	N/A	Yes (refer to eval)	No	No	No	Potential impacts are not considered significant. - The development clearing area has been positioned to avoid sensitive marine-related vegetation (mangroves, salt marsh and wetlands) and no clearing is proposed for the outlet pipeline. - The development type is not inherently hazardous and will not contain activities or chemicals that would degrade soil quality. Small volumes of packaged chemicals may be stored onsite similar to any standard development. Standard manufacture maintenance procedures are sufficient to maintain a low risk of impacts from site plant and equipment. - The development is proposing strict controls on effluent discharge quality. Strict controls would limit the likelihood of contaminants entering the environment and alteration of the nutrient cycle. These quality limits can be formalised through a EPL or WDL process which is mandatory for a discharge of this type. - Direct impacts could occur to a localised benthic environment, potentially altering the habitat for marine and migratory species. Ecological surveys have identified several EPBC Act listed migratory species utilizing this intertidal habitat. - Discharge into the intertidal zone has potential to alter the hydrological regime/natural coastal processes occurring in this area (tidal inundation cycle). Discharged water may lead to greater sediment saturation and inundation outside of periods that would not normally be inundated. Alterations could lead to stress of vegetation in this sensitive habitat. The level of potential stress and impact is unknown (i.e., high uncertainty). - The area of proposed discharge aligns with a conservation significant environment (high sensitivity) and the uncertainties regarding alteration of coastal processes and reliant marine environmental in this environment are currently too high to justify 'no significant impact' without detailed further analysis.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
AIR	1) Air quality <u>Objective:</u> Protect air quality and minimise emissions and their impacts so that environmental values are maintained.	- the chemical, physical and biological characteristics of quality air - the biological processes that depend on the air quality	- There are no permanent sources of point source air pollution in the existing environment of Little Paradise and air quality is likely to be high quality. - There may be minor influence from the GEMCO manganese mine to the south and dust generation from the GAAC facility immediately adjacent to the north. Other minor influence may include vehicles, shipping and seasonal bushfires.	N/A	No	No	No	No	Potential impacts are not considered significant. - Air emissions from vehicles will be localised and temporary (during construction) with no impact on the ambient offshore air quality. - There are no proposed point source emissions from the aquaculture facility. - Given the relatively remote location of the site air quality is expected to be good most of the year and the development would not alter the local or regional quality. - Appropriate dust control measures are effective in mitigating potential impacts.
	2) Atmospheric processes <u>Objective:</u> Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.	- a contribution to the NT's greenhouse gas emissions - adaptation to a changing climate - capacity of communities and country to respond or adapt to climate change	Emissions from the development will be minimal in a local scale greenhouse emissions context.	N/A	No	No	No	No	Potential impacts are not considered significant. - Increase in greenhouse gas emissions associated with proposal related vehicle movements and construction will be minimal and certainly not significant. - The development would not exceed trigger values in the large emitter policy. - GAAC intends for the aquaculture facility to be power from renewable energy.
PEOPLE	1) Community and economy <u>Objective:</u> Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.	- dwellings, homelands, communities, towns and suburbs where people live - liveable environment - good amenity – air quality, noise, aesthetics - access to natural resources including bush food - recreational use of the natural or built environment (e.g. fishing, cycling, sports, picnics) - access to social infrastructure and services including transport and logistics - Healthy lifestyles - sense of wellbeing - good mental health - community aspirations - Financial security - affordable access to food, water, electricity, transport and communication networks - livelihoods - participation in jobs, businesses and education - existing industries such as agriculture, pastoralism, tourism, fisheries - vulnerable sectors of the community - connections to culture and community	- Little Paradise housing development located to the north. - There is minimal traffic on the adjacent Little Paradise access road. - Bartalumba Bay Road has been recently upgraded and resurfaced by GHAC and is in good condition. - GHAC maintains an existing logistics facility immediately north of the proposed aquaculture facility. - Anthropology surveys of the area have been completed and there are no sites of significance in the development area. - Alyangula provides various essential services that can support workers of the facility.	N/A	No	No	No	No	Potential impacts are not considered significant. - GHAC/ GAAC has consulted the residents of the Little Paradise area to identify the most appropriate site for the development. - There are no existing commercial operations in the development area or that will be impacted by the development. - The aquaculture facility will not result in significant disruption to amenity (no sources of significant noise or air emissions). - No sites of cultural heritage significance in the development area. - A vegetated screen to the Little Paradise access road is proposed to reduce visibility of the site from public using Little Paradise road. - The development may increase employment opportunities within the local community during the construction and operational period. The project will not propose a significant change to the existing activities/uses and are unlikely to result in a long-term adverse impact on the local community and economy. - Temporary increase in vehicles during construction activities and operation, but manageable impacts on locals. - Increased pressures on local goods and services to accommodate construction workforce, however this would be temporary and ongoing consultation with the local community will assist in managing potential impacts.

Theme	Environmental factor and objective	Indicative environmental values and sensitivities relevant to each environmental factor	Summary of key environmental values and sensitivities of relevance to the development	Proponent's answer to screening questions 1-5. If answer is 'yes' referral is required (Yes/ No/ Uncertain or Not Applicable (N/A))					Preliminary evaluation of significance (Nature, scale, context and sensitivity; refer definition provided below table)
				Q1	Q2	Q3	Q4	Q5	
		(that are not explicitly protected under culture and heritage legislation addressed in the Culture and heritage factor) - Aboriginal rights and interests, including right of access - cultural practices - sense of belonging, inclusion, connectedness and cohesion - healthy social relationships							- Temporary increase in traffic, including heavy haulage for machinery and equipment. - The operation provides potential social and economic benefits associated with increased local employment options and development of a long-term sustainable new industry for the Groote Archipelago that is not reliant on the mining industry.
	2) Culture and heritage <u>Objective:</u> Protect sacred sites, culture and heritage.	- sacred sites - historic heritage and places - world heritage	- Anthropology surveys of the area have been completed and there are no sites of significance in the development area. Therefore, the potential to encounter previously unidentified heritage sites is very low. - Adjacent marine areas have been used as a historical source of food. - Historic use of the nearby Little Paradise wharf. - There are no significant European heritage sites within or in the vicinity of the site.	N/A	No	No	No	No	Potential impacts are not considered significant. - There are no Aboriginal sites of significance within the development area. - Potential for accidental entry to sacred sites during construction is low. - The development will not extend into the marine environment and therefore considerations such as shipwrecks are not accounted for here. - An AAPA authority certificate has been obtained for the area inclusive of the entire proposed aquaculture facility. The authority contains a conditions to prevent adverse impacts to culture and heritage.
	3) Human health <u>Objective:</u> Protect the health of the Northern Territory population.	- drinking water - recreational water - air quality - bush tucker - radiological limits - biting insects	- The site is not within a Public Drinking Water Area. - Air quality in the area is anticipated to be relatively unimpacted from anthropogenic activities. - Biting insects are prevalent on a seasonal and diurnal basis in and around the development area.	N/A	No	No	No	No	Potential impacts are not considered significant. - Given the location and minor nature of the development it is considered unlikely that significant impacts would occur to human health. - The development works are not expected to cause a significant long-term change to the existing activities/uses of the area and are therefore unlikely to impact on human health. - Biting insect management will need to be implemented for the construction and operational workforce as is consistent with most activities in the NT.

Definition of ‘Significant Impact’

The Northern Territory Environment Protection Act 2019 (EP Act) defines a significant impact as:

“A significant impact of an action is an impact of major consequence having regard to:

(a) the context and intensity of the impact; and

(b) the sensitivity, value and quality of the environment impacted on and the duration, magnitude and geographic extent of the impact”.

The NT EPA guidance on referral of a proposal (NTEPA, 2021a) outlines how the NT EPA determines that environmental impact assessment of a proposal is not required. The NT EPA will consider the proposal in terms of its potential for significant environmental impacts. In its consideration, the NT EPA will examine:

- Context and intensity of the impact
- Duration, magnitude and geographic extent of the impact and
- Sensitivity, value and quality of the environment impacted on.

Environmental impact assessment is unlikely to be required where:

- The type of proposal is not considered hazardous in nature.
- Environmental impacts from activities associated with a proposal are readily understood.
- The potential impacts are limited in extent and duration.
- Environmental values and sensitivities are not present or are unlikely to be significantly impacted by proposed activities.
- Impact mitigation is readily available and proven to be effective in limiting significant impacts to the environment.
- Relevant stakeholders have been identified and engaged.

Section 4 Management Measures and Controls

Numerous desktop and field based studies have informed the self-assessment. The self-assessment assumes the accuracy of the information obtained in the field studies and is predicated on implementing both standard management and control measures, and those recommended in technical studies. The following is a compilation of measures that should be implemented. If the development inclusions or extent change, or the following management measures cannot be implemented, the conclusions in this self-assessment should be reviewed for accuracy:

- An overarching Environmental Management Plan must be implemented and include the following management sub-plans developed for GAAC activities in northern Groote Eylandt. Actions are to strictly adhere to all construction and operational controls stated in the plans:
 - Biosecurity Management Plan.
 - Threatened Species Management Plan.
 - Weed Management Plan.
- GAAC, or their contractor with delegated responsibility, must control all surface water runoff that originates within the proposal area and prevent off-site sedimentation. To achieve this objective, GAAC, or their contractor with delegated responsibility, must:
 - Develop a site-specific Erosion and Sediment Control Plan (ESCP) prior to undertaking any works. The ESCP must be developed in accordance with the International Erosion Control Association (IECA)'s Best Practice Erosion and Sediment Control Document¹.
 - Incorporate ASS identification and management requirements into the site-specific ESCP to address the potential occurrence of ASS during excavation.
 - Design stormwater as well as erosion and sediment control measures in accordance with best management practices outlined in the IECA's Best Practice Erosion and Sediment Control Document, and fully implement these measures prior to commencing construction activities.
 - Conduct site inspections, including visual assessment of surface water runoff structures, drainage structures and erosion control structures to ensure these are operating effectively, twice weekly throughout the clearing² and construction phases and monthly during the operation phase.
 - As indicated by inspections, clear sediment traps of sediment, store and/or dispose of sediment in accordance with Best Practice Erosion and Sediment Control Document and repair any damaged drainage features immediately after any damage is identified.
- Incorporation of operational stormwater management infrastructure to accommodate extreme weather events and regular inspections of stormwater infrastructure.
- Minimise concentrated flow of surface water and ponding (drain lines, sediment bunds, liners etc).
- Clearly mark limits of any clearing and the clearing or earthworks activities within the aquaculture facility area must only take place in the dry season, from 1 April to 31 October inclusive, in any year.
- Revegetation of exposed areas where not proposed to be utilised.
- Significant habitats for the Northern Masked Owl and Northern Quoll, including drainage lines, monsoon forests, *Callitris intratropica* thickets and margins of sandstone habitats, will be avoided (avoidance of key Melaleuca, riparian and monsoon forest habitats, drainage areas, established buffer zones).
- Implementation of a Northern Masked Owl tree check and clearance procedure immediately prior to clearing any area. The procedure is to be developed by a suitably qualified ecologist with understanding of Northern Masked Owls.
- Clearing must be undertaken progressively so as to enable fauna to safely relocate to similar habitat to the north and east. Clearing must commence on the western side closest to Little Paradise access road and progress sequentially from west to east.
- In order to facilitate fauna movement, there shall be no fences installed on the northern, eastern and southern boundaries of the development during clearing. If fences are installed on the perimeter during clearing these shall be temporarily removed, lowered or lifted until all clearing activities are complete.

¹ Best Practice Erosion and Sediment Control Document means the 2008 Best Practice Erosion and Sediment Control Document by the International Erosion Control Association (IECA)

- The proposal area must be fenced appropriately to prevent any non-flying listed terrestrial vertebrate fauna re-entering the area after all clearing has been completed and prior to any construction activity.
- All excavations on site must be covered or equipped with fauna egress ramps (e.g. timber planks, sticks or logs) during night-time, throughout earthworks and construction activities, to prevent terrestrial vertebrate fauna being injured and/or trapped.
- Before 9 am each day or before work commences, whichever comes earlier, throughout earthworks and construction activities, all excavations must be checked for trapped terrestrial vertebrate fauna and, where trapped or injured terrestrial vertebrate fauna is identified, a suitably qualified fauna spotter/catcher or ecologist must be called, and a response be made immediately. Veterinary care, or assistance from a wildlife refuge, must be sought if any terrestrial vertebrate fauna are found injured within the proposal area during earthworks and construction activities.
- Retain hollow logs and woody debris piles on the outside perimeter of the site to provide den sites for Northern Quolls following clearing.
- Vehicle speed within the proposal area must be restricted, signposted and enforced to a maximum of 20 km per hour throughout clearing, construction, and operation.
- There shall be no major hazardous chemical storage onsite during either construction or operation.

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A.1 Protected Matters Search Tool Report

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Aquaculture Stage 2

EPBC Act Self-Assessment



PREPARED FOR:

Groote Aqua Aboriginal Corporation

**CDM
Smith**
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Section 1 Development Overview

The establishment of an aquaculture industry capable of replacing Groote's current reliance on mining income is imperative to the future of the Groote Archipelago economy. Groote Aqua Aboriginal Corporation (GAAC) has been established by the Anindilyakwa Land Council (ALC) and senior traditional owners of Groote Eylandt to facilitate and manage the aquaculture venture.

A pilot-scale aquaculture facility (Stage 1) has been developed adjacent and directly abutting the existing Groote Holdings Aboriginal Corporation (GHAC) logistics and base camp. Expansion of the pilot-scale facility is now planned to facilitate commercially relevant trials through Stage 2.

A Business Plan for Trepang (sea cucumber), blacklip oyster and seaweed was developed in June 2021 and is now undergoing revisions using accumulated data from various trials over the past 5 years (updated document available ~July 2026). Research and development programs are being conducted to provide clarity on potential commercialisation issues such as survival rates, growth rates, harvest value and scaling up potential.

The proposed aquaculture operation on Groote Eylandt is anticipated to provide a sustainable economy via the production of premium seafood whilst offering the people of Groote Eylandt training and employment opportunities. An illustration design is provided in Figure 1-1. The current infrastructure consists of recirculating aquaculture systems made of tanks and raceways under dome structures, individual species labs, a live feed lab, and microalgae and laboratory containers. The aquaculture facility is now planned to evolve in a commercial research scale (stages 2) and provide for additional aquaculture operation (development of flow through system and earthen ponds. The purpose of this assessment is to review the addition of a flow-through system, on-land ponds, bioremediation facilities and a blacklip oyster hatchery.

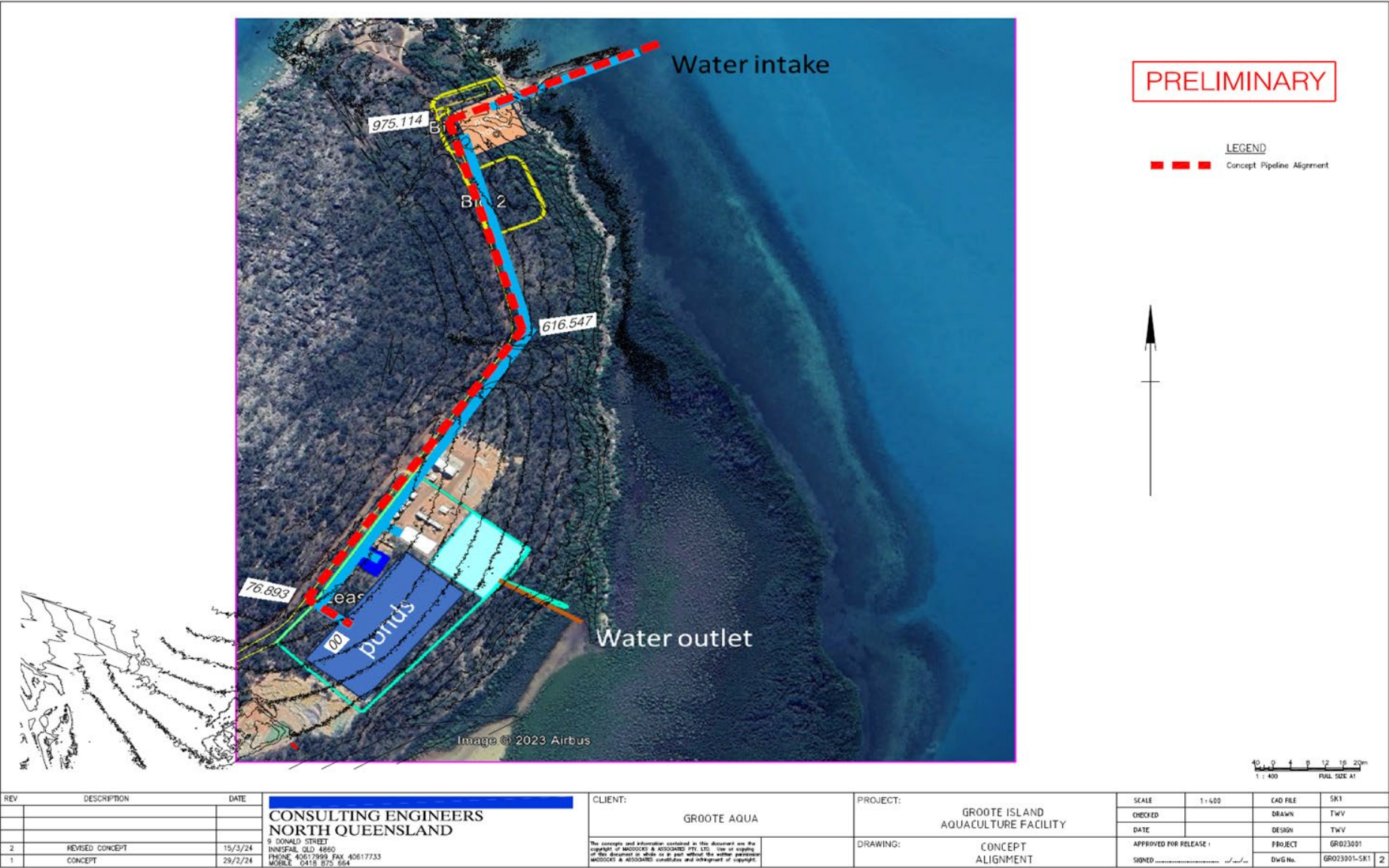


Figure 1-1 Aquaculture Facility Layout

1.1 Legislative Context

The Environment Protection and Biodiversity Conservation Act (EPBC Act) is the Australian Government's central piece of legislation that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places.

Protected matters under the EPBC Act include:

- World heritage properties
- National heritage places
- Wetlands of international importance (Ramsar wetlands)
- Nationally threatened species and ecological communities
- Migratory species protected under international agreements
- Commonwealth marine areas
- Great Barrier Reef Marine Park
- Nuclear actions, and
- A water resource in relation to coal seam gas and large coal mining development.

Proponents may refer projects to the Australian Government Minister for the Environment (the Minister) for a determination on whether their project is a controlled action or not a controlled action. If the action described in the referral is deemed to be a controlled action, then it is likely to have the potential for a significant impact on Matters of National Environmental Significance (MNES) and an assessment process must be undertaken in accordance with the decision from the Minister. Where significant impacts to MNES are deemed likely to occur and are unavoidable, a project proponent may be required to compensate by providing environmental offsets in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012).

Section 2 Staging

Stage 1: Completed

In Stage 1, key species were identified that could be grown together to mimic a natural ecosystem. Novel protocols for their domestication and culture were developed alongside continuous data collection to monitor both operational performance and environmental interactions. This foundational stage was essential not only for selecting candidate species for later expansion but also for assessing the facility's operational dynamics and potential environmental impacts before scaling up. The initial target organisms—saltwater species such as the sandfish (*Holothuria scabra*), seaweed (mostly *Caulerpa* spp.), rabbitfish (*Siganus lineatus*)—were collected under an approved Special Permit (Section 17 of the *Fisheries Act*) for early trials and under Aquaculture Licence C1/558 (approved in September 2023). Subsequent research has allowed an estimate of their survival and growth rates post-capture.

The facility operates with two robust Recirculating Aquaculture Systems (RAS) housed between shipping containers (hatchery), connected to undercover tanks and/or raceways (production and bioremediation). Seawater is collected from the jetty at Bartalumba Bay. The water, transported by trucks to a holding tank at is then filtered through 1 µm filters and sterilized using ultraviolet (UV) light before being used in the RAS. Each system comprised five 500-L tanks (inside the shipping containers) and six 3,000-L raceways or round tanks beneath protective domes. The infrastructure included an integrated biofilter, four bag filters, a UV filter, a protein skimmer, a heat exchanger and three water pumps for each system. Importantly, the design allowed individual tanks and raceways to be isolated in the event of a disease outbreak, and wild organisms were initially quarantined to verify their health before integration into the main system.

Any water discharged from the RAS—whether from biofilter backwash or routine exchanges—is directed into a dedicated bioremediation system. This integrated setup comprised a closed holding tank (ranging from 20,000 L to 30,000 L), a sand filter, holding extractive species (seaweed, oysters, and sea cucumber) to remove remaining nutrients and particulate solids. These measures provided both mechanical and biological filtration, significantly reducing total suspended solids (TSS), total nitrogen (TN), and total phosphorous (TP) before the water was either recirculated or discharged. This system ensured that returned water met or exceeded the quality of the intake seawater. To this day GAAC only discharge 10,000L since the start of operations on lease 2 (July 2023). This is thanks to the implementation of best aquaculture practices that included the use of multiple species and bioremediation, which resulted in GAAC's ability to reuse close to 100% of its water. However, for biosecurity reasons, the new blacklip oyster hatchery cannot rely solely on recirculated water. Additionally, to obtain commercially relevant data to feed in the business plan, GAAC needs to be operated larger system closer to commercial scale than the current RAS. This thus requires a flow through system, which is the purpose of this assessment. The same level of water quality scrutiny will apply for stage 2.

Stage 2: Subject of this Self-Assessment

With Stage 1 complete, the insights gained now inform the project next steps. Stage 1 provided the capacity to develop novel protocols and breed and propagate marine species (sea cucumber, rabbitfish, seaweed, blacklip oyster). However, because GAAC is only running limited amount of tanks and raceway, it need additional space to grow the juvenile rabbitfish and sea cucumber it produced in its hatchery. There is thus now the need for additional production capacity (ponds) albeit still semi-commercial level, and additional water supply needs that cannot be met by carting seawater 4000L at a time. This is Stage 2.

Stage 2 will scale up operations from an R&D using RAS to larger R&D facility with small ponds (2500m², as opposed to traditional 1ha ponds used in commercial aquaculture) and is the subject of this self-assessment. This phase will explore on-growing techniques for animals, macroalgae, and plants within Lease 2. A state-of-the-art, climate-controlled, biosafe hatchery facility will be constructed to produce quality blacklip oyster spats to provide seeds for the growing blacklip oyster industry in the Northern Territory. Development of Stage 2 will require construction of a pipeline to facilitate the intake of seawater to the site and the release of treated water to the adjacent estuary located to the east of the facility.

Seawater will be sourced from the Little Paradise jetty. This will be achieved via an intake line, which will extend 10-20 meters beyond the breakwater's limit. The intake line will be installed in a cut-and-cover trench, approximately 1 meter deep, excavated using a barge-mounted excavator. No dredging will be required and any dredging in that area should be avoided due to the presence of GAAC's R&D oyster lease.

The intake line will reach deeper water by extending 10-20 meters beyond the breakwater. It will connect to a pump station situated on an excavated pad (Figure 2-1). From the pump station, a pipeline will be laid, running approximately 800 meters, parallel to Ngadumyerrka Road. This pipeline will transport saltwater to the proposed aquaculture facility (Figure 1-1).

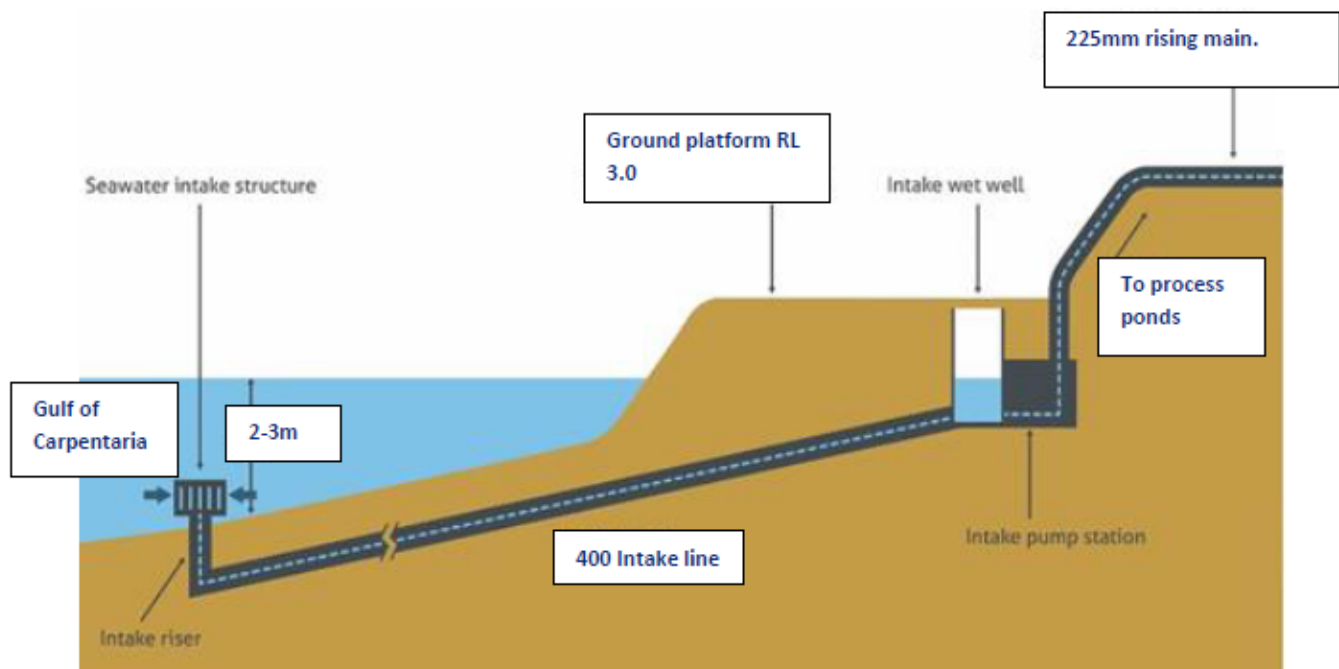


Figure 2-1 Intake arrangement

facility, using a direct small diameter pipe positioning aboveground (Figure 1-1). The water quality parameters of the collected water, within the systems, and prior to discharge will be monitored daily or when collection, or prior to discharge. This will be done using Senect monitors/controllers, YSI Pro and Horiba U-50 water quality meters, Hannah spectrophotometer, and API water quality kits. If after testing the water quality does not match that of the collected water (or the water in the wild) then it will be held in the bioremediation pond and in storage tanks, if needed (30,000L tanks), for further filtration to reduce suspended solids and dissolved nutrients. Although it is unlikely that it will be necessary based on the low stocking density and feed intake, addition of Aqua 'PURE' may be necessary if nitrogenous waste are too high as this product neutralises ammonia and has no effect of marine salts, and is safe for use with marine organisms. The water to be discharged will be of similar or better quality than the water to be collected from that site (Figure 2-2). The main reason to replace the water in the RAS is not to dilute nitrogenous or phosphorous wastes but to replenish micronutrients (e.g., minerals and metals), which may become the limiting factor for the optimal health and growth of the target organisms in those systems.

Chemicals such as betadine, chlorine, soaps, and ethanol will be used daily for cleaning and disinfection purposes. These chemicals are likely to be present in the washdown water used to clean tanks and floors inside the shipping containers and will be neutralised prior to be treated at the site wastewater treatment plant. Culture water and wash down water will never mix, reducing the risk of chemical residue in culture water which could harm the cultured organism and the environment post release.

Based on the volume of the Stage 1 facility (<50,000 L), up to 30% per day (up to 15,000 L/day) was the requirement when we first applied for the EPL. However, during normal operation, and based on the previous 3 yrs of operation, the required water exchange has been sitting between 0% to 1% per week (up to 500 L/week). For Stage 2, the proposed ponds are substantially smaller than conventional commercial aquaculture ponds and will support low trophic extractive species, which require little water renewal. Based on the stage 1 operations since mid-2023, the estimate water renewal rate is between 1-5% (as opposed to 15-30% in traditional fed aquaculture). This equates to 100m³-500m³ per day for the ponds. The hatchery will require less than 20m³ per day but to be safe GAAC will request 20,000L per day allocation bringing the total water requirement to 120m³ to 520m³ per day. This represents a maximum of 520m³/day or 360L per min flow rate, which may be required at certain times of the year (wet season to compensate for rainwater input or high temperature) however the normal operating flow is likely to be closer to a quarter of that (90L per minute).¹

Based on the alignment of the proposed water quality criteria with existing extraction seawater quality and low volumes of water proposed to be discharge, adverse environmental impacts on the receiving environment are considered unlikely. Note that the animals (rabbitfish, sea cucumber, seaweed and oysters) to be grown in the ponds under Stage 2 are all extractive species (unfed) thus nothing will be added to the water that will be piped from Little Paradise Jetty to the site. Nevertheless, in alignment with the values of GAAC, a comprehensive environmental health monitoring program will be proposed.

Figure 2-3 presents a conceptual model for the proposed water discharge arrangement for Stage 2.

¹ These volumes are based on a maximum 30% water exchange which is the uppermost conservative limit.

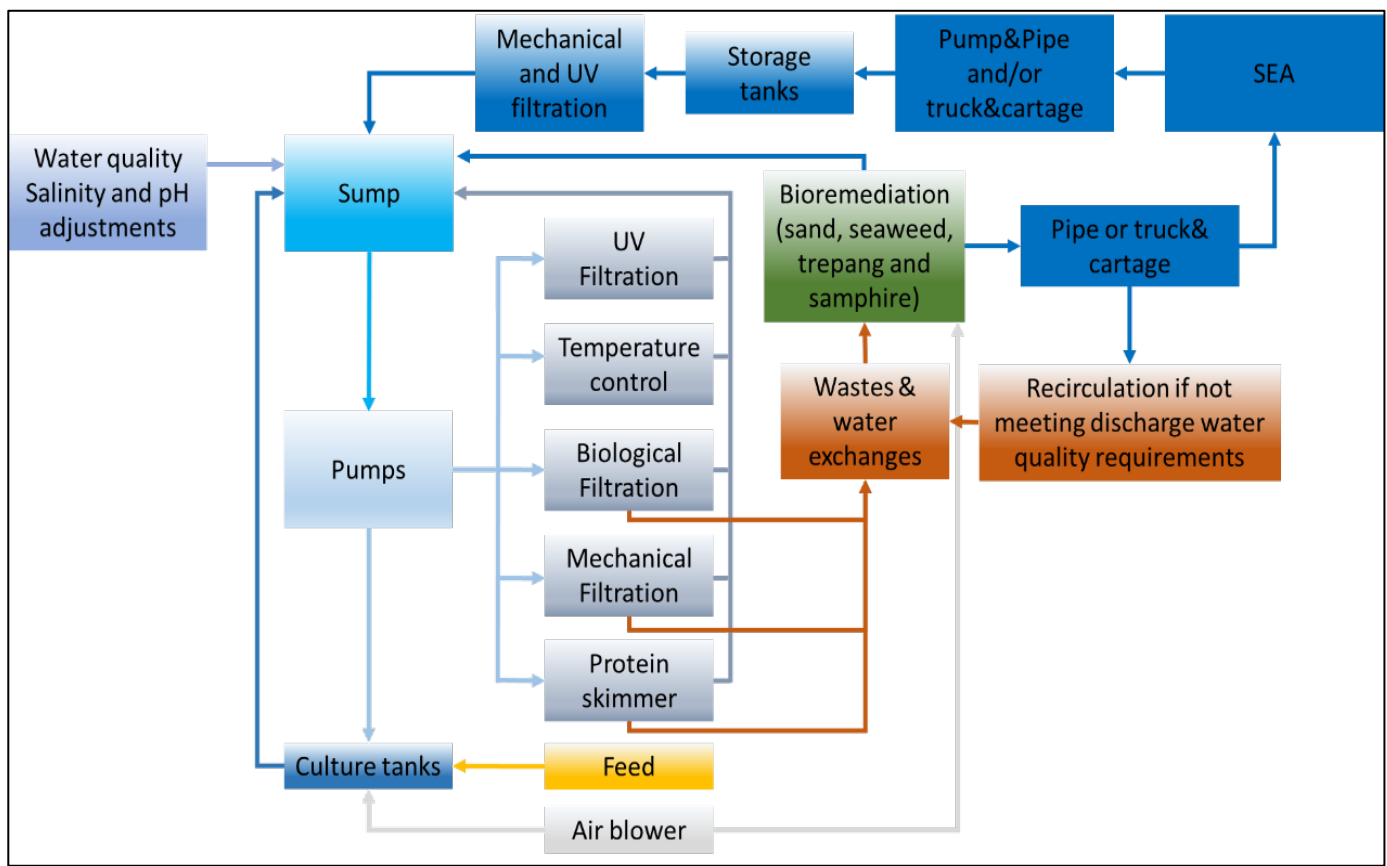


Figure 2-2 Aquaculture Facility Water Flows

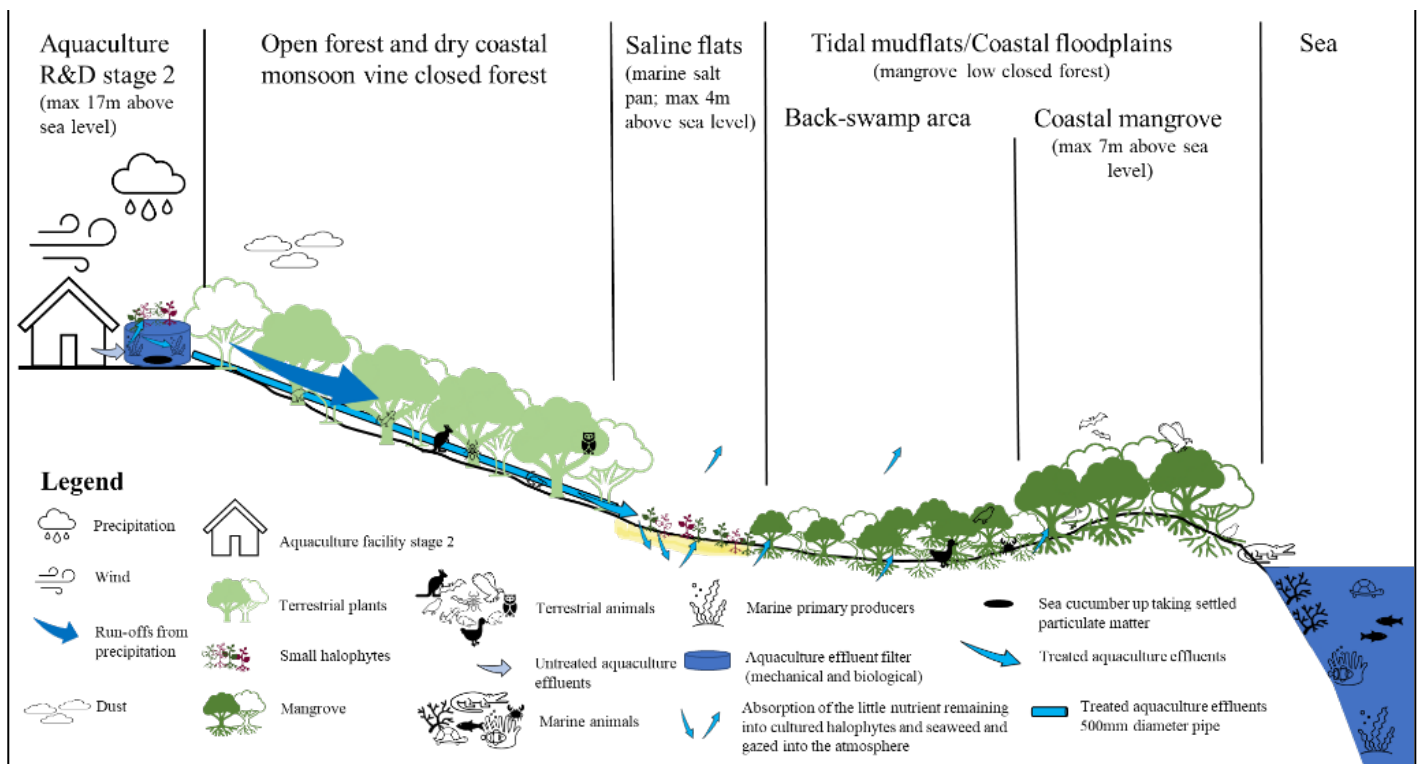


Figure 2-3 Stage 2 Aquaculture Location Setting and Discharge Arrangement

2.1 Biosecurity

Biosecurity is of outmost importance to both protect organisms in the systems from external pathogens or parasites and to prevent introduction of pests or pathogens from the facility to the surrounding environment. Operational checks such as the use of decontamination foot baths, handwash/disinfection stations, dedicated staffs, and standard operating protocols will also be implemented to minimise biosecurity risks. Regular bacterial plating of intake, system and holding water prior to discharge will be done to assess presence and overall density of potentially pathogenic bacteria (e.g., *Vibrio spp.*).

Prior to the discharge of any water from the facility back to the environment, water quality measurements and bacterial plating will have to return results within normal environmental range (comparable to the quality of the extraction water). As an additional measure, the water to be discharged will go through an ozone treatment as an extra sterilisation step. If the quality of the water to be discharge does not match that of the water at the collection point, then it will be held for additional filtration until it does. Beyond the biosecurity control measures described above, the facility will follow management measures and controls as described in GAAC's Biosecurity Management Plan. Since the start of the aquaculture activities (Pole 12) GAAC has had no biosecurity issues including disease outbreaks. GAAC's management team works very closely with the NTFisheries team including its Aquatic Biosecurity Manager and Veterinary Diagnostician and so far the only issue that we have encounter was gas bubble disease in our rabbitfish caused by too much oxygen and saturated gas (too well aerated) in the system which was easily resolved through reduced aeration regime.

2.2 Clearing Extent

The Lease 2 aquaculture facility will be located adjacent to Little Paradise Road and will require internal access road, hatchery (to be build on current stage 1 land, no clearing needed for that one), production ponds, bioremediation ponds and a treated water outfall. The aquaculture facility with all necessary infrastructure is mapped as covering a total of 6.21 ha. For the purpose of this self-assessment it is assumed clearing will encompass the entire 6.21 ha consisting of homogenous open eucalypt forest (VMU40a) (refer to Figure 2-4). However, it is the desire from the GAAC team including directors and operators to retain significant amount of vegetation to allow for a cooler and more shaded environment. The treated water outfall is proposed to intersect monsoon forest (VMU2), however there will be no clearing associated with the outfall pipe.

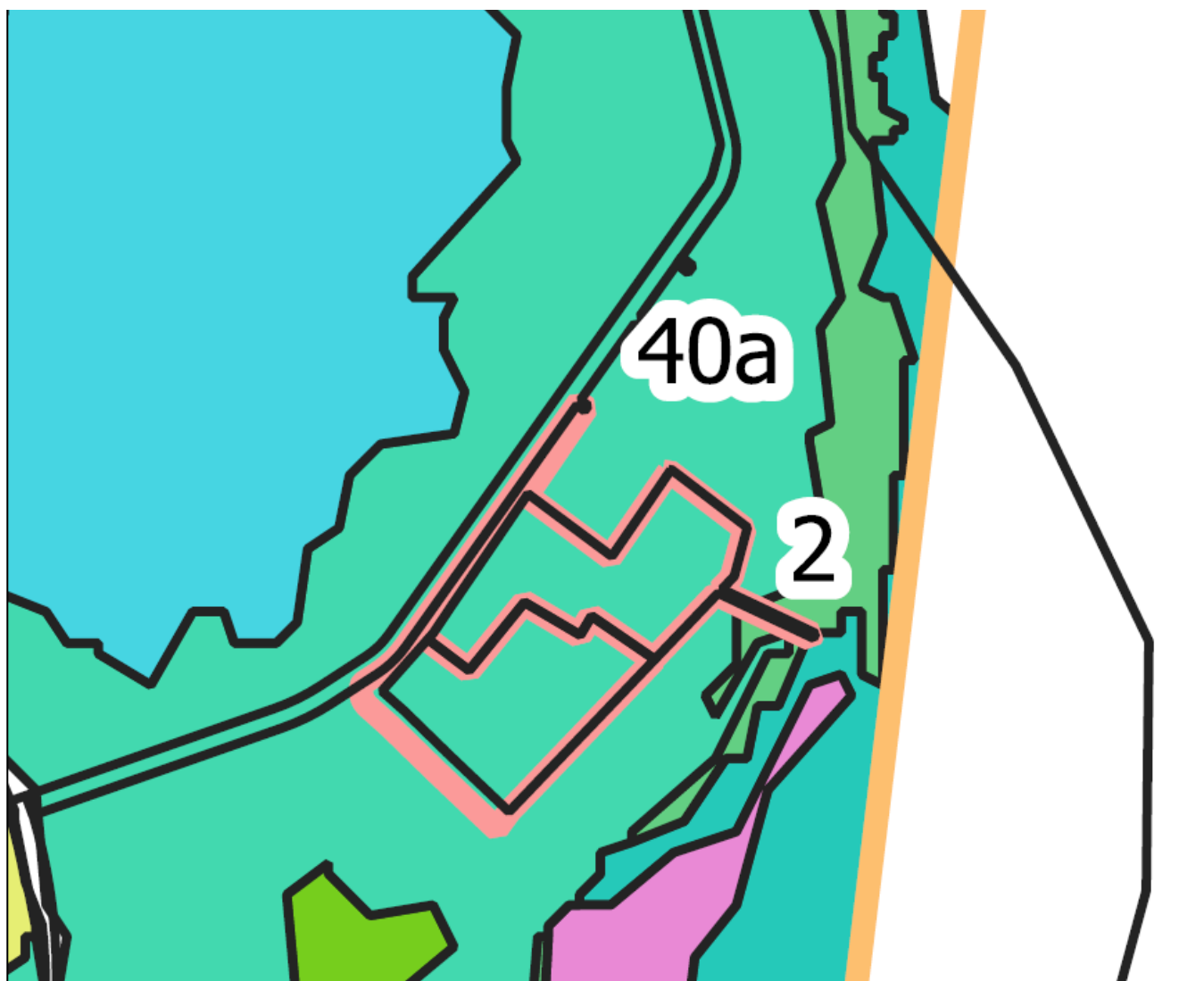


Figure 2-4 Vegetation type in Aquaculture Facility Footprint

Section 3 Matters of National Environmental Significance

The PMST used a 1 km of the Project area. The following sections address presence of MNES relative to the Project area and potential impacts to MNES specific to the proposed temporary road. The following MNES have been identified as known or likely to occur within the Project area:

- Nationally threatened species, and
- Migratory species.

3.1 Existing Environment

3.1.1 World heritage properties

No World Heritage properties occur within the Project area or immediate surrounds. The closest national heritage place is Kakadu, approximately 370 km west of the proposal area. World heritage properties are unlikely to be impacted by the Project.

3.1.2 National heritage places

No National Heritage Places occur within the Project area or immediate surrounds. The closest national heritage place is Kakadu, approximately 370 km west of the proposal area. National Heritage Places are unlikely to be impacted by the Project.

3.1.3 Wetlands of international importance (Ramsar wetlands)

No Ramsar wetlands occur within the Project area or immediate surrounds. The closest Ramsar wetland is Kakadu, approximately 370 km west of the proposal area. Ramsar wetlands are unlikely to be impacted by the Project.

3.1.4 Nationally threatened species and ecological communities

No threatened ecological communities (TECs) are likely to occur within the Project area or nominated buffer area. The PMST identified several conservation significant flora and fauna species with the potential to occur within 1 km of the Project area. A likelihood of occurrence assessment for nationally threatened species is provided within Table 3-1. For the purposes of this assessment, marine species have been excluded from the likelihood of occurrence assessment as they are not considered to be relevant to the Project.

The following species have been identified as being known to occur within the Project area:

- Greater Sand Plover, *Charadrius leschenaultia* (Vulnerable)
- Lesser Sand Plover, *Charadrius mongolus* (Vulnerable)
- Eastern Curlew, *Numenius madagascariensis* (Critically Endangered)
- Northern Masked Owl, *Tyto novaehollandiae kimberli* (Vulnerable)
- Northern Quoll, *Dasyurus hallucatus* (Endangered)
- Ghost Bat, *Macroderma gigas* (Vulnerable)
- Northern Blue-tongue Skink, *Tiliqua scincoides intermedia* (Critically Endangered)
- Mertens' Water Monitor, *Varanus mertensi* (Endangered)

Potential impacts to nationally threatened species and ecological communities are discussed within Section 3.2.

Table 3-1 Likelihood of Occurrence of Threatened Species in the PMST

Common Name	Scientific Name	EPBC Status	Potential Occurrence	Species Summary
Birds				
Sharp-tailed Sandpiper	<i>Calidris acuminata</i>	V, M	Low	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the proposal.
Red Knot	<i>Calidris canutus</i>	V, M	Low	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the proposal.
Curlew Sandpiper	<i>Calidris ferruginea</i>	CE, M	Low	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the proposal.
Greater Sand Plover	<i>Charadrius leschenaultii</i>	V, M	Confirmed	Small numbers on saline tidal flats to the east of the proposal, preferred habitat is not present in the works footprint. Numbers do not trigger MNES significance levels (DoE 2015c).
Lesser Sand Plover^	<i>Charadrius mongolus</i>	E, M	Confirmed	Small numbers on saline tidal flats to the east of the proposal, preferred habitat is not present in the works footprint. Numbers do not trigger MNES significance levels (DoE 2015c).
Gouldian Finch	<i>Chloebia gouldiae</i>	E	Low	Only one historical record on Groote dating to the early 1900s. Not detected in extensive avian surveys in the area.
Red Goshawk	<i>Erythrorhynchus radiatus</i>	E	Low	No previous records on Groote Eylandt. Species not detected in extensive avian surveys in the proposal area.
Asian Dowitcher	<i>Limnodromus semipalmatus</i>	V, M	Low	No previous records on Groote Eylandt, preferred habitat is not present in the proposal footprint.
Western Alaskan Bar-tailed Godwit	<i>Limosa lapponica baueri</i>	V, M*	Low	Regional records on Groote Eylandt but present in low numbers. Could occur occasionally on salt pans to the east of the proposal.
Eastern Curlew	<i>Numenius madagascariensis</i>	CE, M	Confirmed	Small numbers on saline tidal flats to the east of the proposal, preferred habitat is not present in the works footprint. Numbers do not trigger MNES significance levels (DoE 2015c).
Australian Painted Snipe	<i>Rostratula australis</i>	E	Low	No previous records on Groote Eylandt, preferred habitat is not present in the proposal footprint.
Little Tern	<i>Sternula albifrons</i>	V, M	Confirmed	Small numbers on saline tidal flats to the east of the proposal, preferred habitat is not present in the works footprint. Numbers do not trigger MNES significance levels (DoE 2015c).

Common Name	Scientific Name	EPBC Status	Potential Occurrence	Species Summary
Common Greenshank, Greenshank	<i>Tringa nebularia</i>	E, M	Low	No previous records on Groote Eylandt, preferred habitat is not present in the proposal footprint.
Northern Masked Owl ¹	<i>Tyto novaehollandiae kimberli</i>	V	Confirmed	Northern masked owls forage across most of the lowland areas in and surrounding the proposal area, with fewer records in elevated sandstone. The proposal area likely constitutes a small portion (<1%) of 1 pair home ranges, with one nesting area and one roost area identified and avoided during siting, located just to the southwest of the Lease 2 boundary.
Mammals				
Brush-tailed Rabbit-rat	<i>Conilurus penicillatus</i>	V	Low	Extensive camera trapping in and surrounding the proposal area has not detected this species. The nearest records are 12 km to the east (based on data from Anindilyakwa Land and Sea Rangers monitoring 2022).
Northern Quoll	<i>Dasyurus hallucatus</i>	E	Confirmed	Common across the study area. Based on Heiniger <i>et al.</i> (2020a), the proposal clearance footprint (6.21 ha) would impact home range areas approximating 2.05 northern quolls (based on a density estimate of 0.33 quolls/ha).
Ghost Bat	<i>Macroderma gigas</i>	V	Confirmed	A nocturnal feeding roost identified with 1 to 2 bats present approximately 4 km west of the proposal area. No suitable roosting habitat; however, area may be infrequently used for foraging.
Northern Hopping-mouse	<i>Notomys aquilo</i>	V	Low	No historical records close to the proposal footprint, not detected in detailed targeted surveys in the proposal footprint.
Bare-rumped Sheath-tail Bat	<i>Saccolaimus saccolaimus nudiclunatus</i>	V	Low	No previous records on Groote Eylandt, not detected in habitat tree assessments or acoustic recording with targeted analysis routines to detect this species (Armstrong and Konishi 2022).
Northern Brushtail Possum	<i>Trichosurus vulpecula arnhemensis</i>	V	Low	No previous records on Groote Eylandt, not detected in habitat tree assessments or acoustic recording with targeted analysis routines to detect this species (Armstrong and Konishi 2022).
Water Mouse	<i>Xeromys myoides</i>	V	Low	No previous records on Groote Eylandt, preferred habitat (mangroves and adjacent wetland habitat) is not present in the proposal footprint.
Reptiles				
Plains Death Adder	<i>Acanthophis hawkei</i>	V	Low	No previous records on Groote Eylandt, preferred habitat is not present in the proposal footprint.
Loggerhead Turtle	<i>Caretta caretta</i>	E, M	Low	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the proposal footprint. May occur in offshore marine habitats.

Common Name	Scientific Name	EPBC Status	Potential Occurrence	Species Summary
Green Turtle	<i>Chelonia mydas</i>	V, M	Low	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the proposal footprint. May occur in offshore marine habitats.
Leatherback Turtle	<i>Dermochelys coriacea</i>	E, M	Low	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the proposal footprint. May occur in offshore marine habitats.
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	V, M	Low	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the proposal footprint. May occur in offshore marine habitats.
Olive Ridley Turtle	<i>Lepidochelys olivacea</i>	E, M	Low	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the proposal footprint. May occur in offshore marine habitats.
Flatback Turtle	<i>Natator depressus</i>	V, M	Low	Regional records in the Groote Archipelago, preferred beach nesting habitat is not present in the proposal footprint. May occur in offshore marine habitats.
Northern Blue-tongue Skink	<i>Tiliqua scincoides intermedia</i>	CE	Confirmed	Confirmed as occurring across northern Groote Eylandt, including in proximity to the project area.
Mertens' Water Monitor, Mertens's Water Monitor	<i>Varanus mertensi</i>	E	Confirmed	Sighted at several locations outside of the current development footprint in drainage areas and swamp forest habitat.

3.1.5 Migratory species protected under international agreements

Desktop assessments identified several migratory species with the potential to occur throughout the Project area and 1 km buffer. A likelihood of occurrence assessment for these migratory species is contained within Table 3-1.

The following species were identified as being known to occur within the Project area:

- Greater Sand Plover, *Charadrius leschenaultia*
- Lesser Sand Plover, *Charadrius mongolus*
- Eastern Curlew, *Numenius madagascariensis*
- Little Tern, *Sternula albifrons*
- Northern Masked Owl, *Tyto novaehollandiae kimberli*

3.1.6 Commonwealth marine areas

No Commonwealth marine area occur within the Project area or immediate surrounds. The Commonwealth marine area is approximately 50 km east at the closest point. Commonwealth marine areas are unlikely to be impacted by the Project

3.1.7 Great Barrier Reef Marine Park

The proposal area is not within the Great Barrier Reef Marine Park. The proposal area is located approximately 760 km west of the closest point of the Great Barrier Marine Park (north-eastern coast of Cape York).

3.1.8 Nuclear actions

The Project is not a nuclear action.

3.1.9 A water resource in relation to coal seam gas and large coal mining development

The Project is not a coal seam gas or large coal mining development.

3.2 Significant Impact Assessment

The following sections provide an assessment of MNES that have been identified in Section 3.1 as likely or known to occur within the Project area against the Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (DoE, 2013) (Significant Impact Guidelines) and relevant species-specific guidelines where applicable.

3.2.1 Nationally threatened species

Several field survey programs were completed through 2021 and 2022 to establish the baseline environmental conditions and species occurrence in the proposal area (refer to Attachment 1). A number of EPBC Act threatened fauna species occur in habitats within the study area and adjacent coastal areas. The main species include migratory shorebirds, the Northern Masked Owl, Northern Quoll, Northern Blue-tongue Skink and Ghost Bat. Low numbers of listed shorebirds (critically endangered, endangered and vulnerable) were detected on the south-western side of Bartalumba Bay, and in the intertidal zone surrounding the proposed discharge point. The following sections assess each of the detected species against the relevant Significant Impact Guidelines 1.1 criteria.

In line with the Significant Impact Guidelines, an action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:

- Lead to a long-term decrease in the size of a population
- Reduce the area of occupancy of the species
- Fragment an existing population into two or more populations
- Adversely affect habitat critical to the survival of a species
- Disrupt the breeding cycle of a population
- Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- Result in invasive species that are harmful to an endangered species becoming established in the endangered species' habitat
- Introduce disease that may cause the species to decline, or

- *Interfere with the recovery of the species.*

The above criteria also apply to vulnerable species; however, the Significant Impact Guidelines outline that the criteria for vulnerable species only apply to 'important populations', rather than any population within relevant criteria. An 'important population' is defined within the Significant Impact Guidelines as:

A population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- *Key source populations either for breeding or dispersal*
- *Populations that are necessary for maintaining genetic diversity, and/or*
- *Populations that are near the limit of the species range.*

The Preliminary Documentation prepared for the Stage 2 Aquaculture Project contains relevant information on the species description occurrence in the region and local area and mapped habitat within the Project area. Due to the nature and location of the Project, the information provided within the Preliminary Documentation is largely relevant for the proposed development subject to this self-assessment. The following sections provide a significant impact assessment for the species known or likely to occur within the Project area. The Significant Impact Assessments have been adapted from Preliminary Documentation for the project, and contemporary desktop results for the proposed development for each species.

3.2.2 Detected Threatened Species

Based on the desktop study and field survey there are four threatened species that are considered relevant to the proposal being the Northern Masked Owl, Northern Quoll, Northern Blue-tongue Skink and to a lesser extent the Ghost Bat. Table 3-2 provides an assessment of the proposal against the significant impact criteria for the three threatened fauna species known or likely to occur within the proposal area, in accordance with the Significant Impact Guidelines 1.1 (Department of the Environment 2013).

Table 3-2 Assessment Against Significant Impact Criteria: Threatened Species: Northern Masked Owl, Northern Quoll, and Northern Blue-tongued Skink

Criteria	Species		
	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink
Scientific Name	<i>Tyto novaehollandiae kimberli</i>	<i>Dasyurus hallucatus</i>	<i>Tiliqua scincoides intermedia</i>
EPBC Status	Vulnerable	Endangered	Critically Endangered
Significance of individuals detected	The status of the Northern Masked Owl in the Groote Archipelago is fair (DENR and ALC 2019). It is estimated that there are approximately 730 mature masked owls on Groote Eylandt (Barden et al. 2021).	Although the Northern Quoll is listed as Endangered nationally and Critically Endangered by the Northern Territory, its status in the Groote Archipelago is very good (DENR and ALC 2019). Retention of this local status is important for the species due to the absence of Cane Toads in the Archipelago.	Several camera trap detections in the area west of Lease 1 and 2. Not detected in Lease 1 and 2 but may occur there in low numbers.
Lead to a long-term decrease in the size of a population for endangered species or important population for vulnerable species	Unlikely. No Masked Owl habitat will be affected and the population in the Project area is unlikely to be affected.	Unlikely. No Northern Quoll habitat will be affected and the population in the Project area is unlikely to be affected.	Unlikely. The current knowledge of this species indicates that they are associated with sandstone areas that will not be disturbed for the Project.
Reduce the area of occupancy of the species for endangered or important population for vulnerable	Unlikely. No Masked Owl habitat will be affected.	Unlikely. No Northern Quoll habitat will be affected.	Unlikely. Based on current knowledge of the local distribution of this species, the Project will not reduce the area of occupancy of this species.
Fragment an existing population into two or more populations.	Unlikely. No Masked Owl habitat will be affected. The species is highly mobile and likely to continue to use the Project area and surrounds.	Unlikely. No Northern Quoll habitat will be affected. The species is highly mobile and likely to continue to use the Project area and surrounds.	Unlikely. The design will not fragment local northern blue-tongue skink populations.
Adversely affect habitat critical to the survival of a species: For activities such as foraging, breeding, roosting, or dispersal For the long-term maintenance of the species (including the maintenance of species	Unlikely. No Masked Owl habitat will be affected. The Project does not pose a risk to the long-term survival and genetic diversity of the local northern masked owl population.	Unlikely. No Northern Quoll habitat will be affected. The Project does not pose a risk to the long-term survival and genetic diversity of the local Northern Quoll population.	Unlikely. No northern blue-tongue skink habitat will be affected. The Project does not pose a risk to the long-term survival and genetic diversity of the local northern blue-tongue skinks population.

Criteria	Species		
	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink
essential to the survival of the species) To maintain genetic diversity and long-term evolutionary development For the reintroduction of populations or recovery of the species or ecological community			
Disrupt the breeding cycle of a population.	Unlikely. It is unlikely that the Project will significantly interrupt local masked owl breeding.	Unlikely. It is unlikely that the Project will significantly interrupt local northern quoll breeding.	Unlikely. It is unlikely that the Project will significantly interrupt northern blue-tongued skink breeding.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely. No Masked Owl habitat will be affected and the population in the Project area is unlikely to be affected.	Unlikely. No Northern Quoll habitat will be affected.	Unlikely. Based on current knowledge of the local distribution of this species, the Project will not reduce the area of occupancy of this species.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	Unlikely. The foraging efficiency of Northern Masked Owls can be affected by the presence of invasive grasses. Feral cats may occasionally predate northern masked owls while they are feeding on the ground. The Weed Management Plan and Biosecurity Management Plan, including hygiene protocols, will be implemented to avoid the introduction and spread of weeds and pest species.	Unlikely. Northern Quolls are highly susceptible to invasion of Cane Toads as well as predation by and competition with cats and foxes. Foxes are not present on Groote Eylandt and cats are present in low densities (Heiniger et al. 2020b). Implementation of and adherence to the Biosecurity Management Plan aims to prevent invasive species from becoming established in the area.	Unlikely. There are currently no invasive species that are harmful to northern blue-tongued skink in the Project area. The Project has a dedicated quarantine plan to prevent introduction of additional invasive species.
Introduce disease that may cause the species to decline.	Unlikely. Disease is not a current cause of decline for the Northern Masked Owl. The Biosecurity Management Plan, including hygiene protocols, will be implemented during the construction and operation phases of the Project to avoid the introduction and spread of disease and weeds.	Unlikely. Disease is not a current cause of decline for the Northern Quoll, but dasyurids are known to be susceptible to toxoplasmosis. The Biosecurity Management Plan, including hygiene protocols, will be implemented during the construction and operation phases of the Project to avoid the introduction and spread of disease and weeds.	Unlikely. The project is unlikely to introduce disease that might cause the species to decline. The quarantine protocols for the Project are designed to minimise associated risks.

Criteria	Species		
	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink
Interfere with the recovery of the species	Unlikely. There is no adopted or made Recovery Plan for the Northern Masked Owl, but the following recovery actions have been recommended: - Establish and operate a recovery team or regular forum or alliance to assist in the coordination of management actions (Woinarski 2004). - Examine the impacts of land clearing, particularly in the Darwin-Daly River region, and the response to historic clearing in north-eastern Queensland, and use the resulting knowledge to generate guidelines to protect habitat in landscapes subject to increasingly intensive development (Woinarski 2004). - Develop a monitoring program to provide effective and accurate measures of trends in status (Woinarski 2004). - Assess the population size, distribution and habitat requirements (Woinarski 2004). - Assess trends in response to management interventions (Garnett et al. 2011). - Assess causes for decline, i.e. small mammal decline (Garnett et al. 2011). - Maintain and enhance the suitability of habitat through fire management (Woinarski 2004). - Minimise the impacts of current and proposed land clearing activities (Woinarski 2004). - Minimise the impacts caused by the spread of exotic pasture plants (Woinarski 2004) The Project will not interfere with these recovery actions. The surrounding area is within the Anindilyakwa Indigenous Protected Area, which is managed for the protection of biological resources and threatened species.	Unlikely. The 'National recovery plan for the Northern Quoll <i>Dasyurus hallucatus</i>' outlines eight specific objectives. - Protect northern quoll populations on offshore islands from invasion and establishment of cane toads, cats and other potential invasive species - The Biosecurity Management Plan - Foster the recovery of northern quoll subpopulations in areas where the species has survived alongside cane toads - Not relevant - Halt northern quoll declines in areas not yet colonised by cane toads - The status of Northern Quoll in the Groote Archipelago is very good and the Project is unlikely to cause the population to decline - Halt northern quoll declines in areas recently colonised by cane toads - Not relevant - Maintain secure populations and source animals for future reintroductions / introductions, if they become appropriate - The population of Northern Quolls is likely to be maintained alongside the construction and operation phases of the Project - Reduce the risk of northern quoll populations being decimated by disease - The Biosecurity Management Plan, including hygiene protocols, aims to prevent the introduction of disease to the area - Reduce the impact of feral predators on northern quolls - The Biosecurity Management Plan aims to prevent the introduction and establishment of Cane Toads to Groote Eylandt and is unlikely to result in increased numbers of Feral Cats	Unlikely. There are no overarching threats for northern blue-tongued skink on Groote Eylandt other than the risk of introduction of cane toads to the islands and fire management. The Project will not significantly interfere with the overall recovery of the northern blue-tongued skink on Groote Eylandt.

Criteria	Species		
	Northern Masked Owl	Northern Quoll	Northern Blue-tongued Skink
		Raise public awareness of the plight of northern quolls and the need for biosecurity of islands and WA The Project will not interfere with public awareness measures. The surrounding area is within the Anindilyakwa Indigenous Protected Area, which is managed for the protection of biological resources and threatened species.	
Assessment of potential for significant residual impacts	The Project will potentially have some minimal residual significant impacts on the Northern Masked Owl, but are unlikely to be significant based on consideration of the criteria	The Project will potentially have some minimal residual impacts on the Northern Quoll (i.e., minor reduction in habitat extent), but are unlikely to be significant based on consideration of the criteria.	The Project is unlikely to result in a significant residual impact to the species. There are no residual risks other than those identified in this report. Management of cane toads and quarantine is priority for northern blue-tongued skink management in the Groote Archipelago.

3.2.3 Migratory species protected under international agreements

Seven listed migratory shorebirds (three threatened), eleven migratory seabirds, and two other marine migratory species have been recorded in coastal habitats adjacent to the Project area. Migratory shorebird species were present in low numbers in coastal areas of south-western Bartalumba Bay during the 2021 and 2022 field surveys, with a maximum total island count of approximately 30 individuals. The overall numbers of birds in marine and tidal habitats on the margins of Winchelsea Island (offshore from the Project area) were also low, with a maximum count of 116 individual birds.

Under the EPBC Act, 'important habitat' is identified in EPBC Act Policy Statement 1.1 Significant Impact Guidelines – Matters of National Environmental Significance (DoE 2015a). Important habitats in Australia for migratory birds under the EPBC Act include those recognised as nationally or internationally important (DoE 2015b). Under the guidelines, habitat should be considered internationally important if it regularly supports:

- 1 percent (%) of the individuals in a population of one species or subspecies of waterbird; OR
- A total abundance of at least 20,000 waterbirds.

Nationally important habitat for migratory shorebirds can be defined using a similar approach to these international criteria, i.e. if it regularly supports:

- 0.1 % of the flyway population of a single species of migratory shorebird; OR
- 2000 migratory shorebirds; OR
- 15 migratory shorebird species.

Migratory shorebirds are present in low numbers, and none exceed thresholds for 1% or 0.1% of the flyway population. The number of species (6 detected in this study plus 2 local records from existing data) and the total count (approximately 30) is below the significance thresholds for species richness (15 species) and numbers (2000) at a location (DoE 2015b).

Table 3-3 Assessment Against Significant Impact Criteria: Threatened Species: Lesser Sand Plover, Greater Sand Plover, and Eastern Curlew

Criteria	Species		
	Lesser Sand Plover	Greater Sand Plover	Eastern Curlew
Scientific Name	<i>Charadrius mongolus</i>	<i>Charadrius leschenaultii</i>	<i>Numenius madagascariensis</i>
EPBC Status	Endangered	Vulnerable	Critically Endangered
Significance of individuals detected	A maximum of 12 individuals were observed during field surveys, representing an insignificant proportion of the population (<0.1%).	A maximum of six (6) individuals were observed during field surveys, representing an insignificant proportion of the population (<0.1%).	A maximum of six (6) individuals were observed during field surveys, representing an insignificant proportion of the population (<0.1%).
Lead to a long-term decrease in the size of a population for endangered species or important population for vulnerable species	Unlikely. Very few individuals were observed near the Little Paradise Project area and construction and operational activities in the species' habitat is minimal (Little Paradise Marina only). No individuals were observed in the Project area. Therefore, the Project is unlikely to lead to a long-term decrease in the population.	Unlikely. Very few individuals were observed near the Little Paradise Project area and construction and operational activities in the species' habitat is minimal (Little Paradise Marina only). No individuals were observed in the Project area. Therefore, the Project is unlikely to lead to a long-term decrease in the population.	Unlikely. Very few individuals were observed near the Little Paradise Project area and construction and operational activities in the species' habitat is minimal (Little Paradise Marina only). No individuals were observed in the Project area. Therefore, the Project is unlikely to lead to a long-term decrease in the population.
Reduce the area of occupancy of the species for endangered or important population for vulnerable	Unlikely. No individuals of this species were observed in the Project area. The Project is unlikely to reduce the area of occupancy of the species.	Unlikely. No individuals of this species were observed in the Project area. The Project is unlikely to reduce the area of occupancy of the species.	Unlikely. No individuals of this species were observed in the Project area. The Project is unlikely to reduce the area of occupancy of the species.
Fragment an existing population into two or more populations.	Unlikely. The species is highly mobile and migratory; thus, the Project will not fragment a population of the species.	Unlikely. The species is highly mobile and migratory; thus, the Project will not fragment a population of the species.	Unlikely. The species is highly mobile and migratory; thus, the Project will not fragment a population of the species.
Adversely affect habitat critical to the survival of a species: For activities such as foraging, breeding, roosting, or dispersal For the long-term maintenance of the species (including the maintenance of species essential to the survival of the species)	Unlikely. No individuals of this species were observed in the Project area.	Unlikely. No individuals of this species were observed in the Project area.	Unlikely. No individuals of this species were observed in the Project area.

Criteria	Species		
	Lesser Sand Plover	Greater Sand Plover	Eastern Curlew
To maintain genetic diversity and long-term evolutionary development For the reintroduction of populations or recovery of the species or ecological community			
Disrupt the breeding cycle of a population.	Unlikely. The species does not breed in Australia.	Unlikely. The species does not breed in Australia.	Unlikely. The species does not breed in Australia.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Unlikely. No individuals of this species were observed in the Project area. The species is unlikely to decline as a result of Project activities.	Unlikely. No individuals of this species were observed in the Project area. The species is unlikely to decline as a result of Project activities.	Unlikely. No individuals of this species were observed in the Project area. The species is unlikely to decline as a result of Project activities.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	Unlikely. Feral Cats and Red Foxes are a threat to the species. Foxes are not present on Groote Eylandt and cats are present in low densities (Heiniger et al. 2020b). Implementation of and adherence to the Biosecurity Management Plan aims to prevent invasive species from becoming established in the area.	Unlikely. Feral Cats and Red Foxes are a threat to the species. Foxes are not present on Groote Eylandt and cats are present in low densities (Heiniger et al. 2020b). Implementation of and adherence to the Biosecurity Management Plan aims to prevent invasive species from becoming established in the area.	Unlikely. Feral Cats and Red Foxes are a threat to the species. Foxes are not present on Groote Eylandt and cats are present in low densities (Heiniger et al. 2020b). Implementation of and adherence to the Biosecurity Management Plan aims to prevent invasive species from becoming established in the area.
Introduce disease that may cause the species to decline.	Unlikely. Disease is not a current threat for the species. The Biosecurity Management Plan, including hygiene protocols, will be implemented during the construction and operation phases of the Project to avoid the introduction and spread of disease and weeds.	Unlikely. Disease is not a current threat for the species. The Biosecurity Management Plan, including hygiene protocols, will be implemented during the construction and operation phases of the Project to avoid the introduction and spread of disease and weeds.	Unlikely. Disease is not a current threat for the species. The Biosecurity Management Plan, including hygiene protocols, will be implemented during the construction and operation phases of the Project to avoid the introduction and spread of disease and weeds.
Interfere with the recovery of the species	Unlikely. There is no adopted or made Recovery Plan for the Lesser Sand Plover, but the following conservation and management actions are outlined in the conservation advice for the species:	Unlikely. There is no adopted or made Recovery Plan for the Greater Sand Plover, but the following conservation and management actions are outlined in the conservation advice for the species:	Unlikely. There is no adopted or made Recovery Plan for the Eastern Curlew, but the following conservation and management actions are outlined in the conservation advice for the species:

Criteria	Species		
	Lesser Sand Plover	Greater Sand Plover	Eastern Curlew
	Work with governments along the East Asian – Australasian Flyway to prevent destruction of key breeding and migratory staging sites. Protect important habitat in Australia. Support initiatives to improve habitat management at key sites. Maintain and improve protection of roosting and feeding sites in Australia. Advocate for the creation and restoration of foraging and roosting sites. Incorporate requirements for lesser sand plover into coastal planning and management. Manage important sites to identify, control and reduce the spread of invasive species. Manage disturbance at important sites which are subject to anthropogenic disturbance when lesser sand plovers are present – e.g. discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures. The Project will not interfere with these conservation and management actions.	Work with governments along the East Asian – Australasian Flyway to prevent destruction of key breeding and migratory staging sites. Protect important habitat in Australia. Support initiatives to improve habitat management at key sites. Maintain and improve protection of roosting and feeding sites in Australia. Advocate for the creation and restoration of foraging and roosting sites. Incorporate requirements for greater sand plover into coastal planning and management. Manage important sites to identify, control and reduce the spread of invasive species. Manage disturbance at important sites which are subject to anthropogenic disturbance when greater sand plovers are present – e.g. discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures. The Project will not interfere with these conservation and management actions.	Work with governments along the East Asian – Australasian Flyway to prevent destruction of key migratory staging sites. Develop and implement an International Single Species Action Plan for eastern curlew with all range states. Support initiatives to improve habitat management at key sites. Maintain and improve protection of roosting and feeding sites in Australia. Incorporate requirements for eastern curlews into coastal planning and management. Manage important sites to identify, control and reduce the spread of invasive species. Manage disturbance at important sites when eastern curlews are present – e.g. discourage or prohibit vehicle access, horse riding and dogs on beaches, implement temporary site closures. Monitor the progress of recovery, including the effectiveness of management actions and the need to adapt them if necessary. The Project will not interfere with these conservation and management actions.
Assessment of potential for significant residual impacts	The Project is unlikely to have residual significant impacts on the Lesser Sand Plover.	The Project is unlikely to have residual significant impacts on the Greater Sand Plover.	The Project is unlikely to have residual significant impacts on the Eastern Curlew.

Table 3-4 Assessment Against Significant Impact Criteria: Migratory Birds

Criteria	Species		
	Whimbrel	Common Greenshank	Common Sandpiper
Have you surveyed for the migratory bird?	Yes	Yes	Yes

Criteria	Species		
	Whimbrel	Common Greenshank	Common Sandpiper
Is the proposed Activity within the range of the species?	Yes	Yes	Yes
Is the proposed activity likely to substantially modify, destroy or isolate an area of important habitat?	No.	No.	No.
Seriously disrupt the lifecycle of an ecologically significant proportion of a population of the migratory birds?	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population
Number of Site Surveys Detected in	3	2	4
Habitat	Tidal flats, mud flats, salt pans	Tidal flats, mud flats, salt pans	Rocky shores, mangroves, tidal flats
Comments	Extensive tidal mudflats and salt pans occur adjacent to mangroves.	Extensive tidal mudflats and salt pans occur adjacent to mangroves.	Extensive tidal mudflats and salt pans occur adjacent to mangroves.
Area of Significant Habitat in the Project Area?	Based on surveys conducted in the Little Paradise area in January 2021, the marine and tidal habitats surrounding the peninsula do not qualify as internationally or nationally significant for migratory shorebirds.	Based on surveys conducted in the Little Paradise area in January 2021, the marine and tidal habitats surrounding the peninsula do not qualify as internationally or nationally significant for migratory shorebirds.	Based on surveys conducted in the Little Paradise area in January 2021, the marine and tidal habitats surrounding the peninsula do not qualify as internationally or nationally significant for migratory shorebirds.
Significant Impact Area Thresholds for Areas of Important Habitat 1 % (Hectares)	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species
Significant Impact Area Thresholds for Areas of Important Habitat 0.1%	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species
Maximum Number Sighted in Surveys Little Paradise	2	1	2

Criteria	Species		
	Whimbrel	Common Greenshank	Common Sandpiper
Ecologically Significant Proportion of a population (individuals) - 1% ²	400	550	300
Ecologically Significant Proportion of a population (individuals) - 0.1% ⁴	40	55	30

Table 3-5 Assessment Against Significant Impact Criteria: Migratory Shorebirds and other Migratory Species

Criteria	Species				
	Caspian Tern	Greater Crested Tern	Little Tern	Eastern Osprey	Arafura Fantail
Have you surveyed for the migratory bird?	Yes	Yes	Yes	Yes	Yes
Is the proposed Activity within the range of the species?	Yes	Yes	Yes	yes	Yes
Is the proposed activity likely to substantially modify, destroy or isolate an area of important habitat?	No. The small volumes and anticipated water quality and discharge regime are such that little modification of the natural habitat is anticipated.	No. The small volumes and anticipated water quality and discharge regime are such that little modification of the natural habitat is anticipated.	No. The small volumes and anticipated water quality and discharge regime are such that little modification of the natural habitat is anticipated.	No. The small volumes and anticipated water quality and discharge regime are such that little modification of the natural habitat is anticipated.	No. The small volumes and anticipated water quality and discharge regime are such that little modification of the natural habitat is anticipated.
Seriously disrupt the lifecycle of an ecologically significant proportion of a population of the migratory birds?	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population	Unlikely. The area around the Project site does not support an ecologically significant proportion of the species' population
Number of Site Surveys Detected in	1	5	3	2	1

² Calculated from the estimated flyway population in Table A of the *Background Paper to the Wildlife Conservation Plan for Migratory Shorebirds* (DEH 2005).

Criteria	Species				
	Caspian Tern	Greater Crested Tern	Little Tern	Eastern Osprey	Arafura Fantail
Habitat	Marine and coastal habitats, rocky shores	Marine and coastal habitats, rocky shores	Marine and coastal habitats, rocky shores	Coastal marine, rocky shores	Wet sclerophyll forests and other moist dense forests
Comments	Suitable foraging habitat exist within the extensive tidal mudflats and salt pans adjacent to the mangroves.	Suitable foraging habitat exist within the extensive tidal mudflats and salt pans adjacent to the mangroves.	Suitable foraging habitat exist within the extensive tidal mudflats and salt pans adjacent to the mangroves.	Two eastern ospreys were recorded in mangrove areas to the east of the Study area and one below the main cliff approximately 2 km west. Nest sites were not detected.	One individual was observed at the edge of lease 9.
Area of Significant Habitat in the Project Area?	Based on surveys conducted in the Little Paradise area in January 2021, the marine and tidal habitats surrounding the peninsula do not qualify as internationally or nationally significant for migratory shorebirds.	Based on surveys conducted in the Little Paradise area in January 2021, the marine and tidal habitats surrounding the peninsula do not qualify as internationally or nationally significant for migratory shorebirds.	Based on surveys conducted in the Little Paradise area in January 2021, the marine and tidal habitats surrounding the peninsula do not qualify as internationally or nationally significant for migratory shorebirds.	There are likely to be only one or two pairs in local area, and development of the proposed landing facility will require disturbance of no more than 30 m – 50 m of coastal foreshore habitat. Nests sites were not detected in the Project area.	0.5 ha of monsoon forest
Significant Impact Area Thresholds for Areas of Important Habitat 1 % (Hectares)	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species.	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species.	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species.	840 km coastline ⁶	4,500 ha ⁶
Significant Impact Area Thresholds for Areas of Important Habitat 0.1%	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species.	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species.	No sites in the vicinity of the Project area are listed in the Nationally Important Wetlands Directory for this species.	84 km coastline ⁶	450 ha ⁶
Maximum Number Sighted in Surveys Little Paradise	2	25	4	2	1
Ecologically Significant Proportion of a population (individuals) - 1%	2,500 ⁵	1,500 ³	1,900 ⁵	240 ⁴	22,000 ⁶

³ Calculated from the lower estimated global population in IUCN Red List for birds (BirdLife International 2023).

⁴ Referral guideline for 14 birds listed as migratory species under the EPBC Act (DoE 2015b).

Criteria	Species				
	Caspian Tern	Greater Crested Tern	Little Tern	Eastern Osprey	Arafura Fantail
Ecologically Significant Proportion of a population (individuals) - 0.1%	250 ⁵	150 ⁵	190 ⁵	24 ⁶	2,200 ⁶

Section 4 Conclusion and Recommendations

Numerous desktops and field-based studies have informed the self-assessment. The self-assessment assumes the accuracy of the information obtained in the field studies and is predicated on implementing both standard management and control measures, and those recommended in technical studies. The following is a compilation of measures that should be implemented. If the development inclusions or extent change, or the following management measures cannot be implemented, the conclusions in this self-assessment should be reviewed for accuracy:

- Water release will occur only on an outgoing high tide.
- An overarching Environmental Management Plan must be implemented and include the following management sub-plans developed for GAAC activities in northern Groote Eylandt. Actions are to strictly adhere to all construction and operational controls stated in the plans:
 - Biosecurity Management Plan.
 - Threatened Species Management Plan.
 - Weed Management Plan.
- GAAC, or their contractor with delegated responsibility, must control all surface water runoff that originates within the proposal area and prevent off-site sedimentation. To achieve this objective, GAAC, or their contractor with delegated responsibility, must:
 - Develop a site-specific Erosion and Sediment Control Plan (ESCP) prior to undertaking any works. The ESCP must be developed in accordance with the International Erosion Control Association (IECA)'s Best Practice Erosion and Sediment Control Document⁵.
 - Incorporate ASS identification and management requirements into the site-specific ESCP to address the potential occurrence of ASS during excavation.
 - Design stormwater as well as erosion and sediment control measures in accordance with best management practices outlined in the IECA's Best Practice Erosion and Sediment Control Document, and fully implement these measures prior to commencing construction activities.
 - Conduct site inspections, including visual assessment of surface water runoff structures, drainage structures and erosion control structures to ensure these are operating effectively, twice weekly throughout the clearing⁶ and construction phases and monthly during the operation phase.
 - As indicated by inspections, clear sediment traps of sediment, store and/or dispose of sediment in accordance with Best Practice Erosion and Sediment Control Document and repair any damaged drainage features immediately after any damage is identified.
- Incorporation of operational stormwater management infrastructure to accommodate extreme weather events and regular inspections of stormwater infrastructure.
- Minimise concentrated flow of surface water and ponding (drain lines, sediment bunds, liners etc).
- Clearly mark limits of clearing and the clearing or earthworks activities within the aquaculture facility area must only take place in the dry season, from 1 April to 31 October inclusive, in any year.
- Revegetation of exposed areas where not proposed to be utilised.
- Significant habitats for the Northern Masked Owl and Northern Quoll, including drainage lines, monsoon forests, *Callitris intratropica* thickets and margins of sandstone habitats, will be avoided (avoidance of key Melaleuca, riparian and monsoon forest habitats, drainage areas, established buffer zones).
- Implementation of a Northern Masked Owl tree check and clearance procedure immediately prior to clearing any area. The procedure is to be developed by a suitably qualified ecologist with understanding of Northern Masked Owls.
- The final clearance is to be completed by a suitably qualified fauna spotter/catcher or ecologist and must identify any suitable habitat trees for Northern Masked Owl (hollow-bearing trees) and confirm recent usage. If any moderate to high suitability habitat trees occur within the footprint and cannot be retained, they will be removed following an assessment by the ecologist and using controlled felling techniques. If these single large habitat trees with hollows suitable for Northern Masked Owls can be retained, a minimum buffer of 20 m will be established.

⁵ Best Practice Erosion and Sediment Control Document means the 2008 Best Practice Erosion and Sediment Control Document by the International Erosion Control Association (IECA) (available online from: <https://www.austieca.com.au/publications/best-practice-erosion-and-sediment-control-bpesc-document>).

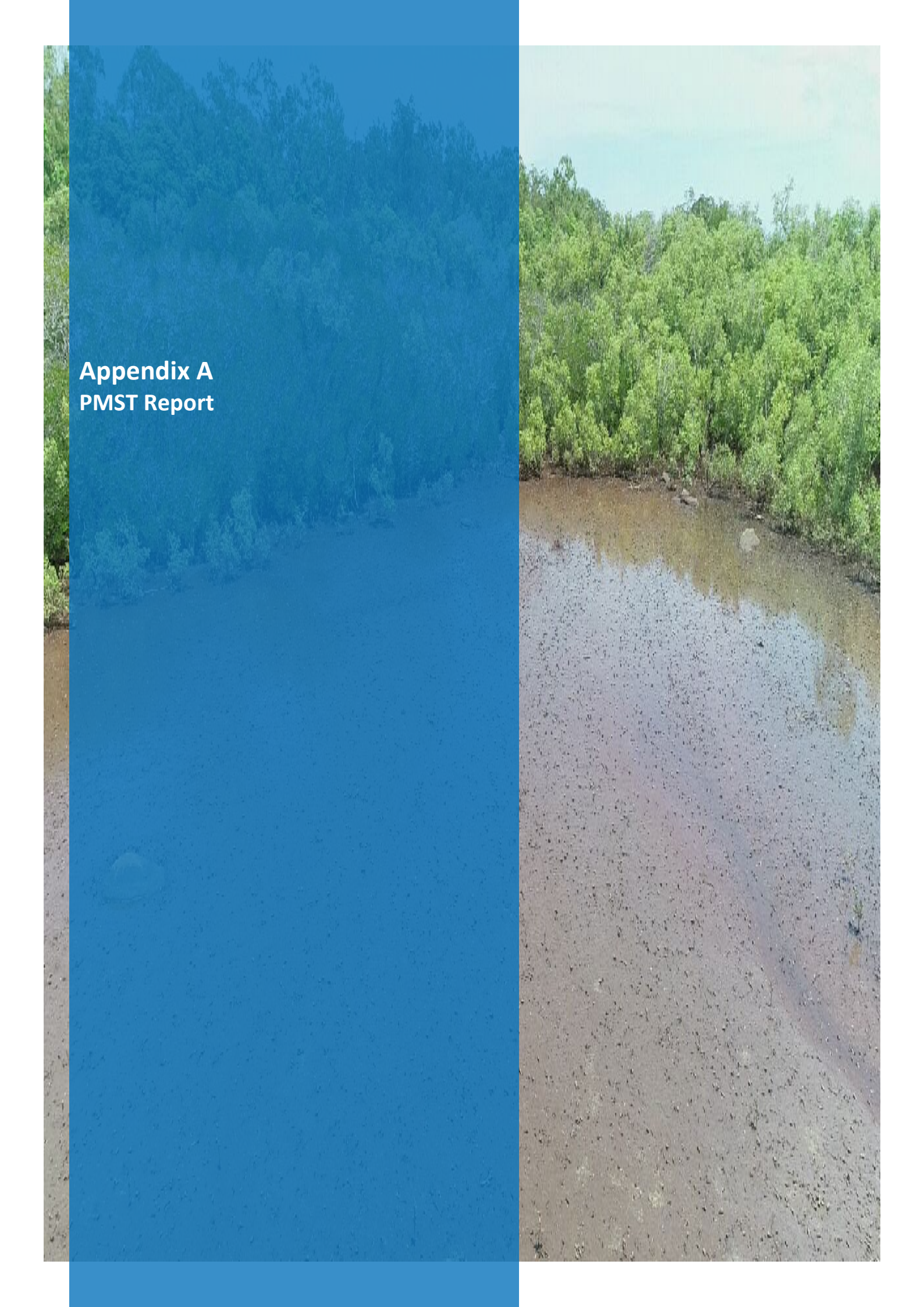
- Have a suitably qualified fauna spotter/catcher or ecologist⁷ on site during clearing operations. The fauna spotter or ecologist must check and clear all vegetation, tree hollows, logs, burrows and other habitat features immediately prior to clearing.
- The suitably qualified fauna spotter/catcher or ecologist must remain on site observing and checking for the presence of terrestrial vertebrate fauna⁸ during all clearing activities. If any terrestrial vertebrate fauna is identified, an exclusion zone of 20 metres radius of the location of the fauna must be established and no clearing must be undertaken within the exclusion zone until the fauna has self-relocated or been relocated out of the proposal area by a suitably qualified fauna spotter/catcher or ecologist.
- Any clearing must be undertaken progressively so as to enable fauna to safely relocate to similar habitat to the north and east. Clearing must commence on the western side closest to Little Paradise access road and progress sequentially from west to east.
- In order to facilitate fauna movement, there shall be no fences installed on the northern, eastern and southern boundaries of the development during clearing. If fences are installed on the perimeter during clearing these shall be temporarily removed, lowered or lifted until all clearing activities are complete.
- The proposal area must be fenced appropriately to prevent any non-flying listed terrestrial vertebrate fauna re-entering the area after all clearing has been completed and prior to any construction activity.
- All excavations on site must be covered or equipped with fauna egress ramps (e.g. timber planks, sticks or logs) during night-time, throughout earthworks and construction activities, to prevent terrestrial vertebrate fauna being injured and/or trapped.
- Before 9 am each day or before work commences, whichever comes earlier, throughout earthworks and construction activities, all excavations must be checked for trapped terrestrial vertebrate fauna and, where trapped or injured terrestrial vertebrate fauna is identified, a suitably qualified fauna spotter/catcher or ecologist must be called, and a response be made immediately. Veterinary care, or assistance from a wildlife refuge, must be sought if any terrestrial vertebrate fauna are found injured within the proposal area during earthworks and construction activities.
- Retain hollow logs and woody debris piles on the outside perimeter of the site to provide den sites for Northern Quolls following clearing.
- Vehicle speed within the proposal area must be restricted, signposted and enforced to a maximum of 20 km per hour throughout clearing, construction, and operation.
- There shall be no major hazardous chemical storage onsite during either construction or operation.

⁷ Suitably qualified fauna spotter/catcher or ecologist means a person licenced under Northern Territory legislation to detect, capture, care for, assess, and release wildlife disturbed by vegetation clearance activities who has at least three years' experience undertaking this work, and given sufficient authority to temporarily halt clearing to enable the safe relocation of terrestrial vertebrate fauna. If a person meets all the criteria above but it is not licenced under Northern Territory Legislation, the person must be supervised by someone licenced under the Northern Territory legislation to undertake the activities noted above at all times.

⁸ Terrestrial vertebrate fauna means vertebrate animals living on land or using land (including aquatic systems) for all or part of their lives, including birds, mammals (including bats), reptiles, amphibians, and freshwater fish.

Section 5 References

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The image is a full-page photograph of a mangrove forest. The left half of the image is covered by a semi-transparent blue overlay. On the right half, the mangrove trees and their reflection in the water are visible. The text 'Appendix A PMST Report' is located on the blue overlay.

Appendix A PMST Report

Environmental Management Plan (EMP)

Groote Aqua Aboriginal Corporation (GAAC)

Stage 2 Aquaculture Development – Little Paradise

Prepared for the Northern Territory Environment Protection Authority (NT EPA)

Prepared by: Dr. Valentin Thepot, Groote Aqua Aboriginal Corporation (GAAC)

Email/phone: vthepot@grooteaqua.com.au / 0460012284

Location: Little Paradise, Groote Eylandt, Northern Territory

Date: September 2026 (Revision 2)

This revision updates the Stage 2 EMP to align with the NT EPA's Guideline for the Preparation of an Environmental Management Plan (2015), and with GAAC's Stage 2 EPL and EPA supporting documents.

1. Introduction

Groote Aqua Aboriginal Corporation (GAAC) was established in 2021 with the objective of supporting the economic transition of Groote Eylandt from a mining-dependent economy to a diversified and sustainable blue economy built upon the responsible use of Sea Country resources. The organisation operates under the direction of Anindilyakwa Traditional Owners and seeks to create long-term employment, training, enterprise development, and stewardship opportunities that align with cultural values and aspirations.

Since commencement of operations, GAAC has focused on developing novel aquaculture systems suitable for the environmental, social, economic and cultural context of Groote Eylandt. The organisation has deliberately adopted a staged development approach whereby small-scale research and development activities are used to inform future expansion while minimising environmental risks and capital expenditure.

The Stage 1 aquaculture facility at Little Paradise was established as a research and development platform to investigate the culture of native marine species including blacklip rock oysters (*Saccostrea spathulata*), sandfish sea cucumber (*Holothuria scabra*), golden-lined rabbitfish (*Siganus lineatus*), and several species of seaweed including *Caulerpa racemosa*. The facility was also used to develop and validate integrated multi-trophic aquaculture systems designed to reduce environmental impacts while improving resource efficiency.

Over the past three years, Stage 1 operations have demonstrated that low trophic aquaculture species can be successfully cultured under Northern Territory conditions while maintaining high standards of biosecurity, water quality management, and environmental performance. The operation has generated significant biological, operational, and environmental data which now forms the basis for the proposed Stage 2 development.

The Stage 2 expansion represents the next step in the development of a sustainable Indigenous-led aquaculture industry on Groote Eylandt. The project has been specifically designed to bridge the gap between small-scale research and future commercial operations by generating commercially relevant production, environmental and economic data.

The proposed Stage 2 development includes the construction and operation of eight R&D ponds, a one-hectare bioremediation pond, a seawater intake pipeline, pump station, rising main and treated water discharge infrastructure, together with the hatchery expansion completed as an earlier stage of works. Unlike conventional fed aquaculture operations, the facility has been designed around low trophic and extractive aquaculture species that require minimal feed inputs and provide ecosystem services including nutrient uptake, water filtration and sediment processing.

The overarching environmental objective of GAAC is to demonstrate that aquaculture development can occur while maintaining and enhancing the environmental values of Anindilyakwa Sea Country. This Environmental Management Plan outlines the measures that will be implemented to avoid, minimise, monitor and manage environmental risks associated with construction and operation of the Stage 2 development. The EMP is

intended to be a living document and will be reviewed periodically as additional environmental information becomes available and as operational experience is gained.

2. Project Background

Aquaculture has been identified as a strategic industry capable of contributing to the long-term economic development of Groote Eylandt beyond the anticipated closure of mining activities. The region possesses extensive marine resources, suitable climatic conditions, high-quality seawater and strong cultural connections to Sea Country that collectively provide significant opportunities for sustainable seafood production.

Recognising this opportunity, GAAC commenced research and development activities in 2022 to investigate aquaculture systems capable of producing high-value seafood products while maintaining a low environmental footprint.

Stage 1 activities focused on the development of recirculating aquaculture systems, hatchery technologies, biosecurity procedures, water treatment systems and integrated bioremediation approaches. Research activities were undertaken using native species considered suitable for future industry development including blacklip rock oysters, sandfish sea cucumber, rabbitfish and seaweeds.

Significant achievements have been realised during Stage 1. GAAC successfully developed hatchery and nursery protocols for blacklip oysters and sandfish sea cucumber, established year-round production systems for rabbitfish, validated integrated multi-trophic aquaculture approaches and demonstrated exceptionally high water reuse rates through the use of advanced treatment and bioremediation systems.

The blacklip oyster program has evolved into a major strategic initiative for Northern Australia. Through funding provided by Aboriginal Investment NT, GAAC is currently constructing a commercial-scale blacklip oyster hatchery that will supply spat to Indigenous aquaculture operations across the Northern Territory including projects located on the Tiwi Islands, South Goulburn Island and Wadeye.

Similarly, the rabbitfish program has demonstrated the ability of native herbivorous fish to provide environmental services through the consumption of nuisance algae and biofouling organisms. Rabbitfish produced by GAAC have already been utilised as part of the Darwin Waterfront coral garden initiative where they assisted with the management of seaweed biomass and improvement of water quality.

Stage 1 operations have also demonstrated the effectiveness of nutrient recovery systems that utilise seaweed, oysters and sea cucumbers to convert nutrients traditionally considered waste into valuable biomass. This circular approach significantly reduces nutrient discharge and improves environmental performance compared with conventional aquaculture systems. The successful outcomes achieved during Stage 1 provide confidence that expansion to Stage 2 can occur while maintaining high environmental standards. The proposed development therefore represents a logical progression of activities already proven under local operating conditions.

3. Existing Stage 1 Operations

The existing Stage 1 facility occupies a relatively small footprint within Lease 2 at Little Paradise and operates primarily as a research and development facility.

The facility consists of recirculating aquaculture systems housed within modified shipping containers, laboratory spaces, algal culture facilities, quarantine systems, raceways, tanks and associated support infrastructure. Water treatment systems include mechanical filtration, biological filtration, ultraviolet sterilisation, protein skimming and bioremediation tanks.

Seawater is currently collected from Bartalumba Bay and transported to the facility using a cartage tank. Following collection, the seawater undergoes filtration, sterilisation and water quality conditioning before being utilised within hatchery and nursery systems.

A defining characteristic of the Stage 1 operation is its emphasis on water conservation. The recirculating aquaculture systems routinely achieve water reuse rates exceeding those commonly observed within commercial aquaculture facilities. This minimises seawater demand, reduces waste generation and provides substantial environmental benefits.

The operation has also served as a practical platform for the development of biosecurity procedures. Quarantine systems, pathogen monitoring, water quality management protocols and staff training programs have all been developed and refined through daily operation of the facility.

Importantly, the facility has operated without significant environmental incidents and has demonstrated that aquaculture can be undertaken responsibly within the environmental and cultural context of Groote Eylandt.

The knowledge gained through operation of Stage 1 has directly informed the design of the proposed Stage 2 development, particularly with respect to water requirements, treatment systems, biosecurity controls, environmental monitoring and nutrient management.

4. Stage 2 Development Overview

The Stage 2 development has been designed to generate commercially relevant production and environmental performance data while maintaining the flexibility required for ongoing research and innovation. As an earlier stage of works, GAAC has completed the expansion of hatchery infrastructure from a container-based facility to a purpose-built, temperature-controlled hatchery housed within a 30 m × 12 m shed. This facility supports the production of blacklip oyster spat, sea cucumber juveniles, rabbitfish fingerlings and seaweed cultures, and is now existing, operational infrastructure that the remaining Stage 2 works (ponds, bioremediation pond, and water intake/discharge infrastructure) will connect into.

The project also includes the construction of eight production ponds, each approximately 2,500 square metres in area and 1.5 metres deep. These ponds will provide approximately 30,000 cubic metres of production capacity and will be operated using low trophic aquaculture species and integrated multi-trophic aquaculture principles.

A one-hectare bioremediation pond will be constructed adjacent to the production ponds. The bioremediation pond will act as a final polishing system where nutrients, suspended solids and organic matter can be further processed by seaweeds, oysters, sea cucumbers and associated biological communities prior to discharge or recirculation.

To support operation of the facility, a dedicated seawater intake system will be installed at Bartalumba Bay. The intake will comprise a passive screened intake structure connected to a 400 mm gravity intake pipeline that conveys seawater to a wet well and pump station. Seawater will then be transferred to the facility through a 225 mm PE100 rising main extending approximately one kilometre between the intake location and the aquaculture site.

The facility has been designed to operate using relatively low water exchange rates compared with conventional aquaculture systems. Based upon operational experience gained during Stage 1, daily water exchange rates are expected to range between one and five percent of total pond volume. This substantially reduces seawater demand while maintaining adequate environmental conditions for cultured species.

A key objective of the development is to demonstrate that sustainable aquaculture production can occur while maintaining environmental values and supporting long-term economic opportunities for Traditional Owners.

5. Legal and Regulatory Framework

This section identifies the legislation, approvals and environment protection objectives relevant to the Stage 2 development, consistent with the NT EPA's Guideline for the Preparation of an Environmental Management Plan (2015).

5.1 Key Approvals

- Northern Territory Environment Protection Authority (NT EPA): Environment Protection Licence (EPL) for Stage 2, and environmental protection approval (EPA) for the Stage 2 expansion, each supported by a dedicated supporting document.
- This Environmental Management Plan (EMP), prepared to satisfy the NT EPA's EMP requirements under the Waste Management and Pollution Control Act 1998 (WMPC Act) and to support both the EPL and EPA applications.
- Any land tenure, Aboriginal Land Rights, and clearing permit requirements applicable to the Aquaculture Lease at Little Paradise.

5.2 Waste Management and Pollution Control Act 1998

Under section 12 of the WMPC Act, GAAC has a general environmental duty to take all measures that are reasonable and practicable to prevent or minimise pollution or environmental harm, and to reduce the amount of waste generated by the Stage 2 development. This EMP is the primary mechanism through which GAAC demonstrates how that duty is met across construction and operation.

5.3 National Pollutant Inventory (NPI) Objective

The NPI, implemented in the Northern Territory through the Environment Protection (National Pollutant Inventory) Objective 2004 under the WMPC Act, requires facilities that exceed threshold quantities of listed substances to report annual emissions and transfers to air, land and water. GAAC's approach has had regard to this objective by minimising the storage and handling of NPI-listed substances on site (fuel is stored only at the existing self-bunded diesel tank, with no new fuel storage introduced for Stage 2), by reusing excavated material rather than importing or disposing of it, and by maintaining spill prevention and containment measures. GAAC will review the substances used and stored on site against the NPI reporting thresholds as Stage 2 moves from construction into operation, and will report in accordance with the NPI framework if those thresholds are met.

5.4 Water Act 1992 – Beneficial Uses and Water Quality Objectives

Beneficial uses and water quality objectives may be declared for Northern Territory waters under the Water Act 1992. For the coastal and marine waters adjacent to the site, the relevant beneficial uses are expected to include aquatic ecosystem protection, aquaculture, Aboriginal traditional and cultural use, and recreational use. The environmental management strategies described in this EMP — including erosion and sediment control, dust suppression, hatchery effluent treatment and dilution, dangerous goods management, and water quality monitoring — have each been designed with these beneficial uses in mind. Where site-specific water quality objectives have not been declared for this water resource, GAAC's approach is to adopt the ANZECC/ANZG default guideline values as an interim performance benchmark until any site-specific objectives are declared or confirmed by the NT EPA.

5.5 Commonwealth Legislation

Approval under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is required for an action that has, will have, or is likely to have a significant impact on a matter of national environmental significance. GAAC has had regard to this requirement through the referral and self-assessment processes described in the Stage 2 EPL and EPA supporting documents.

6. Environmental Management Framework

This EMP forms part of GAAC's broader environmental management system, described further in Section 18 (Reporting, Auditing and Continuous Improvement). Overall responsibility for environmental performance and compliance with this EMP rests with the GAAC General Manager. Day-to-day implementation responsibilities — during construction and operation respectively — are set out in Section 9 (Construction Environmental Management) and throughout the issue-specific chapters of this EMP. All personnel and contractors receive an environmental induction covering their responsibilities under this EMP prior to commencing work on site.

7. Environmental Values and Sensitivities

The proposed Stage 2 aquaculture development is located within the Little Paradise precinct on Groote Eylandt and occurs within an area of significant environmental, cultural and social importance to the Anindilyakwa people. The surrounding landscape forms part of Anindilyakwa Sea Country and supports a diverse range of interconnected terrestrial, coastal and marine ecosystems that contribute to the ecological health, productivity and cultural significance of the region.

The protection of these environmental values underpins the design, construction and operation of the proposed aquaculture facility. The long-term success of the project is intrinsically linked to the health of the surrounding environment, as the operation relies on high-quality seawater, healthy marine ecosystems and the ongoing stewardship of Sea Country by Traditional Owners. Consequently, environmental protection and sustainable resource use have been incorporated as core principles throughout project planning and decision-making.

Coastal and Marine Environment

The waters of Bartalumba Bay and the surrounding coastal environment support a wide range of marine habitats and ecological processes that are characteristic of the Gulf of Carpentaria region. These marine ecosystems support fish, crustaceans, molluscs, sea cucumbers, planktonic organisms and other marine fauna that contribute to biodiversity, ecosystem productivity and local fisheries.

The bay experiences regular tidal exchange, which supports water quality maintenance, nutrient cycling and ecological connectivity between marine and estuarine environments. The marine environment is also important from a cultural perspective, providing resources used for customary harvest and maintaining cultural connections to Sea Country.

The proposed seawater intake infrastructure has been specifically designed to minimise disturbance to the marine environment through the use of passive intake screens, low intake velocities and placement adjacent to existing disturbed infrastructure associated with the Little Paradise breakwater. By locating the intake within an already modified area, the project seeks to avoid unnecessary impacts on previously undisturbed marine habitats.

Operationally, the aquaculture facility depends upon maintaining the quality of the surrounding marine environment. Water extracted from Bartalumba Bay will undergo treatment prior to entering culture systems, and discharge water will be managed through filtration, bioremediation and monitoring programs designed to ensure that environmental values are protected.

Mangrove Communities

Mangrove communities occur throughout portions of the Groote Eylandt coastline and represent one of the most important ecological assets within the broader region. Mangroves provide nursery habitat for numerous fish and crustacean species, stabilise shorelines, trap sediments, cycle nutrients and contribute significantly to coastal productivity.

The ecological functions provided by mangroves support both biodiversity conservation and fisheries productivity. Many species that utilise mangrove habitats form part of the broader marine food web and contribute to the ecological integrity of coastal waters.

The project has been designed to avoid direct impacts on mangrove communities. No clearing of mangroves is proposed and infrastructure layouts have been developed to maintain separation from sensitive coastal vegetation. Water quality monitoring and discharge management procedures have been incorporated into the project design to ensure that mangrove ecosystems are not adversely affected by facility operations.

Intertidal Habitats

Intertidal mudflats, shallow coastal areas and associated habitats occur within the broader Bartalumba Bay environment. These habitats provide feeding and resting areas for a variety of marine organisms and contribute to ecosystem productivity through nutrient cycling and biological activity.

Intertidal habitats are particularly sensitive to changes in water quality and sedimentation. Consequently, construction activities involving marine infrastructure will be managed carefully to minimise turbidity generation, sediment mobilisation and disturbance of benthic environments.

Construction of the intake pipeline will occur adjacent to the existing breakwater alignment, thereby minimising the extent of disturbance required. Construction methodologies will seek to limit the footprint of marine works and avoid unnecessary impacts on surrounding habitats.

Marine Water Quality

The maintenance of marine water quality is one of the most important environmental objectives associated with the project. High-quality seawater is essential both for the health of cultured organisms and the protection of surrounding ecosystems.

The Stage 2 development has been specifically designed around low-trophic aquaculture species and integrated multi-trophic aquaculture principles that significantly reduce nutrient loading relative to conventional fed aquaculture operations. Sea cucumbers, oysters, seaweeds and rabbitfish all contribute to nutrient recovery and water quality improvement within the system.

A dedicated bioremediation pond has been incorporated into the facility design to provide additional treatment capacity prior to discharge. Water quality monitoring will be undertaken at intake, production, bioremediation and discharge locations to ensure environmental objectives are achieved and to provide early warning of any emerging issues.

The project adopts a precautionary approach to water management whereby discharge will only occur when water quality objectives have been satisfied and environmental risks are considered acceptable.

Terrestrial Vegetation Communities

The proposed development area contains vegetation communities typical of the Groote Eylandt coastal environment. These vegetation communities provide habitat for native fauna, contribute to erosion control, reduce dust generation and support landscape connectivity.

Although some vegetation clearing will be required to facilitate construction of ponds and supporting infrastructure, the project has been deliberately designed to minimise clearing requirements and retain as much existing vegetation as practicable. Existing mature trees and vegetation corridors provide significant operational and environmental benefits and will be retained wherever possible. Vegetation buffers assist with dust suppression, temperature moderation, wind reduction and biosecurity. Retention of vegetation also contributes to visual amenity and reduces the overall environmental footprint of the development.

Areas not required for ongoing operations will remain undisturbed wherever practical, and rehabilitation activities will be undertaken where necessary to stabilise disturbed areas and promote revegetation.

Native Fauna

The Groote Eylandt region supports a diverse range of terrestrial, coastal and marine fauna. These species utilise a variety of habitats including woodlands, coastal vegetation, mangroves, intertidal areas and marine waters.

The project footprint is located within an area that has already experienced historical disturbance associated with previous development activities. This reduces the likelihood of significant impacts on fauna populations when compared with development of a previously undisturbed site.

Potential impacts to fauna during construction may include temporary disturbance associated with noise, vehicle movements and vegetation clearing. These impacts are expected to be localised and temporary in nature. Construction activities will be managed to minimise disturbance where practical.

Operational activities are not expected to result in significant impacts to fauna provided environmental management measures are implemented effectively. Water quality monitoring, waste management, biosecurity controls and vegetation retention measures will collectively contribute to protection of fauna values.

Threatened, Migratory and Protected Species

The broader Groote Eylandt region may support species protected under Territory and Commonwealth legislation, including migratory marine species, marine turtles, seabirds and other fauna that utilise coastal and marine habitats.

The project has been assessed through self-assessment processes undertaken under both the Environment Protection and Biodiversity Conservation Act and the Northern Territory environmental assessment framework. These assessments concluded that significant impacts on matters of national environmental significance are unlikely.

The marine intake has been designed to minimise interactions with marine fauna through the use of passive screening systems and low intake velocities. Operational monitoring and adaptive management will be used to identify and address any unforeseen issues should they arise.

Cultural Values and Sea Country

The most significant value associated with the project area is its importance as Anindilyakwa Sea Country. The marine and coastal environments surrounding Groote Eylandt support cultural practices, customary harvesting, intergenerational knowledge transfer and cultural identity.

The project has been developed by and for Anindilyakwa people with the objective of creating sustainable economic opportunities while maintaining strong cultural connections to Sea Country. Traditional Owners have been directly involved in the development of the project and continue to guide its direction and implementation.

Protection of Sea Country is not only an environmental objective but also a cultural responsibility. Environmental monitoring, biosecurity management, water quality protection and sustainable resource use are therefore viewed as both environmental and cultural obligations.

By integrating Indigenous leadership, environmental stewardship and sustainable aquaculture practices, the project seeks to demonstrate a model of development that delivers social, economic and environmental benefits while maintaining the integrity of Anindilyakwa Sea Country.

Environmental Stewardship

The proposed Stage 2 development has been designed around the principle that economic development and environmental protection are not mutually exclusive. Through the use of low- trophic aquaculture species, integrated multi-trophic aquaculture systems, nutrient recovery processes, extensive monitoring programs and adaptive management, the facility aims to achieve a high standard of environmental performance.

The project will continue to evolve as knowledge is gained through operation and monitoring. Environmental management measures will be reviewed regularly and improved where opportunities are identified. Through this process of continual improvement, GAAC seeks to establish a benchmark for environmentally responsible Indigenous-led aquaculture development in Northern Australia.

8. Conceptual Site Model

A conceptual site model (CSM) has been prepared consistent with section 5.8 of the NT EPA's Guideline for the Preparation of an Environmental Management Plan (2015) and the NT EPA's Guidelines on Conceptual Site Models. The CSM represents the nature, fate and transport of discharges, wastes or contaminants associated with the Stage 2 development, and underpins the Environmental Risk Assessment in Section 16 and the monitoring programs described throughout this EMP.

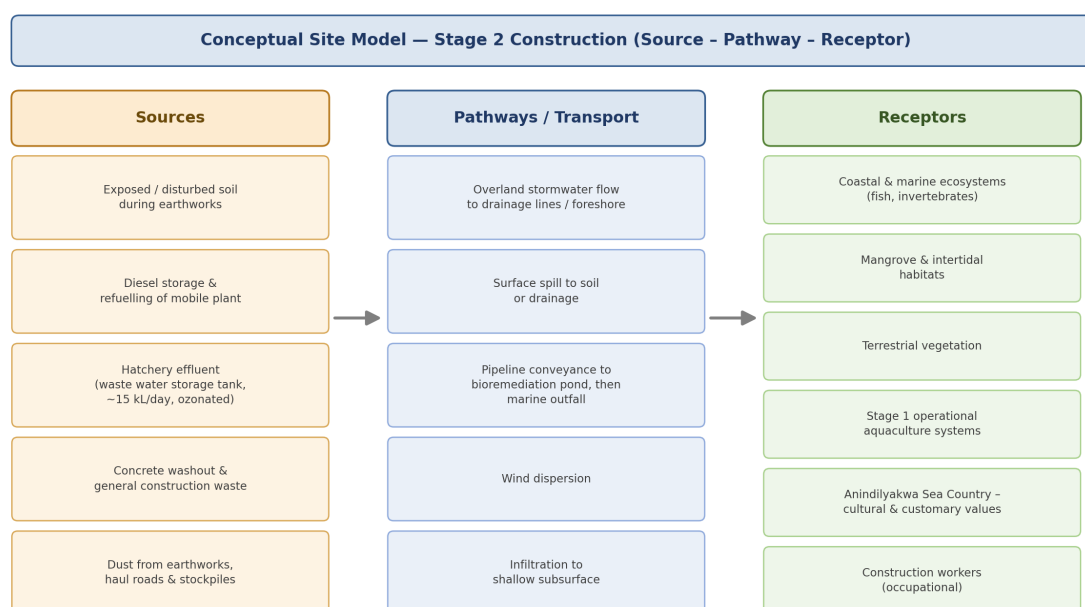


Figure 1: Conceptual site model showing the source–pathway–receptor linkages considered for the Stage 2 development.

Table 1 sets out the same information in table format, distinguishing potential from actual pathways based on the controls described elsewhere in this EMP.

Source	Pathway (potential/actual)	Exposure route	Receptor
Exposed / disturbed soil during earthworks	Overland stormwater flow to drainage lines and foreshore (potential — likelihood reduced by dry-season construction timing, see Section 9)	Direct contact; sediment deposition	Coastal and marine ecosystems; mangrove and intertidal habitats
Diesel storage and refuelling of mobile plant	Surface spill to soil or drainage (potential — existing self-bunded tank and spill containment, see Section 9)	Direct contact; ingestion by biota	Soil; shallow subsurface; coastal waters
Hatchery effluent (waste water storage tank, ~15 kL/day)	Pipeline conveyance to the bioremediation pond, then marine outfall (actual — treated by ozonation prior to release)	Direct contact; dilution and dispersion in receiving waters	Coastal and marine ecosystems

Source	Pathway (potential/actual)	Exposure route	Receptor
Dust from earthworks, haul roads, and stockpiles	Wind dispersion (potential — elevated during dry-season works, managed per Section 9)	Inhalation; deposition on vegetation or water	Terrestrial vegetation; Stage 1 operational systems; construction and site workers
Pond and treatment system discharge during operation	Bioremediation pond, then marine outfall (actual, treated)	Dilution and dispersion in receiving waters	Coastal and marine ecosystems; aquaculture beneficial use
General construction and operational waste	Surface release to ground or drainage (potential — managed per Sections 9 and 13)	Direct contact	Soil; drainage lines; coastal waters

The CSM will be reviewed and refined as construction and operational monitoring data are collected, and as any site-specific survey or contour information becomes available.

9. Construction Environmental Management

The objective of the Construction Environmental Management Plan (CEMP) is to ensure that all construction activities associated with the Stage 2 development are undertaken in a manner that protects environmental values, minimises disturbance to surrounding ecosystems, prevents pollution and ensures compliance with all relevant legislative and regulatory requirements.

The remaining Stage 2 construction works involve the construction of eight production ponds, a one-hectare bioremediation pond, seawater intake infrastructure, pump station, rising main, discharge infrastructure, access roads and associated support facilities. The hatchery expansion referenced elsewhere in this EMP has already been completed as an earlier stage of works and does not form part of the construction activities described in this chapter. Construction activities will occur within an area that has already experienced varying degrees of historical disturbance associated with previous development and infrastructure; however, construction activities still have the potential to generate environmental impacts if not appropriately managed.

GAAC is committed to implementing best-practice environmental management measures throughout the construction phase and to continuously reviewing and improving environmental performance as construction progresses.

9.1 Construction Activities

Major construction activities associated with the remaining Stage 2 works include:

- Earthworks associated with pond excavation and embankment (bund wall) construction, undertaken as a single excavation campaign rather than staged pond-by-pond.
- Construction of access roads and service corridors.
- Installation of the seawater intake pipeline.
- Marine trench excavation adjacent to the existing breakwater.
- Construction of the pump station and wet well.
- Installation of the 225 mm PE100 rising main.
- Construction of the bioremediation pond.
- Installation of discharge infrastructure.
- Equipment mobilisation and demobilisation.
- Temporary laydown and material storage areas.

9.2 Construction Timing and Staging

All excavation and bulk earthworks will be undertaken during the dry season (approximately May to October). This timing has been adopted for two reasons: it allows earthworks to be carried out on stable, workable ground rather than saturated or muddy conditions, and it substantially reduces the risk of sediment-

laden runoff and erosion, since works are not exposed to the higher-intensity rainfall events that occur during the wet season.

Construction is sequenced into the following stages, with an indicative duration for each: site establishment (approx. 2 weeks); pond field earthworks, with all ponds excavated in a single campaign (approx. 1.5 months); pipeline trenching for the intake and discharge lines (approx. 1 month); progressive stabilisation (approx. 3 weeks); and final stabilisation ahead of the wet season (approx. 1 week) — an indicative total construction duration of approximately 4 months.

Excavated material generated during pond construction will, where suitable, be reused on-site to form the pond embankments (bund walls), rather than being removed from site or sourced from an external borrow area. This reduces the volume of material handling and the overall extent of ground disturbance, and reflects the underlying geology of the site, which contains large sandstone boulders that would make deeper or more extensive excavation both technically difficult and considerably more costly.

Roles and Responsibilities

Environmental management during construction is the responsibility of all personnel working on the project.

The GAAC General Manager shall retain overall responsibility for environmental performance and compliance with licence conditions, approvals and commitments contained within this Environmental Management Plan.

Construction supervisors and contractors shall be responsible for ensuring environmental controls are implemented, maintained and monitored throughout the construction period. All personnel and subcontractors will receive an environmental induction prior to commencing work. The induction will include environmental responsibilities, reporting requirements, sensitive environmental values, spill response procedures, waste management requirements and emergency contacts.

Any environmental incidents, non-conformances or near misses must be reported immediately to the Construction Supervisor and recorded within the project incident management system.

Vegetation Clearing and Habitat Disturbance

Vegetation clearing represents one of the most significant environmental disturbances associated with the Stage 2 development. While the project has been designed to minimise clearing requirements, some vegetation removal will be necessary to accommodate ponds, infrastructure and access corridors.

Clearing will be restricted to approved disturbance areas and undertaken progressively as construction advances. Clearing boundaries will be clearly delineated prior to commencement of works to prevent accidental disturbance outside approved areas.

Where practical, mature trees and vegetation buffers will be retained to provide wind protection, erosion control, dust suppression, habitat values and microclimate regulation. Existing vegetation corridors may also assist in reducing biosecurity risks by acting as natural barriers to airborne dust and contaminants.

Vegetation removed during clearing activities will be managed appropriately. Suitable material may be mulched and reused on site for erosion control or rehabilitation purposes. Material unsuitable for reuse will be disposed of in accordance with relevant regulatory requirements.

If native fauna are encountered during clearing operations, works will cease in the immediate area until the animal can move away safely or appropriate advice is obtained.

Soil Management and Topsoil Conservation

Topsoil represents a valuable resource that supports rehabilitation and revegetation activities. Wherever practical, topsoil will be stripped separately from subsoil and stockpiled for future reuse.

Topsoil stockpiles will be located away from drainage lines, coastal areas and traffic routes to minimise erosion and contamination. Stockpiles will be stabilised if they are expected to remain in place for extended periods.

Earthworks will be undertaken in a manner that minimises soil compaction and disturbance outside designated construction areas. Vehicle movements will be restricted to approved access routes wherever practical.

The effectiveness of soil management measures will be assessed through routine inspections during construction.

Erosion and Sediment Control

The Groote Eylandt environment experiences intense rainfall during the wet season. Consequently, erosion and sediment control measures are critical to preventing sediment mobilisation and protecting surrounding environments.

Erosion and sediment risk for the remaining Stage 2 works is managed principally through construction timing and methodology (Section 9.2) — confining excavation to the dry season and reusing excavated material to form pond bund walls — rather than through intensive sediment treatment infrastructure. Temporary diversion drains or bunding, and check dams or rock/log barriers, will be retained as a contingency measure in the event of any out-of-season rainfall.

Pond excavation is undertaken as a single campaign within the dry-season window (Section 9.2), rather than staged pond-by-pond; the dry-season timing itself is the primary control against sediment mobilisation during this period.

All erosion and sediment controls will be inspected regularly and following significant rainfall events. Damaged or ineffective controls will be repaired or upgraded as required.

Sediment-laden runoff will not be permitted to enter natural drainage pathways, mangrove areas, intertidal habitats or marine environments.

Marine Construction Activities

Marine construction activities are associated primarily with installation of the seawater intake pipeline and intake structure adjacent to the existing Little Paradise breakwater.

The intake pipeline will be installed within a cut-and-cover trench aligned with the existing breakwater footprint. Installation within an already modified area significantly reduces environmental disturbance relative to a new marine corridor.

The trench is anticipated to be approximately one metre deep and may be excavated using a barge-mounted excavator. Excavation activities have the potential to generate localised turbidity and sediment disturbance. Consequently, construction methods will be selected to minimise sediment mobilisation wherever practical.

Marine works will be planned to take advantage of favourable tidal conditions and weather windows where possible. Construction personnel will monitor turbidity visually throughout works and implement corrective measures if excessive sediment disturbance is observed.

Concrete ballast blocks and support structures will be installed to secure the intake pipeline and maintain long-term stability. Care will be taken during installation to avoid unnecessary disturbance to adjacent marine habitats.

Construction vessels and equipment used for marine works will be maintained in good operating condition to minimise the risk of fuel, oil or hydraulic fluid leaks.

Dust Management

Dust generation may occur during vegetation clearing, earthworks, excavation, vehicle movements and material handling activities. Excessive dust has the potential to affect surrounding vegetation, construction personnel, operational infrastructure and water quality. Dust may also act as a vector for fungal spores, bacteria and other contaminants that could pose biosecurity risks.

Dust suppression measures may include:

- Water application to roads and disturbed areas.
- Speed restrictions on access roads.
- Progressive rehabilitation of disturbed areas.
- Retention of vegetation buffers.
- Minimisation of exposed surfaces.
- Covering or stabilisation of stockpiles where required.

Construction activities may be modified or temporarily suspended during periods of extreme wind if dust cannot be adequately controlled.

Waste Management During Construction

Construction activities will generate a range of waste streams including vegetation, packaging materials, scrap metal, plastics, timber, concrete waste, domestic waste and potentially hazardous materials.

Waste management will follow the waste hierarchy, prioritising avoidance, reduction, reuse and recycling wherever practical.

Construction waste will be segregated where appropriate to maximise recycling opportunities. Waste unsuitable for reuse or recycling will be transported to approved disposal facilities.

Littering is prohibited and waste receptacles will be provided throughout construction areas.

Regular inspections will be undertaken to ensure waste is being managed appropriately.

Fuel and Chemical Management

Construction activities require the use of fuels, oils, greases and other chemicals. Improper handling or storage of these substances could result in environmental contamination.

All dangerous goods, including diesel and other fuels, are stored at the existing self-bunded diesel tank located on-site adjacent to the current power generation area; no new fuel storage facilities are required for the Stage 2 construction works. Refuelling of mobile plant and equipment is undertaken using drip trays and spill containment measures, away from drainage lines and the foreshore.

Spill kits appropriate to the materials stored on site will be maintained in accessible locations. Personnel handling fuels and chemicals will be trained in spill prevention and spill response procedures. Any spill, regardless of size, will be reported to the Construction Supervisor and managed in accordance with incident response procedures.

Noise and Vibration Management

Construction activities will generate temporary increases in noise associated with machinery operation, vehicle movements and earthworks.

Noise-generating activities will be restricted to normal construction hours wherever practical. Equipment will be maintained in good working order to minimise excessive noise emissions.

The project is located within an industrial precinct and is not expected to generate significant noise impacts on nearby sensitive receptors. Nevertheless, reasonable measures will be implemented to minimise unnecessary noise generation.

Rehabilitation and Site Stabilisation

Rehabilitation will be undertaken progressively wherever practical during construction. Areas no longer required for active construction, and not required for permanent infrastructure — such as temporary laydown areas and construction access tracks — will be stabilised to minimise erosion and facilitate revegetation. The grow-out ponds, bioremediation pond, and associated water infrastructure are permanent, productive infrastructure and are not subject to rehabilitation; this distinction is addressed further in Section 19 (Closure and Rehabilitation).

Rehabilitation objectives include:

- Stabilisation of disturbed surfaces.
- Prevention of erosion and sediment transport.
- Re-establishment of vegetation where appropriate.
- Reduction of dust generation.
- Integration of disturbed areas into the surrounding landscape.

The effectiveness of rehabilitation measures will be assessed through routine inspections and incorporated into environmental reporting processes.

Environmental Monitoring During Construction

Environmental monitoring during construction will focus on verifying the effectiveness of management measures and identifying issues requiring corrective action.

Monitoring activities may include:

- Inspection of erosion and sediment controls.
- Inspection of fuel and chemical storage areas.
- Verification of clearing boundaries.
- Dust monitoring through visual inspections.
- Waste management inspections.
- Marine works inspections.
- Rehabilitation inspections.
- Incident and complaint monitoring.

Monitoring outcomes will be recorded and reviewed regularly by project personnel.

Environmental Incident Management

Any environmental incident occurring during construction will be reported immediately and investigated to determine root causes and corrective actions.

Environmental incidents may include:

- Fuel or chemical spills.
- Unauthorised clearing.
- Significant erosion events.
- Sediment releases.

- Waste management failures.
- Marine pollution events.
- Wildlife interactions.
- Community complaints.

Corrective actions will be implemented as soon as practicable and tracked through to completion.

Lessons learned from incidents will be incorporated into ongoing environmental management and contractor training programs.

Construction Environmental Management Summary

The Stage 2 aquaculture development has been designed to minimise environmental impacts through careful planning, staged construction and implementation of robust environmental management controls.

Construction activities will be undertaken in a manner that protects environmental values, maintains compliance with regulatory requirements and supports the long- term sustainability objectives of the project.

Through implementation of the measures described within this Construction Environmental Management Plan, significant adverse environmental impacts are not anticipated during construction of the proposed Stage 2 development.

10. Water Intake and Discharge Management

The objective of the Water Intake and Discharge Management Plan is to ensure that seawater extraction, treatment, use, recirculation and discharge associated with the Stage 2 aquaculture facility are undertaken in a manner that protects the environmental values of Bartalumba Bay and the surrounding Anindilyakwa Sea Country while providing a reliable supply of high-quality seawater for aquaculture operations.

Specific objectives of this plan are to:

- Maintain a reliable supply of seawater suitable for hatchery and pond operations.
- Minimise impacts to marine organisms associated with seawater extraction.
- Protect marine and coastal water quality.
- Minimise nutrient discharge through water reuse and bioremediation.
- Prevent the release of pathogens and contaminants to the environment.
- Ensure compliance with applicable licence conditions and environmental approvals.
- Provide a monitoring and adaptive management framework to support continual improvement.

The Stage 2 facility has been designed around low-trophic aquaculture species, integrated multi- trophic aquaculture principles and extensive water reuse. As a result, the facility is expected to require substantially lower water exchange rates than conventional fed aquaculture systems.

Water Demand and Operational Philosophy

The proposed Stage 2 development consists of eight production ponds, a one-hectare bioremediation pond, and associated support infrastructure, together with an expanded hatchery completed as an earlier stage of works.

Unlike conventional aquaculture operations that rely on high stocking densities and significant feed inputs, the GAAC production model focuses on low trophic and extractive species including sea cucumbers, oysters, seaweeds and rabbitfish. These species require relatively low water exchange rates and contribute directly to water quality improvement through nutrient uptake and biological filtration.

Based on operational experience obtained during Stage 1, anticipated water exchange rates are expected to range between one and five percent of total pond volume per day. This represents a substantial reduction

compared to conventional pond aquaculture systems where daily water exchange rates commonly exceed fifteen to thirty percent.

The reduced water demand significantly decreases the volume of seawater extracted from Bartalumba Bay and correspondingly reduces discharge volumes, energy consumption and environmental risks. The overall water management philosophy is based on:

- Maximising water reuse.
- Treating nutrients as a resource rather than a waste product.
- Utilising biological treatment processes wherever practical.
- Minimising discharge volumes.
- Maintaining high standards of biosecurity.
- Protecting receiving environmental values.

Seawater Intake Infrastructure

Seawater will be sourced from Bartalumba Bay via a dedicated intake system located adjacent to the existing Little Paradise breakwater.

The intake location was selected following consideration of water quality, operational reliability, accessibility and environmental factors. Locating the intake adjacent to existing infrastructure minimises the requirement for disturbance of previously undisturbed marine habitats and allows the project to utilise an already modified marine corridor.

The intake system consists of:

- A passive screened marine intake structure.
- A 400 mm diameter gravity intake pipeline.
- An intake riser.
- Concrete ballast and support structures.
- An isolation valve system.
- A wet well and pump station.
- A 225 mm PE100 rising main connecting the intake to the aquaculture facility.

The intake pipeline will be installed within a cut-and-cover trench aligned with the existing breakwater. The trench is expected to be approximately one metre deep and the pipeline will be secured using concrete ballast blocks designed to provide long-term stability under marine conditions.

The intake structure will extend beyond the end of the existing breakwater into deeper water to maintain adequate submergence during low tide conditions. The intake location has been selected to maintain a minimum water depth above the intake and minimise the risk of sediment entrainment. The intake system has been designed to provide a reliable supply of seawater under a range of tidal and seasonal conditions while minimising maintenance requirements and environmental impacts.

Marine Intake Screen and Fauna Protection

Protection of marine organisms has been a primary design consideration for the intake system.

The seawater intake will incorporate a passive wedge-wire intake screen utilising triangular profile mesh. This design provides several environmental and operational advantages compared with conventional intake screens.

The wedge-wire profile minimises biofouling accumulation while maintaining hydraulic efficiency. The screen design also reduces turbulence and provides a large screening surface area, allowing intake velocities to remain low.

Low intake velocities reduce the risk of:

- Impingement of fish and larger organisms.
- Entrainment of eggs and larvae.
- Injury to marine fauna.
- Excessive debris accumulation.

The intake structure has been positioned away from shallow intertidal habitats and areas likely to support high densities of juvenile fish.

Routine inspections will be undertaken to assess:

- Structural integrity.
- Biofouling levels.
- Debris accumulation.
- Screen condition.
- Hydraulic performance.

Where necessary, screen cleaning will be undertaken using methods that minimise environmental disturbance. Removable screen components may be transported to shore for maintenance and cleaning where appropriate.

The intake system will be reviewed periodically and modified if monitoring identifies opportunities to further reduce environmental interactions.

Wet Well and Pump Station

The intake pipeline will discharge via gravity into a wet well located adjacent to the pump station.

The wet well provides temporary storage and hydraulic buffering between tidal inflows and pump operation. This arrangement allows the pump station to operate efficiently despite fluctuations in water levels associated with tidal cycles.

The pump station has been designed to:

- Provide reliable seawater supply.
- Accommodate variations in tidal conditions.
- Reduce pump cycling.
- Support future operational flexibility.
- Minimise maintenance requirements.

The station will incorporate duty and standby pumps to provide redundancy and reduce operational risk.

Control systems will automatically shut down pumps if low water levels are detected within the wet well. This prevents pump damage and provides additional protection against intake blockages or extreme tidal conditions.

Routine inspections and preventative maintenance programs will be implemented to ensure ongoing reliability of the intake and pumping systems.

Rising Main Infrastructure

Seawater will be transferred from the pump station to the aquaculture facility via a 225 mm PE100 rising main.

The rising main has been designed to accommodate the anticipated operational flow requirements of the Stage 2 facility while providing adequate pressure ratings and durability for long-term operation.

The pipeline alignment has been selected to utilise existing service corridors wherever practical, thereby minimising disturbance to surrounding vegetation and environmental values.

The rising main will incorporate:

- Isolation valves.
- Air release valves.
- Scour valves.
- Inspection points.
- Maintenance access locations.

These components facilitate operation, maintenance and emergency response activities.

Routine inspections will be undertaken to identify leaks, damage or operational issues. Any identified defects will be repaired promptly to minimise water losses and environmental risks.

Water Treatment Systems

Prior to entering hatchery and production systems, seawater will undergo a series of treatment processes designed to optimise water quality and minimise biosecurity risks.

Treatment processes may include:

Mechanical Filtration

Mechanical filtration removes suspended solids, debris and larger planktonic organisms from incoming seawater.

The primary filtration system will consist of submerged drum filtration capable of removing particles greater than approximately 50 microns.

Mechanical filtration reduces organic loading, improves water clarity and enhances the performance of downstream treatment systems.

Ultraviolet Sterilisation

Ultraviolet sterilisation provides an important biosecurity barrier by reducing bacterial, viral and microbial loads within incoming seawater.

UV systems will be sized to provide effective treatment across the anticipated operating flow range and will be maintained in accordance with manufacturer recommendations.

Ozone Treatment

Ozone treatment provides an additional level of water quality improvement and pathogen reduction.

Ozone may be delivered through venturi injection systems coupled with foam fractionation technology. This process assists in:

- Oxidation of dissolved organic compounds.
- Reduction of microbial loads.
- Improvement of water clarity.
- Enhancement of biosecurity outcomes.

Water Quality Conditioning

Where required, water quality parameters including salinity, alkalinity and pH may be adjusted to optimise conditions for cultured species.

Adjustments will be undertaken in a controlled manner using established operating procedures.

Internal Water Reuse

Water reuse is a central component of the GAAC environmental management strategy.

The facility has been designed to maximise reuse and recirculation wherever practical. Water discharged from culture systems will undergo treatment and bioremediation prior to reuse or discharge.

Benefits of water reuse include:

- Reduced seawater extraction.
- Reduced discharge volumes.
- Improved nutrient recovery.
- Lower operational costs.
- Enhanced environmental performance.

Operational experience gained through Stage 1 has demonstrated the effectiveness of water reuse systems under local conditions and these principles will continue to underpin Stage 2 operations.

Discharge Water Management

Discharge management has been designed around a precautionary environmental philosophy.

Prior to discharge, water will pass through multiple treatment barriers including:

- Production system treatment processes.
- Biological nutrient uptake.
- Integrated multi-trophic aquaculture systems.
- Bioremediation ponds.
- Ozone treatment systems.
- Settling and retention processes.

The one-hectare bioremediation pond forms a critical component of the discharge management strategy. This pond provides additional hydraulic retention time and supports biological treatment processes that further improve water quality prior to discharge. Discharge volumes will be minimised wherever practical through reuse and recirculation.

Discharge water quality will be monitored routinely to verify treatment effectiveness and support environmental decision-making.

Water Quality Monitoring

Monitoring will occur throughout the water management system including:

- Intake water.
- Hatchery systems.
- Production ponds.
- Bioremediation ponds.
- Final discharge points.

Parameters monitored will include:

- Dissolved oxygen.
- Temperature.
- Salinity.
- pH.

- Turbidity.
- Ammonia.
- Nitrite.
- Nitrate.
- Chlorophyll.
- Bacterial abundance.
- Vibrio species where relevant.

Monitoring data will be reviewed routinely and incorporated into operational decision-making processes.

Any trends indicating deterioration in water quality will trigger investigation and corrective actions.

Corrective Actions

Where monitoring identifies water quality concerns, corrective actions may include:

- Increasing retention time within treatment systems.
- Reducing discharge volumes.
- Increasing water recirculation.
- Optimising aeration systems.
- Increasing bioremediation capacity.
- Modifying stocking densities.
- Adjusting operational procedures.
- Undertaking maintenance on treatment equipment.

The selected response will depend on the nature and severity of the issue identified.

Performance Objectives

The success of the Water Intake and Discharge Management Plan will be measured against the following objectives:

- Reliable supply of seawater to support operations.
- No significant impacts to marine fauna associated with seawater extraction.
- No significant deterioration of receiving water quality attributable to facility operations.
- Effective operation of treatment and bioremediation systems.
- Compliance with environmental licence conditions.
- Continuous improvement of water use efficiency and environmental performance.

Through implementation of the measures described within this Water Intake and Discharge Management Plan, GAAC aims to demonstrate best-practice sustainable aquaculture water management while protecting the environmental and cultural values of Anindilyakwa Sea Country.

Marine Intake Management

The intake pipeline will be installed adjacent to the existing breakwater. The trench is anticipated to be approximately one metre deep and installed within an existing disturbed corridor. A passive wedge-wire style screen will minimise entrainment and biofouling.

Routine inspections will assess structural integrity, screen condition, biofouling levels and overall operational performance. Inspection frequency will be adjusted based on operational experience and environmental conditions.

11. Bioremediation and Nutrient Recovery

The objective of the Bioremediation and Nutrient Recovery Plan is to maximise the beneficial use of nutrients entering the aquaculture system, minimise waste generation, improve water quality and reduce the potential environmental impacts associated with aquaculture production.

Unlike conventional aquaculture operations, where nutrients are often treated as waste products requiring disposal or dilution, the Stage 2 development has been designed around the principle that nutrients represent a valuable resource that can be captured, transformed and converted into additional biomass. This approach aligns with GAAC's commitment to circular economy principles, sustainable aquaculture practices and the protection of Anindilyakwa Sea Country.

Specific objectives of this plan are to:

- Minimise nutrient discharge to the environment.
- Maximise nutrient recovery within production systems.
- Improve water quality through biological treatment processes.
- Reduce organic waste accumulation.
- Enhance system resilience and environmental performance.
- Increase resource efficiency through integrated production systems.
- Demonstrate best-practice integrated multi-trophic aquaculture in Northern Australia.

The bioremediation strategy forms one of the most important environmental management measures incorporated into the Stage 2 facility and underpins the project's low environmental footprint.

Integrated Multi-Trophic Aquaculture Philosophy

The Stage 2 aquaculture facility has been designed around Integrated Multi-Trophic Aquaculture (IMTA) principles.

IMTA is an approach whereby species occupying different trophic levels are cultured within the same production system, allowing nutrients generated by one species to become a resource for another. This process mimics natural ecological relationships and significantly improves nutrient utilisation efficiency.

In conventional monoculture aquaculture systems, nutrients enter the system primarily through feed. A substantial proportion of those nutrients are subsequently lost through dissolved wastes, faeces, uneaten feed and other organic matter. These waste streams can contribute to nutrient accumulation, deterioration in water quality and increased environmental risk. The IMTA approach adopted by GAAC seeks to intercept these nutrient pathways and convert them into additional production through the incorporation of species that perform complementary ecological functions.

Rather than treating nutrients as a waste product, the facility has been designed to capture, recycle and utilise nutrients at multiple stages throughout the production cycle.

This approach provides environmental, operational and economic benefits while supporting the long-term sustainability of the aquaculture operation.

Nutrient Sources Within the System

Nutrients entering the aquaculture facility originate from several sources.

The primary source is naturally occurring nutrients present within seawater collected from Bartalumba Bay. Coastal waters naturally contain dissolved nitrogen, phosphorus, organic matter and planktonic biomass that support marine productivity.

Additional nutrient inputs may arise from:

- Animal feeds used within hatchery and nursery systems (microalgae).

- Metabolic wastes produced by cultured animals.
- Naturally occurring biological productivity within ponds.
- Organic matter generated through routine operations.
- Detritus and biofouling organisms.

The objective of the bioremediation strategy is to ensure that these nutrients remain within productive pathways for as long as possible before discharge is considered.

Sea Cucumber Bioremediation

Sea cucumbers (*Holothuria scabra*) form a critical component of the nutrient recovery strategy.

Sea cucumbers are natural deposit feeders that consume organic matter deposited on pond and tank bottoms. Through their feeding activities they assist in reducing the accumulation of organic sediments and converting waste materials into biomass.

Benefits provided by sea cucumbers include:

- Reduction of organic matter accumulation.
- Improved sediment quality.
- Nutrient recycling.
- Reduced risk of anaerobic sediment development.
- Increased resource recovery.
- Production of a valuable seafood product.

By continuously processing sediments, sea cucumbers act as natural benthic bioremediators and contribute significantly to maintaining healthy pond environments.

The use of sea cucumbers also reduces the frequency and intensity of sediment management activities that may otherwise be required in conventional aquaculture systems.

Blacklip Oyster Bioremediation

Blacklip rock oysters (*Saccostrea echinata*) provide another important bioremediation pathway within the facility.

Oysters are filter-feeding organisms that remove suspended particles, plankton and organic matter from the water column.

As water passes through oyster culture areas, suspended solids are captured and incorporated into oyster biomass or deposited as biodeposits where they can subsequently be utilised by other organisms within the system.

The incorporation of oysters provides several environmental benefits including:

- Improved water clarity.
- Reduction of suspended solids.
- Removal of phytoplankton biomass.
- Nutrient recovery.
- Enhanced ecosystem function.
- Additional commercial production.

Because oysters derive nutrition directly from naturally occurring productivity and suspended organic matter, they provide a highly efficient mechanism for nutrient capture and recycling.

The oyster component of the system therefore contributes simultaneously to environmental management and economic outcomes.

Seaweed Nutrient Recovery

Seaweeds represent one of the most effective biological nutrient recovery mechanisms available within aquaculture systems.

Seaweeds absorb dissolved nutrients directly from the water column and utilise those nutrients for growth. In doing so, they remove nitrogen, phosphorus and other dissolved compounds that may otherwise contribute to water quality deterioration. The Stage 2 facility incorporates seaweed production within both production and bioremediation systems.

Benefits associated with seaweed cultivation include:

- Uptake of dissolved nitrogen.
- Uptake of dissolved phosphorus.
- Improved water quality.
- Production of commercially valuable biomass.
- Carbon capture.
- Habitat provision for beneficial organisms.

Seaweed biomass generated through nutrient recovery processes may subsequently be utilised as feed for rabbitfish, incorporated into composting systems or developed into value-added products.

This creates an additional pathway through which nutrients remain within productive use rather than becoming waste.

Rabbitfish Ecosystem Services

Rabbitfish (*Siganus lineatus*) contribute to nutrient management through their grazing behaviour and ecological role within the production system.

Rabbitfish consume macroalgae, biofouling organisms and other biological growth that may otherwise accumulate within production infrastructure.

Benefits provided by rabbitfish include:

- Biological control of algae.
- Reduction of biofouling.
- Improved pond management.
- Nutrient conversion into harvestable biomass.
- Reduced maintenance requirements.

The rabbitfish component of the system further strengthens the integrated nature of the facility by linking nutrient recovery pathways with commercial seafood production.

The successful use of rabbitfish as an environmental services species has already been demonstrated through previous collaborations involving water quality improvement initiatives within the Northern Territory.

Bioremediation Pond Function

A dedicated one-hectare bioremediation pond forms the final stage of the nutrient recovery and treatment process.

The bioremediation pond has been incorporated into the facility design to provide:

- Additional nutrient uptake capacity.
- Hydraulic retention time.
- Settlement of suspended particles.

- Biological treatment.
- Water quality stabilisation.
- Increased system resilience.

Water entering the bioremediation pond will pass through a semi-natural treatment environment supporting multiple nutrient recovery pathways.

The pond acts as a polishing step prior to any potential discharge and provides a buffer capable of absorbing short-term fluctuations in nutrient loading.

The large surface area and volume of the pond significantly increase treatment capacity compared with conventional mechanical treatment systems alone.

This approach reduces reliance on energy-intensive treatment technologies while improving environmental performance.

Nutrient Recovery Performance

The success of the nutrient recovery strategy will be assessed through routine monitoring of:

- Total nitrogen.
- Total phosphorus.
- Ammonia.
- Nitrite.
- Nitrate.
- Chlorophyll.
- Dissolved oxygen.
- Turbidity.
- Organic matter accumulation.
- Biomass production.

Monitoring results will be used to evaluate treatment effectiveness and identify opportunities for optimisation.

Trends indicating declining performance will trigger investigation and implementation of corrective actions where required.

Nutrient Discharge Minimisation

A fundamental objective of the Stage 2 development is to minimise nutrient discharge to the surrounding environment.

This objective is achieved through:

- Low water exchange rates.
- Water reuse.
- Biological filtration.
- Mechanical filtration.
- Seaweed production.
- Oyster filtration.
- Sea cucumber bioremediation.
- Rabbitfish grazing.
- Bioremediation pond treatment.
- Ozone treatment.
- Adaptive management.

The combination of these measures significantly reduces nutrient concentrations prior to discharge and contributes to protection of receiving environmental values.

Adaptive Management

The nutrient recovery system will be managed adaptively throughout the life of the project.

As operational knowledge increases, opportunities may arise to further improve nutrient utilisation efficiency and environmental performance.

Potential future improvements may include:

- Expansion of seaweed production.

- Additional oyster filtration capacity.
- Modified pond configurations.
- Enhanced recirculation systems.
- New bioremediation technologies.
- Additional monitoring parameters.

Adaptive management ensures that the system remains responsive to changing conditions and supports continual improvement.

Performance Objectives

The effectiveness of the Bioremediation and Nutrient Recovery Plan will be assessed against the following objectives:

- Demonstrated reduction in nutrient concentrations through the treatment train.
- Effective operation of the one-hectare bioremediation pond.
- Maintenance of water quality suitable for cultured species.
- Minimal accumulation of organic sediments.
- Reduced nutrient discharge relative to conventional aquaculture systems.
- Increased nutrient recovery through biomass production.
- Protection of receiving environmental values.
- Continuous improvement of resource use efficiency.

Through implementation of the integrated bioremediation strategy described in this plan, GAAC aims to demonstrate that aquaculture production can occur in a manner that not only minimises environmental impacts but actively contributes to improved resource efficiency, nutrient recovery and environmental stewardship across Anindilyakwa Sea Country.

12. Water Quality Monitoring

Objectives

The objective of the Water Quality Monitoring Program is to ensure that water quality throughout the Stage 2 aquaculture facility remains suitable for cultured species, supports the effective operation of treatment and bioremediation systems, protects receiving environmental values and demonstrates compliance with environmental approvals and licence conditions. Water quality monitoring forms one of the most important environmental management tools available to GAAC. Monitoring provides the information necessary to assess environmental performance, identify emerging issues before they become significant problems and support adaptive management decisions.

The monitoring program has been developed based on operational experience gained through the Stage 1 facility, where routine monitoring has been undertaken since 2022. This experience has provided a detailed

understanding of the environmental conditions required for successful operation of low-trophic aquaculture systems on Groote Eylandt.

Specific objectives of the monitoring program are to:

- Verify the effectiveness of water treatment systems.
- Maintain suitable environmental conditions for cultured species.
- Assess the performance of bioremediation systems.
- Detect changes in water quality before adverse impacts occur.
- Support operational decision-making.
- Demonstrate environmental compliance.
- Protect receiving environmental values.
- Support continual improvement of facility operations.

Monitoring Philosophy

The Stage 2 facility has been designed around the principle that effective environmental management requires monitoring at multiple points throughout the production process rather than relying solely on end-point discharge monitoring.

Monitoring will therefore occur throughout the facility including:

- Intake water.
 - Water treatment systems.
 - Hatchery systems.
 - Production ponds.
 - Bioremediation ponds.
 - Discharge points.
- Receiving environments where required. This approach allows water quality changes to be tracked through the entire treatment train and provides a detailed understanding of system performance.

Monitoring data will be used not only to demonstrate compliance but also to optimise production systems, improve resource efficiency and support environmental stewardship.

Monitoring Locations

Intake Water Monitoring

Monitoring of intake water provides a baseline against which operational performance can be assessed.

Intake monitoring allows GAAC to:

- Characterise source water quality.
- Identify seasonal trends.
- Assess natural environmental variability.
- Inform operational decisions.
- Compare intake and discharge conditions.

Monitoring of intake water will occur at the marine intake structure and may be supplemented by additional monitoring within Bartalumba Bay where required.

Hatchery Monitoring

The hatchery contains some of the most sensitive life stages present within the facility and consequently requires intensive monitoring.

Water quality monitoring within hatchery systems allows early identification of changes that may affect:

- Larval survival.
- Growth rates.
- Settlement success.
- Animal health.
- Biosecurity outcomes.

Monitoring frequencies within hatchery systems will generally exceed those applied elsewhere within the facility.

Production Pond Monitoring

Production ponds represent the largest water bodies within the facility and support a range of biological, chemical and physical processes.

Monitoring of production ponds is necessary to:

- Assess environmental conditions.
- Monitor nutrient dynamics.
- Evaluate production performance.
- Identify developing water quality issues.
- Support operational management decisions.

Monitoring will occur at representative locations throughout each pond system.

Bioremediation Pond Monitoring

The one-hectare bioremediation pond forms a critical component of the nutrient recovery and treatment process.

Monitoring within the bioremediation pond allows assessment of:

- Nutrient removal efficiency.
- Biological productivity.
- Treatment performance.
- Water quality trends.
- Hydraulic performance.

Data collected from the bioremediation pond will be used to evaluate the effectiveness of the treatment process and identify opportunities for optimisation.

Discharge Monitoring

Monitoring of discharge water provides assurance that treatment systems are functioning effectively and that environmental objectives are being achieved.

Discharge monitoring also provides an important mechanism for demonstrating environmental performance to regulators and stakeholders.

Discharge monitoring results will be reviewed prior to release events where practical.

Water Quality Parameters

Dissolved Oxygen

Dissolved oxygen is one of the most important water quality parameters affecting animal health and biological treatment processes.

Low dissolved oxygen concentrations may result in:

- Animal stress.
- Reduced growth.
- Increased disease susceptibility.
- Reduced treatment performance.
- Mortality events.

Dissolved oxygen will therefore be monitored routinely throughout the facility.

Temperature

Water temperature influences virtually all biological processes within aquaculture systems.

Temperature affects:

- Growth rates.
- Feeding behaviour.
- Oxygen demand.
- Disease dynamics.
- Metabolic activity.

Monitoring of temperature provides essential information for operational management and environmental assessment.

Salinity

Salinity influences the physiological performance of cultured species and provides important information regarding water balance within the system.

Monitoring salinity assists in:

- Managing hatchery operations.
- Assessing rainfall impacts.
- Evaluating evaporation rates.
- Supporting water exchange decisions.

The pH of water influences nutrient availability, biological processes and animal health.

Monitoring of pH provides an indication of:

- Biological activity.
- Water chemistry stability.
- Treatment performance.
- Potential operational issues.

Turbidity

Turbidity is used as an indicator of suspended solids and water clarity.

Elevated turbidity may indicate:

- Increased organic loading.
- Sediment disturbance.
- Treatment system issues.
- Algal blooms.

Routine monitoring assists in identifying these issues before significant impacts occur.

Ammonia

Ammonia is a key indicator of nutrient loading and biological waste accumulation.

Elevated ammonia concentrations may adversely affect cultured organisms and indicate declining treatment performance.

Monitoring ammonia provides early warning of potential water quality deterioration.

Nitrite

Nitrite is an intermediate product of biological nitrification processes and may become toxic at elevated concentrations.

Monitoring nitrite provides information regarding:

- Biological filtration performance.
- Nitrogen cycling.
- Treatment efficiency.

Nitrate

Nitrate is generally less toxic than ammonia or nitrite but remains an important indicator of nutrient accumulation within the system.

Monitoring nitrate assists in evaluating:

- Nutrient dynamics.
- Bioremediation performance.
- Long-term system balance.

Total Nitrogen

Total nitrogen monitoring provides a broader assessment of nutrient concentrations and treatment performance.

This parameter is particularly useful for evaluating the effectiveness of nutrient recovery strategies.

Total Phosphorus

Phosphorus is a key nutrient influencing biological productivity.

Monitoring phosphorus assists in assessing:

- Nutrient recovery.
- Water quality trends.
- Potential environmental risks.

Chlorophyll

Chlorophyll monitoring provides an indication of phytoplankton abundance and overall biological productivity.

Monitoring chlorophyll assists in identifying:

- Algal blooms.
- Productivity trends.
- Treatment performance.

Bacterial Monitoring

Bacterial monitoring forms an important component of both water quality management and biosecurity. Monitoring may include:

- Total bacterial abundance.
- *Vibrio* species.
- Indicator organisms.
- Pathogen surveillance where required.

Results will assist in evaluating treatment performance and biosecurity outcomes.

Monitoring Equipment

Water quality monitoring will utilise industry-standard equipment including:

- YSI multiparameter meters.
- Hanna spectrophotometers.
- API test kits.
- Fluorometers.
- Portable dissolved oxygen meters.
- Salinity and conductivity meters.
- Continuous monitoring sensors where appropriate.

All equipment will be calibrated and maintained according to manufacturer recommendations.

Calibration records will be retained and made available during audits and inspections.

Monitoring Frequency

Monitoring frequency will vary according to the parameter being measured and the operational importance of that parameter.

In general:

- Critical operational parameters such as dissolved oxygen, temperature and salinity will be monitored daily.
- Nutrient parameters such as ammonia, nitrite and nitrate will be monitored several times per week or as operational requirements dictate.
- Broader environmental monitoring parameters may be assessed weekly or monthly depending on risk and management objectives. Monitoring frequencies may be adjusted based on operational experience and environmental conditions.

Data Management

All monitoring data will be recorded electronically and retained within the facility environmental management system.

Data records will include:

- Date and time.
- Monitoring location.
- Parameter measured.
- Instrument used.
- Result obtained.
- Operator details.

- Observations where relevant.

Data quality checks will be undertaken routinely to identify anomalies or potential recording errors.

Historical monitoring records will be retained to allow long-term trend analysis and performance assessment.

Trigger Values and Corrective Actions

Water quality trigger values will be developed based on:

- Species requirements.
- Historical monitoring data.
- Industry standards.
- Regulatory requirements.
- Environmental objectives.

Exceedance of trigger values will not necessarily indicate environmental harm but will initiate investigation and assessment.

Potential corrective actions may include:

- Increasing aeration.
- Adjusting water exchange rates.
- Modifying stocking densities.
- Optimising treatment systems.
- Increasing retention times.
- Undertaking maintenance activities.
- Reviewing operational procedures.

The specific response implemented will depend on the parameter affected and the magnitude of the exceedance.

Reporting

Water quality monitoring results will be reviewed routinely by operational staff and management.

Monitoring data will be incorporated into:

- Operational reports.
- Environmental performance reviews.
- Incident investigations.
- Annual environmental reports.
- Regulatory reporting requirements.

Significant trends, exceedances or incidents will be investigated and documented.

Continuous Improvement

The Water Quality Monitoring Program will be reviewed periodically to ensure it remains appropriate for the scale and complexity of operations.

As additional information becomes available, monitoring locations, parameters and frequencies may be modified to improve effectiveness and efficiency.

The objective of continual improvement is to ensure that monitoring remains a proactive management tool that supports environmental protection, operational performance and sustainable aquaculture development.

Performance Objectives

The effectiveness of the Water Quality Monitoring Program will be assessed against the following objectives:

- Maintenance of suitable water quality for cultured species.
- Effective operation of treatment and bioremediation systems.
- Protection of receiving environmental values.
- Timely identification of emerging issues.
- Compliance with environmental approvals and licence conditions.
- Maintenance of accurate and reliable monitoring records.
- Demonstrated continual improvement in environmental performance.

Through implementation of this monitoring framework, GAAC aims to maintain a high standard of environmental stewardship and provide a robust evidence base demonstrating the sustainable operation of the Stage 2 aquaculture facility.

13. Waste Management

The objective of the Waste Management Plan is to minimise waste generation, maximise resource recovery, prevent environmental contamination and ensure that all waste materials generated during construction and operation of the Stage 2 aquaculture facility are managed in a safe, responsible and environmentally sustainable manner.

GAAC recognises that effective waste management is a critical component of environmental stewardship and sustainable aquaculture. The organisation is committed to applying the principles of the waste hierarchy by prioritising waste avoidance, reduction, reuse, recycling, recovery and, where necessary, appropriate disposal.

The Stage 2 development has been deliberately designed around low-trophic aquaculture species and integrated multi-trophic aquaculture principles, which inherently reduce waste generation relative to conventional aquaculture systems. Nutrient recovery, bioremediation and circular economy principles form the foundation of the waste management strategy.

Specific objectives of this plan are to:

- Minimise waste generation throughout construction and operation.
- Maximise opportunities for reuse and recycling.
- Prevent pollution of land, groundwater, surface water and marine environments.
- Ensure waste storage and handling practices protect environmental values.
- Promote beneficial reuse of organic materials wherever practical.
- Maintain compliance with relevant legislation and licence conditions.
- Support continual improvement in resource efficiency.

Waste Management Philosophy

The facility has been designed around the concept that many materials traditionally considered waste can instead be treated as resources.

Organic matter generated within aquaculture systems contains nutrients and biological value that may be recovered through composting, bioremediation or integration into other production pathways. This approach reduces disposal requirements while improving environmental performance.

The waste management hierarchy adopted by GAAC is:

1. Avoid waste generation.
2. Reduce waste volumes.

3. Reuse materials where practical.
4. Recycle materials where possible.
5. Recover value from residual materials.
6. Dispose of remaining waste appropriately.

Application of this hierarchy throughout project activities is expected to significantly reduce waste generation and improve resource utilisation.

Waste Streams

Waste generated by the facility may be broadly categorised into:

- Organic wastes.
- Aquaculture production wastes.
- Sediments and sludge.
- General waste.
- Recyclable materials.
- Hazardous wastes.
- Construction wastes.
- Laboratory wastes.
- Biosecurity wastes.

Each waste stream requires specific management measures to ensure environmental protection and operational efficiency.

Organic Waste Management

Organic waste generated during aquaculture operations includes:

- Animal mortalities.
- Biological filtration residues.
- Harvest processing residues.
- Seaweed biomass.
- Organic sediments.
- Plant material.
- General biodegradable waste.

Organic materials will be managed in a manner that maximises nutrient recovery and minimises environmental impacts.

Where practical, organic materials will be directed toward composting systems or other beneficial reuse pathways.

The use of composting aligns with the broader philosophy of nutrient recovery and circular resource use adopted throughout the facility.

Organic waste stockpiles will not be allowed to accumulate in a manner that creates odour issues, attracts pests or presents biosecurity risks.

Routine inspections will ensure organic waste is managed appropriately.

Animal Mortalities

Animal mortalities are an unavoidable component of aquaculture operations and require careful management to minimise environmental and biosecurity risks.

All mortalities will be removed from production systems as soon as practicable following detection and placed into a commercial composter for treatment and pasteurisation.

Routine inspections of culture systems will assist in identifying mortalities early and preventing deterioration in water quality.

Mortality events may occur as a result of:

- Natural causes.

- Handling stress.
- Predation.
- Environmental conditions.
- Disease events.
- Equipment failures.

Mortality numbers and observations will be recorded to assist with production management and disease surveillance.

Small quantities of mortalities may be incorporated into approved composting systems where appropriate. Larger mortality events or disease-related mortalities may require alternative disposal methods depending on biosecurity requirements.

Where disease is suspected, disposal methods will be determined in consultation with relevant authorities if required.

Pond Sediment Management

Although low-trophic aquaculture systems generate substantially less organic waste than conventional fed aquaculture operations, some accumulation of organic matter and sediments is expected within production ponds over time.

Sediment accumulation will be monitored through routine inspections and operational assessments.

When sediment removal becomes necessary, material will be assessed for:

- Organic content.
- Odour.
- Contamination risks.
- Beneficial reuse opportunities.

Suitable material may be reused for:

- Composting.
- Landscaping.
- Rehabilitation activities.
- Soil improvement. Sediment removal activities will be undertaken in a manner that minimises dust generation, runoff and environmental disturbance.

Storage areas for removed sediments will be selected to prevent nutrient-rich runoff entering natural waterways or marine environments.

Seaweed Biomass Management

Seaweed cultivation forms an important component of the facility's nutrient recovery strategy.

Harvested seaweed represents a valuable resource rather than a waste product and may be utilised for:

- Human consumption.
- Animal feed.
- Rabbitfish production.
- Composting.
- Research and development activities.
- Cosmetic and nutraceutical applications.

Seaweed not suitable for commercial use may still provide value through composting or nutrient recycling programs.

The objective is to ensure that seaweed biomass remains within productive use pathways wherever practical.

General Waste

General waste generated during facility operations may include:

- Food packaging.
- Domestic waste.
- Non-recyclable plastics.
- Damaged equipment.
- Miscellaneous materials.

General waste volumes will be minimised through purchasing practices, reuse initiatives and recycling programs.

Waste receptacles will be provided throughout the facility and waste collection schedules established to prevent accumulation. General waste will be transported to approved disposal facilities where necessary.

Littering is prohibited throughout the site.

Recycling

GAAC is committed to maximising recycling opportunities wherever practical.

Materials potentially suitable for recycling include:

- Cardboard.
- Paper.
- Aluminium.
- Steel.
- Glass.
- Plastic containers.
- Electrical equipment.
- Batteries.

Recyclable materials will be segregated where practical and stored appropriately prior to transport for recycling.

The effectiveness of recycling programs will be reviewed periodically as part of the continuous improvement process.

Hazardous Waste Management

Hazardous wastes may be generated through routine maintenance, laboratory operations and infrastructure management.

Potential hazardous waste streams include:

- Waste oils.
- Greases.
- Fuel-contaminated materials.
- Chemical containers.
- Laboratory reagents.
- Batteries.
- Fluorescent lighting components.
- Contaminated absorbent materials.

Hazardous wastes will be stored separately from general waste streams and clearly identified.

Storage areas will be designed to prevent leaks, spills and environmental contamination.

Hazardous wastes will be disposed of through appropriately licensed waste management providers.

Records of hazardous waste generation, storage and disposal will be maintained.

Fuel and Chemical Containers

Empty fuel, oil and chemical containers may retain residual contents capable of causing environmental contamination if not managed appropriately.

Containers will be:

- Stored securely.
- Prevented from accumulating unnecessarily.
- Inspected regularly.
- Recycled where suitable programs exist.
- Disposed of appropriately where recycling is not possible.

Damaged containers presenting a contamination risk will be managed immediately.

Construction Waste Management

Construction activities associated with the Stage 2 development will generate a variety of waste streams including:

- Vegetation.
- Timber.
- Packaging.
- Scrap metal.
- Plastics.
- Concrete waste.
- Surplus materials. Construction contractors will be required to minimise waste generation and maximise opportunities for reuse and recycling.

Construction waste will be managed in accordance with the waste hierarchy and relevant environmental obligations.

Waste materials will not be burned, buried or disposed of on-site unless specifically approved.

Laboratory Waste Management

Laboratory activities may generate specialised waste streams requiring additional management measures.

Laboratory waste may include:

- Sample containers.
- Chemical reagents.
- Diagnostic materials.
- Contaminated consumables.

Laboratory wastes will be segregated, labelled and managed according to their risk profile.

Personnel involved in laboratory activities will receive appropriate training in waste handling and disposal procedures.

Biosecurity Waste

Biosecurity waste includes materials potentially contaminated by pathogens or disease agents.

Examples include:

- Quarantine wastes.
- Disease investigation materials.
- Contaminated equipment.
- Animal health diagnostic materials.

Biosecurity waste will be managed in accordance with facility biosecurity procedures.

Where disease events occur, disposal methods may be modified to minimise transmission risks.

Additional controls may be implemented depending on the nature of the biosecurity threat.

Waste Storage Areas

Dedicated waste storage areas will be established throughout the facility. Waste storage areas will be designed to:

- Prevent litter generation.
- Prevent access by animals.
- Prevent contamination of land and water.
- Facilitate waste segregation.
- Support efficient collection and removal.

Storage areas will be inspected regularly to verify appropriate management.

Any deficiencies identified will be corrected promptly.

Monitoring and Inspections

Routine inspections will be undertaken to assess:

- Waste segregation.
- Storage conditions.
- Waste volumes.
- Recycling performance.
- Signs of contamination.
- Odour generation.
- Pest activity.

Inspection findings will be documented and corrective actions implemented where required.

Monitoring information will support continual improvement of waste management practices.

Incident Management

Waste-related incidents may include:

- Litter releases.
- Waste storage failures.
- Chemical contamination.
- Fuel contamination.
- Illegal dumping.
- Wastewater leaks.
- Odour complaints.

Any waste-related incident will be investigated and corrective actions implemented to prevent recurrence.

Where required, incidents will be reported in accordance with regulatory obligations.

Performance Objectives

The effectiveness of the Waste Management Plan will be assessed against the following objectives:

- Minimisation of waste generation.
- Increased resource recovery and recycling.
- Effective management of organic wastes.
- Prevention of contamination of land and water.
- Appropriate management of hazardous materials.
- Compliance with legislative and licence requirements.
- Absence of significant waste-related environmental incidents.
- Demonstrated continual improvement in waste management performance.

Through implementation of this Waste Management Plan, GAAC aims to establish a waste management framework that supports sustainable aquaculture production, protects environmental values and maximises resource efficiency throughout the life of the Stage 2 development.

14. Biosecurity Management

The objective of the Biosecurity Management Plan is to minimise the risk of introduction, establishment, amplification and release of pathogens, pests, invasive species and contaminants associated with aquaculture activities while protecting cultured animals, surrounding ecosystems and the environmental values of Anindilyakwa Sea Country.

Biosecurity is a fundamental component of sustainable aquaculture and underpins the long-term viability of the Stage 2 development. The movement of water, animals, equipment, vessels, vehicles and personnel all present potential pathways through which biological hazards may be introduced or spread. Consequently, the facility has been designed around a multiple-barrier biosecurity framework that combines physical infrastructure, operational procedures, monitoring programs and staff training. The biosecurity management system seeks to protect not only cultured organisms within the facility but also the broader marine environment and wild populations that occur throughout Groote Eylandt and the Gulf of Carpentaria region.

Specific objectives of this plan are to:

- Prevent introduction of aquatic diseases and pathogens.
- Prevent establishment of invasive marine pests.
- Minimise disease transmission within the facility.
- Prevent release of pathogens to surrounding environments.

- Protect the health and welfare of cultured animals.
- Maintain confidence in aquaculture products and operations.
- Support compliance with Northern Territory and Commonwealth biosecurity requirements.
 - Promote a culture of proactive biosecurity awareness among staff, contractors and visitors.

Biosecurity Philosophy

The Stage 2 facility adopts a precautionary biosecurity philosophy whereby prevention is considered substantially more effective and less costly than disease response or eradication.

Biosecurity risks cannot be completely eliminated; however, they can be significantly reduced through the implementation of multiple complementary control measures.

The facility therefore utilises a layered biosecurity approach incorporating:

- Controlled site access.
- Quarantine procedures.
- Water treatment systems.
- Animal health monitoring.
- Equipment disinfection.
- Staff training.
- Environmental monitoring.
- Incident response planning.
- Adaptive management. Each layer provides additional protection and reduces the likelihood that a single failure could result in a significant biosecurity event.

Biosecurity Risk Pathways

Potential biosecurity risks may enter or move through the facility via several pathways.

These include:

- Incoming seawater.
- Broodstock collection.
- Juvenile animal movements.
- Equipment transfers.
- Vehicles.
- Vessels.
- Personnel.
- Visitors.
- Wildlife interactions.
- Feed and consumables.
- Construction activities.
- Research activities.

Understanding these pathways allows biosecurity controls to be targeted effectively and proportionately.

The risk profile of each pathway will be reviewed periodically and management measures adjusted as required.

Site Access Controls

Controlling access to the facility represents one of the most effective biosecurity measures available.

Access to operational areas will be restricted to authorised personnel and approved visitors. Entry points will be clearly identified and biosecurity signage installed where appropriate.

Visitors entering operational areas may be required to comply with biosecurity procedures including: • Sign-in requirements.

- Footbath use.
- Hand sanitisation.
- Personal protective equipment requirements.
- Equipment inspection.
- Restrictions on animal contact.

Access to sensitive areas such as hatcheries, quarantine facilities and broodstock systems may be further restricted based on operational requirements.

The objective of site access controls is to minimise the risk of introducing pathogens, pests or contaminants into operational systems.

Personnel Biosecurity

Personnel movement represents a potential pathway for disease transmission between systems and facilities.

All staff, contractors and visitors will be required to comply with facility biosecurity procedures.

Personnel may be required to:

- Wash hands before entering operational areas.
- Utilise designated footbaths.
- Wear appropriate protective clothing.
- Avoid unnecessary movement between systems.
- Report unusual animal health observations.
- Comply with quarantine restrictions.

Staff training will ensure personnel understand their role in maintaining biosecurity standards and responding appropriately to potential threats.

A strong biosecurity culture is considered essential to the success of the facility.

Vehicle and Equipment Management

Vehicles and equipment have the potential to transport pathogens, pests, sediments and contaminants between locations. Where practical, equipment will be dedicated to specific operational areas to reduce cross-contamination risks.

Equipment transferred between systems may require:

- Cleaning.
- Disinfection.
- Inspection.
- Drying periods.

Vehicles entering operational areas may be subject to inspection and cleaning requirements depending on the level of biosecurity risk.

Particular attention will be given to equipment associated with hatcheries, quarantine facilities and broodstock systems.

Vessel Biosecurity

Marine vessels operating within Bartalumba Bay and surrounding waters may act as vectors for marine pests, fouling organisms and pathogens.

Vessels used by the facility will be maintained to minimise biofouling and prevent unnecessary transfer of marine organisms.

Where practical:

- Vessel hulls will be inspected regularly.
- Fouling organisms will be removed.
- Bilge water will be managed appropriately.
- Equipment exposed to seawater will be cleaned and inspected.

The objective is to minimise the risk of introducing or spreading marine pests within the region.

Incoming Seawater Biosecurity

Seawater represents one of the most significant potential pathways for biological hazards entering the facility.

To manage this risk, incoming seawater will undergo multiple treatment processes before entering culture systems.

These treatment processes may include:

Mechanical Filtration

Mechanical filtration removes larger particles, debris and many planktonic organisms.

Filtration reduces biological loading and improves the effectiveness of downstream treatment processes.

Ultraviolet Sterilisation

Ultraviolet sterilisation provides an important biosecurity barrier by reducing microbial loads including bacteria, viruses and other microorganisms.

Ozone Treatment

Ozone treatment provides an additional level of pathogen reduction and water quality improvement.

Ozone systems assist in reducing microbial abundance and improving overall system hygiene.

Water Quality Monitoring

Routine monitoring of water quality and microbial indicators provides additional assurance regarding treatment effectiveness.

The combination of these treatment barriers significantly reduces biosecurity risks associated with incoming seawater.

Broodstock and Animal Movements

The introduction of broodstock, larvae, juveniles or research animals presents a potential disease transmission pathway.

All incoming animals will be subject to risk assessment prior to introduction into the facility.

Where appropriate, animals may undergo:

- Health assessments.

- Quarantine periods.
- Diagnostic testing.
- Observation programs.

Animal movements between systems will be minimised wherever practical and undertaken in accordance with established procedures.

Records of animal movements will be maintained to support traceability and disease investigations if required.

Quarantine Systems

Quarantine facilities provide an important biosecurity barrier between incoming animals and established production systems.

The purpose of quarantine is to:

- Observe animal health.
- Detect potential disease issues.
- Reduce disease transmission risks.
- Support safe introduction of new stock.

Quarantine systems will be physically separated from production areas wherever practical.

Equipment used within quarantine areas will be dedicated to those systems or disinfected prior to reuse elsewhere.

Personnel working within quarantine areas may be required to follow additional biosecurity protocols.

Animal Health Monitoring

Routine animal health monitoring provides an early warning mechanism for disease detection.

Monitoring activities may include:

- Behavioural observations.
- Survival assessments.
- Growth performance monitoring.
- Visual health inspections.
- Diagnostic investigations.
- Water quality assessments.

Unusual observations including elevated mortalities, abnormal behaviour, reduced feeding activity or visible lesions will trigger further investigation.

Early detection is essential for effective disease management and minimisation of impacts.

Disease Response Procedures

Despite preventative measures, disease events may occur.

If a disease outbreak is suspected:

- Affected systems may be isolated.
- Animal movements may be restricted.
- Enhanced monitoring may be implemented.
- Diagnostic investigations may be initiated.
- Biosecurity controls may be strengthened.
- Authorities may be notified where required.

The specific response will depend on the nature and severity of the event.

The objective is to minimise impacts while protecting unaffected systems and surrounding environments.

Wildlife Interactions

Wild animals may act as vectors for disease transmission.

Potential wildlife interactions include:

- Birds.
- Reptiles.
- Mammals.
- Wild fish.
- Invertebrates.

Facility design incorporates measures intended to reduce unnecessary wildlife access to sensitive operational areas.

Wildlife will not be harmed except where authorised and necessary for safety or environmental management purposes.

Any unusual wildlife interactions will be documented and assessed.

Marine Pest Management

The introduction or spread of marine pest species represents a significant environmental risk.

Marine pest management focuses on:

- Vessel hygiene.
- Equipment cleaning.
- Biofouling management.
- Monitoring.
- Staff awareness.

Routine inspections of intake infrastructure, vessels and marine equipment will assist in identifying unusual organisms or fouling communities.

Suspected marine pest detections will be reported and investigated.

Cleaning and Disinfection

Cleaning and disinfection procedures are fundamental to effective biosecurity management.

Cleaning removes organic matter and debris that may harbour pathogens.

Disinfection reduces the survival of microorganisms and disease agents.

Cleaning and disinfection procedures may apply to:

- Equipment.
- Tanks.
- Pipelines.
- Nets.
- Vehicles.
- Protective clothing.
- Quarantine systems.

Products selected for disinfection will be appropriate for their intended use and managed in accordance with manufacturer recommendations.

Biosecurity Training

All personnel will receive biosecurity training appropriate to their responsibilities.

Training topics may include:

- Biosecurity principles.
- Disease recognition.
- Quarantine procedures.
- Equipment disinfection.
- Animal handling.
- Incident reporting.
- Emergency response.

Refresher training will be provided periodically and following significant procedural changes.

Training records will be maintained by the facility.

Biosecurity Auditing and Review

The biosecurity management system will be reviewed periodically to ensure its effectiveness.

Reviews may consider:

- Animal health outcomes.
- Disease incidents.
- Monitoring results.
- Compliance observations.
- Emerging threats.
- Industry developments.

Audit findings will be documented and corrective actions implemented where necessary.

Continual improvement is a key component of the biosecurity framework.

Incident Reporting

Biosecurity incidents may include:

- Suspected disease outbreaks.
- Unusual mortality events.
- Quarantine breaches.
- Introduction of unauthorised animals.
- Marine pest detections.
- Equipment contamination.
- Treatment failures.

All incidents will be reported promptly and investigated to determine causes and corrective actions. Where required, incidents will be reported to relevant authorities.

Performance Objectives

The effectiveness of the Biosecurity Management Plan will be assessed against the following objectives:

- No significant disease outbreaks attributable to management failures.
- Effective operation of quarantine systems.
- Maintenance of healthy cultured populations.
- Compliance with biosecurity procedures.
- Effective treatment of incoming seawater.
- Timely identification and investigation of biosecurity risks.
- No introduction of known marine pest species through facility operations.
- Continuous improvement in biosecurity performance.

Through implementation of this Biosecurity Management Plan, GAAC aims to maintain a robust and proactive biosecurity framework that protects cultured animals, supports sustainable aquaculture production and safeguards the environmental values of Anindilyakwa Sea Country.

15. Land Clearing and Vegetation Management

The objective of the Land Clearing and Vegetation Management Plan is to minimise vegetation disturbance, protect environmental values, maintain ecosystem function, reduce erosion risks and ensure that land clearing associated with the Stage 2 aquaculture development is undertaken in a responsible and environmentally sustainable manner.

The Stage 2 development has been designed to balance operational requirements with environmental protection. The project recognises that native vegetation provides important ecological, cultural and operational benefits and that unnecessary clearing should be avoided wherever practical.

Specific objectives of this plan are to:

- Minimise the total area of vegetation clearing required for the development.
- Retain existing vegetation wherever practical.
- Protect native fauna habitat and ecological connectivity.
- Reduce erosion and sediment transport risks.
- Maintain visual amenity and landscape values.
- Support rehabilitation of disturbed areas.
- Protect cultural and environmental values associated with Anindilyakwa Sea Country.
- Ensure compliance with relevant environmental approvals and regulatory requirements.

The project has adopted a philosophy of selective clearing and vegetation retention rather than broadscale site clearing. This approach reduces environmental impacts while providing operational benefits including dust suppression, wind protection and biosecurity enhancement.

Existing Site Conditions

The Stage 2 development area is located within the Little Paradise precinct on Groote Eylandt and consists primarily of previously disturbed and modified land adjacent to the existing Stage 1 aquaculture facility.

The broader landscape supports vegetation communities typical of the Groote Eylandt coastal environment, including open woodland, shrubland and coastal vegetation assemblages. These vegetation communities provide habitat for native fauna, contribute to ecosystem processes and form part of the broader environmental values of the area.

Vegetation within and surrounding the project area performs a range of important ecological functions including:

- Soil stabilisation.
- Erosion control.

- Dust suppression.
- Habitat provision.
- Carbon sequestration.
- Microclimate regulation.
- Hydrological regulation.
- Ecological connectivity.

Vegetation also provides operational benefits by reducing wind speeds, lowering evaporation rates, improving working conditions and acting as a natural buffer around aquaculture infrastructure.

Consequently, vegetation retention has been incorporated into the overall site design wherever practical.

Clearing Requirements

Construction of the Stage 2 development will require clearing associated with:

- Eight production ponds.
- One-hectare bioremediation pond.
- Access roads.
- Utility corridors.
- Pumping infrastructure.
- Operational areas.
- Drainage infrastructure.
- Supporting facilities.

The total disturbance footprint is expected to be approximately four hectares, although the actual area cleared may be reduced through detailed design and retention of vegetation buffers.

The project does not propose broadscale clearing of the lease area. Clearing will be limited to areas required for construction and safe operation of infrastructure.

Where practical, vegetation located outside operational footprints will remain undisturbed.

Vegetation Retention Strategy

A key environmental objective of the project is the retention of vegetation wherever practical.

Retaining vegetation provides several important benefits.

Environmental Benefits

Retained vegetation contributes to:

- Habitat protection.
- Biodiversity conservation.
- Erosion prevention.
- Dust suppression.
- Reduced sediment transport.
- Improved water quality outcomes.
- Ecological connectivity. Vegetation retention also assists in reducing the overall environmental footprint of the project.

Operational Benefits

Retained vegetation provides operational advantages including:

- Wind protection.
- Reduced evaporation losses.
- Shade provision.
- Improved working conditions.
- Reduced maintenance requirements.
- Improved infrastructure protection.

These benefits contribute directly to improved operational efficiency and environmental performance.

Biosecurity Benefits

Vegetation buffers may also contribute to biosecurity outcomes by reducing dust transport and acting as physical barriers between operational areas and surrounding environments.

The retention of vegetation is therefore considered both an environmental and operational management measure.

Clearing Methodology

Clearing activities will be undertaken progressively and only as required.

The progressive clearing approach reduces the amount of exposed soil present at any one time and decreases the risk of erosion, sediment transport and dust generation.

Prior to commencement of clearing:

- Clearing boundaries will be identified.
- Construction personnel will be briefed on clearing limits.
- Sensitive areas will be identified where necessary.
- Environmental controls will be established.

Clearing activities will be undertaken using appropriately sized machinery and equipment selected to minimise unnecessary disturbance.

Clearing outside approved disturbance areas is prohibited.

Protection of Retained Vegetation

Vegetation retained within or adjacent to the development area will be protected throughout construction and operation.

Protection measures may include:

- Clearly marking retained vegetation.
- Establishing exclusion zones.
- Restricting vehicle movements.
- Limiting stockpiling activities near retained vegetation.
- Managing drainage to prevent erosion around root systems.

Construction personnel will be instructed not to damage retained vegetation unless specifically authorised.

Any accidental damage to retained vegetation will be reported and assessed.

Topsoil Management

Topsoil is a valuable resource that supports rehabilitation and revegetation activities.

Where practical, topsoil will be stripped separately from subsoil and stockpiled for future reuse.

Topsoil management objectives include:

- Retaining soil fertility.
- Preserving seed banks.
- Supporting rehabilitation.
- Reducing rehabilitation costs.
- Improving revegetation success.

Topsoil stockpiles will be located away from drainage pathways and managed to minimise erosion and degradation.

Long-term stockpiles may be stabilised through vegetation establishment if required.

Native Fauna Considerations

Vegetation clearing has the potential to temporarily disturb native fauna.

Potential impacts may include: • Habitat loss.

- Temporary displacement.
- Disturbance from machinery.
- Increased movement of fauna through adjacent areas.

To minimise impacts:

- Clearing will occur progressively.
- Unnecessary clearing will be avoided.
- Vegetation corridors will be retained where practical.
- Personnel will remain vigilant for wildlife.

If fauna are encountered during clearing activities, reasonable efforts will be made to allow animals to move away from work areas safely.

The project is not expected to result in significant impacts to native fauna populations due to the relatively small footprint and previously disturbed nature of the site.

Erosion Prevention

Vegetation plays an important role in preventing soil erosion and maintaining site stability.

Where vegetation is removed, erosion prevention measures will be implemented including:

- Progressive rehabilitation.
- Stabilisation of exposed soils.
- Surface water management.
- Erosion and sediment controls.
- Retention of vegetation buffers.

These measures are particularly important during the wet season when rainfall intensity may increase erosion risks.

The effectiveness of erosion control measures will be assessed through routine inspections.

Dust Suppression

Vegetation significantly reduces dust generation by stabilising soils and reducing wind speeds.

Retaining vegetation wherever practical contributes directly to dust management outcomes. Additional dust suppression measures may include:

- Water application.
- Speed restrictions.
- Progressive rehabilitation.
- Stabilisation of stockpiles.

Dust generation will be monitored throughout construction activities and corrective actions implemented if necessary.

Rehabilitation and Revegetation

Areas disturbed during construction that are not required for ongoing operations will be rehabilitated where practical.

Rehabilitation objectives include:

- Surface stabilisation.
- Erosion prevention.
- Dust suppression.
- Visual integration.
- Habitat restoration where appropriate.

Rehabilitation methods may include:

- Topsoil replacement.
- Natural regeneration.
- Revegetation using local species.
- Mulching.
- Surface stabilisation techniques.

The extent of rehabilitation required will depend on the final operational footprint of the facility.

Weed Management

Disturbance associated with construction activities may increase the risk of weed establishment.

Weed management measures will include:

- Monitoring disturbed areas.
- Early detection and treatment.
- Vehicle hygiene where appropriate.
- Management of stockpiles.
- Rehabilitation of disturbed areas.

Weed infestations identified during inspections will be managed using appropriate control methods.

The objective is to prevent establishment and spread of weed species within the project area.

Monitoring and Inspections

Routine inspections will be undertaken throughout construction and operation to assess:

- Clearing boundaries.
- Vegetation retention effectiveness.
- Erosion risks.
- Rehabilitation progress.
- Weed presence.
- Dust generation.

- Stability of disturbed areas.

Inspection findings will be recorded and corrective actions implemented where required.

Monitoring outcomes will also inform future environmental management decisions.

Incident Management

Vegetation-related incidents may include:

- Clearing outside approved boundaries.
 - Unauthorised vegetation damage.
 - Significant erosion events.
 - Rehabilitation failures.
 - Weed outbreaks.
- Dust-related complaints. All incidents will be investigated and corrective actions implemented to prevent recurrence.

Where required, incidents will be reported in accordance with environmental approval and licence requirements.

Performance Objectives

The effectiveness of the Land Clearing and Vegetation Management Plan will be assessed against the following objectives:

- Clearing limited to approved disturbance areas.
- Retention of vegetation wherever practical.
- No significant erosion attributable to vegetation removal.
- Successful rehabilitation of disturbed areas.
- Effective management of weeds.
- Minimal dust generation from disturbed surfaces.
- Protection of environmental and cultural values.
- Compliance with environmental approvals and licence conditions.

Through implementation of this Land Clearing and Vegetation Management Plan, GAAC seeks to minimise the environmental footprint of the Stage 2 development while maintaining the ecological, cultural and operational benefits provided by native vegetation across the Little Paradise site.

16. Environmental Risk Assessment

The purpose of the Environmental Risk Assessment (ERA) is to identify, evaluate and manage environmental risks associated with the construction, operation, maintenance and eventual closure of the Stage 2 aquaculture facility at Little Paradise.

The Environmental Risk Assessment provides the framework through which potential environmental hazards are systematically identified and managed to minimise the likelihood of environmental harm. The assessment recognises that while all development activities involve some level of risk, those risks can be effectively reduced through appropriate planning, engineering controls, operational procedures, monitoring programs and adaptive management.

The objectives of the Environmental Risk Assessment are to:

- Identify environmental hazards associated with project activities.
- Assess the likelihood and consequence of environmental impacts.

- Prioritise risks requiring management actions.
- Establish mitigation measures and environmental controls.
- Support regulatory compliance.
- Inform monitoring and reporting programs.
- Facilitate continual improvement in environmental performance.
- Protect the environmental and cultural values of Anindilyakwa Sea Country.

This risk assessment adopts a precautionary approach whereby potential environmental impacts are considered during both normal operating conditions and abnormal or emergency situations.

16.1 Risk Assessment Methodology

Environmental risks have been assessed in accordance with the principles of AS/NZS ISO 31000:2018 Risk Management — Guidelines, by considering both the likelihood of an event occurring and the potential consequences should that event occur, informed by the Conceptual Site Model in Section 8. Likelihood and consequence are each rated on a five-point scale (from rare/insignificant to almost certain/severe), combined to give an inherent risk rating, and re-assessed following the application of proposed controls to give a residual risk rating. Risk ratings reflect the effectiveness of proposed mitigation measures and operational controls, and are reviewed periodically as monitoring data and operational experience accumulate; where uncertainty exists (for example, in the absence of a site-specific topographic survey — see Section 8), a precautionary, conservative rating has been applied.

The assessment incorporates information derived from operational experience gained during Stage 1 activities, design information associated with the Stage 2 development, existing environmental conditions, aquaculture industry experience, environmental monitoring data, and regulatory guidance and best-practice principles.

16.2 Risk Management Hierarchy

Environmental risks will be managed in accordance with the hierarchy of controls.

Where practical, risks will be managed through:

1. Elimination of the hazard.
2. Substitution with lower-risk alternatives.
3. Engineering controls.
4. Administrative controls.
5. Monitoring and adaptive management.

Engineering controls are generally preferred as they provide more reliable and consistent risk reduction than administrative controls alone.

The Stage 2 facility incorporates numerous engineered environmental safeguards including water treatment systems, bioremediation ponds, intake screening systems, spill containment infrastructure and emergency response systems.

16.3 Risk Discussion

Construction Environmental Risks

Vegetation Clearing

Vegetation clearing represents one of the primary environmental risks associated with construction activities.

Potential impacts include:

- Habitat disturbance.
- Loss of vegetation cover.
- Increased erosion risk.
- Dust generation.
- Reduced visual amenity.

The project has been designed to minimise clearing requirements through selective clearing and vegetation retention. Clearing will be restricted to approved disturbance areas and undertaken progressively to minimise impacts.

Residual risk following implementation of controls is considered low.

Erosion and Sediment Transport

Earthworks associated with pond construction, access roads and infrastructure installation may create erosion risks if not appropriately managed.

Potential impacts include:

- Sediment mobilisation.
- Water quality degradation.
- Habitat smothering.
- Increased turbidity.

Mitigation measures include:

- Erosion and sediment controls.
- Progressive rehabilitation.
- Stabilisation of exposed soils.
- Drainage management.
- Routine inspections.

Residual risk is considered low.

Dust Generation

Construction activities may generate dust through vegetation clearing, excavation and vehicle movements.

Potential impacts include:

- Reduced air quality.
- Impacts on vegetation.
- Operational nuisance.
- Biosecurity concerns.

Dust suppression measures include vegetation retention, water application, speed controls and progressive rehabilitation.

Residual risk is considered low.

Fuel and Chemical Spills

Construction activities require fuels, oils and chemicals that may cause contamination if released into the environment.

Potential impacts include:

- Soil contamination.

- Groundwater contamination.
- Surface water contamination.
- Marine pollution. Mitigation measures include:
 - Bunded storage.
 - Spill kits.
 - Staff training.
 - Refuelling procedures.
 - Incident response planning.

Residual risk is considered low.

Marine Construction Activities

Installation of the seawater intake infrastructure may generate localised impacts within the marine environment.

Potential impacts include:

- Temporary turbidity.
- Sediment disturbance.
- Habitat disturbance.
- Marine pollution.

The intake alignment has been selected to utilise an existing disturbed corridor adjacent to the breakwater, substantially reducing environmental impacts.

Marine construction activities will be managed through environmental supervision, equipment maintenance and construction controls.

Residual risk is considered low.

Operational Environmental Risks

Nutrient Enrichment and Water Quality Impacts

The discharge of nutrient-rich water is commonly considered one of the most significant environmental risks associated with aquaculture operations.

Potential impacts include:

- Elevated nutrient concentrations.
- Algal blooms.
- Reduced water quality.
- Changes in ecological communities.

The Stage 2 development incorporates multiple mitigation measures including:

- Low water exchange rates.
- Integrated multi-trophic aquaculture.
- Seaweed nutrient uptake.
- Oyster filtration.
- Sea cucumber bioremediation.
- One-hectare bioremediation pond.
- Water quality monitoring.

These measures substantially reduce nutrient discharge risks compared with conventional aquaculture systems.

Residual risk is considered low.

Failure of Water Treatment Systems

Water treatment systems are essential for maintaining water quality and biosecurity outcomes.

Potential impacts associated with treatment system failure include:

- Reduced water quality.
- Increased pathogen loads.
- Elevated nutrient concentrations.
- Operational disruptions.

Treatment systems will be supported by:

- Preventative maintenance.
- Routine inspections.
- Monitoring programs.
- Redundancy where appropriate.
- Emergency response procedures.

Residual risk is considered low to moderate.

Disease Outbreaks

Disease outbreaks represent one of the most significant operational risks facing aquaculture facilities.

Potential impacts include:

- Animal mortalities.
- Production losses.
- Biosecurity incidents.
- Environmental risks associated with disposal activities.

The facility incorporates extensive biosecurity measures including:

- Quarantine systems.
- Water treatment.
- Health monitoring.
- Access controls.
- Staff training.

Disease response procedures have been developed to minimise impacts should an outbreak occur.

Residual risk is considered moderate.

Marine Pest Introduction

The introduction or spread of marine pest species could result in environmental and operational impacts.

Potential impacts include:

- Competition with native species.
- Habitat alteration.
- Increased maintenance requirements.
- Biosecurity concerns.

Controls include vessel hygiene, equipment management, monitoring and staff awareness programs.

Residual risk is considered low.

Animal Escape

Although the cultured species are native to the region, animal escape events may occur under certain circumstances.

Potential causes include:

- Infrastructure damage.
- Flooding.
- Human error.
- Extreme weather events.

The risk is reduced through:

- Infrastructure design.
- Routine inspections.
- Water management systems.
- Emergency response procedures.

As cultured species are native to the region, environmental consequences are considered limited.

Residual risk is considered low.

Solid Waste Generation

Improper waste management could result in contamination or environmental degradation.

Potential impacts include:

- Litter.
- Soil contamination.
- Attraction of pests.
- Odour generation.

Waste management procedures, recycling programs and routine inspections minimise these risks.

Residual risk is considered low.

Extreme Weather Risks

Cyclones

Cyclones represent one of the most significant environmental and operational risks affecting Groote Eylandt.

Potential impacts include:

- Infrastructure damage.
- Power outages.
- Flooding.
- Animal losses.
- Environmental releases.

Mitigation measures include:

- Cyclone preparedness procedures.

- Emergency response planning.
- Infrastructure design standards.
- Backup power systems.
- Routine inspections.

Residual risk remains moderate due to the unpredictable nature of severe weather events.

Extreme Rainfall and Flooding

Intense rainfall may affect water management infrastructure and increase erosion risks.

Potential impacts include:

- Overtopping of ponds.
- Increased turbidity.
- Sediment transport.
- Infrastructure damage.

The facility has been designed with appropriate freeboard, drainage systems and emergency management procedures.

Residual risk is considered low to moderate.

Cultural and Social Risks

Impacts to Sea Country

The project recognises that environmental impacts may also have cultural consequences.

Potential impacts include:

- Reduced environmental quality.
- Impacts to customary harvesting.
- Loss of community confidence.

The project's emphasis on environmental protection, monitoring and Traditional Owner leadership significantly reduces these risks.

Residual risk is considered low.

Reputational Risks

Environmental incidents may affect stakeholder confidence and community support.

Transparent reporting, proactive management and continuous engagement with stakeholders will assist in managing reputational risks.

Residual risk is considered low.

16.4 Environmental Risk Register

Table 2 consolidates the construction and operational risks discussed above, and adds two risks identified since the previous revision of this EMP: fire (bushfire risk during dry-season construction) and data gaps arising from the absence of a site-specific topographic survey.

Hazard	Potential impact	Key controls	Inherent risk	Residual risk
Vegetation clearing	Habitat loss, erosion	Selective clearing, vegetation retention	Moderate	Low

Hazard	Potential impact	Key controls	Inherent risk	Residual risk
Sediment transport	Water quality impacts	Dry-season timing, spoil reuse, diversion drains as contingency	Moderate	Low
Fuel spill	Soil and water contamination	Self-bunded tank, spill kits, drip trays, training	High	Low
Fire (bushfire risk, dry season)	Loss of vegetation/habitat, infrastructure damage	Water cartage tanks doubling as firefighting resource, cleared perimeter, hot works permits, daily fire danger monitoring	High	Low
Marine construction	Turbidity and habitat disturbance	Construction controls, monitoring	Moderate	Low
Nutrient discharge	Water quality degradation	IMTA, bioremediation pond, ozonation, dilution, monitoring	High	Low
Treatment failure	Reduced water quality	Maintenance, monitoring, redundancy	Moderate	Low–Moderate
Disease outbreak	Mortalities, biosecurity impacts	Quarantine, monitoring, biosecurity controls	High	Moderate
Marine pest introduction	Ecological impacts	Vessel hygiene, inspections	Moderate	Low
Animal escape	Ecological impacts	Infrastructure design, inspections	Moderate	Low
Waste management failure	Contamination	Waste management procedures	Moderate	Low
Cyclone damage	Infrastructure failure	Emergency planning, design standards	High	Moderate
Extreme rainfall	Flooding, erosion	Drainage systems, freeboard	Moderate	Low–Moderate
Data gaps in site-specific survey information	Construction planning based on indicative rather than surveyed data	CSM to be refined as monitoring data are collected; survey data to be obtained to support detailed design where required	Moderate	Low–Moderate

Risk Review and Continuous Improvement

Environmental risks will be reviewed:

- Annually.
- Following significant incidents.
- Following major operational changes.
- Following amendments to environmental approvals.
- When new information becomes available.

The review process will consider monitoring results, incident investigations, audit findings and operational experience.

Where opportunities for improvement are identified, mitigation measures and management procedures will be updated accordingly.

Performance Objectives

The effectiveness of the Environmental Risk Assessment framework will be assessed against the following objectives:

- Environmental risks identified and regularly reviewed.
- Appropriate controls implemented for identified risks.
- No significant environmental incidents attributable to unmanaged risks.

- Effective incident response and corrective action implementation.
- Continuous improvement in environmental performance.
- Compliance with environmental approvals and licence conditions.
- Protection of environmental and cultural values.

Through implementation of this Environmental Risk Assessment framework, GAAC seeks to ensure that environmental risks associated with the Stage 2 aquaculture development are systematically identified, managed and reduced to levels that are acceptable from both environmental and operational perspectives while supporting the long-term stewardship of Anindilyakwa Sea Country.

17. Emergency Response and Incident Management

The objective of the Emergency Response and Incident Management Plan is to provide a structured framework for preventing, responding to, managing and recovering from environmental incidents, operational emergencies and unforeseen events associated with the construction and operation of the Stage 2 aquaculture facility.

The plan is designed to minimise risks to personnel, infrastructure, cultured animals, environmental values and cultural values while ensuring that incidents are managed in a timely, coordinated and effective manner.

The Stage 2 development operates within a dynamic coastal environment subject to seasonal weather patterns, tropical cyclones, marine conditions and biological risks. While the facility has been designed with multiple layers of environmental protection and operational redundancy, emergency preparedness remains essential to ensuring environmental and operational resilience.

Specific objectives of this plan are to:

- Protect human health and safety.
- Protect environmental values and Sea Country.
- Minimise environmental impacts arising from incidents.
- Protect cultured animals and production systems.
- Provide clear response procedures and responsibilities.
- Ensure timely notification and reporting of incidents.
- Facilitate recovery following emergencies.
- Support continual improvement through incident investigation and review.

This plan applies to all personnel, contractors, visitors and activities associated with the facility.

Emergency Management Philosophy

GAAC adopts a proactive emergency management philosophy based on the principles of prevention, preparedness, response and recovery.

The facility has been designed to reduce the likelihood and consequences of incidents through:

- Engineering controls.
- Redundant infrastructure.
- Preventative maintenance.
- Environmental monitoring.
- Staff training.
- Biosecurity procedures.
- Emergency preparedness planning.

Despite these measures, incidents may still occur. The objective of emergency management is therefore not only to prevent incidents but also to ensure that appropriate systems are in place to respond effectively when required.

All incidents will be assessed based on:

- Actual impacts.
- Potential impacts.
- Risk to human health.
- Risk to environmental values.
- Risk to animal welfare.
- Regulatory reporting obligations.

Emergency responses will be proportional to the nature and severity of the incident.

Emergency Response Structure

The General Manager retains overall responsibility for emergency response and incident management across the facility. During an emergency, the General Manager or delegated representative will assume the role of Incident Controller and coordinate response activities.

Responsibilities may include:

- Assessing the incident.
- Coordinating emergency actions.
- Mobilising resources.
- Communicating with stakeholders.
- Managing regulatory notifications.
- Authorising recovery actions.
- Reviewing incident outcomes.

All personnel are responsible for:

- Reporting incidents immediately.
- Following emergency procedures.
- Protecting their own safety and that of others.
- Assisting with emergency response where trained and safe to do so.

Emergency contact lists will be maintained and reviewed periodically.

Incident Classification

Incidents will be classified according to severity to ensure appropriate response and reporting.

Minor Incident

A minor incident is an event that:

- Can be managed by site personnel.
- Results in negligible environmental impact.
- Does not require external assistance.
- Does not trigger regulatory notification requirements.

Examples include:

- Small contained spills.
- Minor equipment failures.

- Localised waste management issues.

Moderate Incident

A moderate incident is an event that:

- Requires management intervention.
- Has the potential to cause environmental harm.
- May require notification of management.
- May require additional resources.

Examples include:

- Significant equipment failure.
- Moderate spill events.
- Localised fish mortality events.
- Temporary loss of water treatment systems.

Major Incident

A major incident is an event that:

- Results in actual or potential environmental harm.
- Requires activation of emergency response procedures.
- May require external assistance.
- May trigger regulatory reporting obligations.

Examples include:

- Major chemical spills.
- Cyclone damage.
- Significant fish kills.
- Biosecurity emergencies.
- Major infrastructure failures.
- Environmental releases.

Incident Reporting Procedures

All personnel are required to report environmental incidents immediately upon becoming aware of them.

Incident reporting shall include:

- Time and date.
- Location.
- Description of the incident.
- Immediate actions taken.
- Potential environmental impacts.
- Personnel involved.
- Photographic evidence where practical.

The Incident Controller will assess the information and determine the required response level.

Incidents requiring regulatory notification will be reported in accordance with relevant legislation, licence conditions and approval requirements.

Records of all incidents will be maintained within the facility environmental management system.

Cyclone Preparedness and Response

Tropical cyclones represent one of the most significant environmental and operational risks affecting Groote Eylandt.

Potential impacts include:

- Structural damage.
- Power outages.
- Flooding.
- Loss of seawater supply.
- Damage to ponds.
- Environmental releases.
- Animal losses.

Cyclone Preparedness

Prior to each cyclone season:

- Infrastructure inspections will be completed.
- Emergency equipment will be checked.
- Backup generators will be serviced.
- Fuel reserves will be verified.
- Emergency contact lists updated.
- Staff briefings conducted.

When cyclone warnings are issued:

- Loose materials will be secured.
- Vehicles relocated where necessary.
- Hazardous materials secured.
- Water levels adjusted where appropriate.
- Emergency supplies checked.

Cyclone Response

During cyclone conditions:

- Personnel safety takes precedence.
- Non-essential activities cease.
- Communication systems remain active where possible.
- Emergency procedures are implemented.

Recovery

Following cyclone passage:

- Damage assessments will be undertaken.
- Environmental impacts assessed.
- Infrastructure inspected.
- Corrective actions prioritised.
- Regulatory notifications completed if required.

Fuel and Chemical Spill Response

Fuel and chemical spills have the potential to impact soil, groundwater, surface water and marine environments.

Immediate Response

Upon discovery of a spill:

- Stop the source if safe to do so.
- Contain the spill.
- Prevent migration into waterways.
- Deploy spill response equipment.
- Notify supervisors immediately.

Assessment

The response team will assess:

- Volume released.
- Material involved.
- Environmental sensitivity.
- Potential impacts.

Recovery and Cleanup

Contaminated materials will be recovered and disposed of appropriately.

Affected areas may require remediation depending on the extent of contamination.

Spill response equipment will be replenished following use.

Investigation

All spills will be investigated to identify:

- Root causes.
- Contributing factors.
- Corrective actions.

Water Quality Incident Response

Water quality incidents may include:

- Low dissolved oxygen.
- Elevated ammonia.
- Elevated nitrite.
- Excessive turbidity.
- Algal blooms.
- Treatment failures.

Potential consequences include:

- Animal stress.
- Mortalities.
- Reduced treatment performance.
- Environmental impacts.

Response actions may include:

- Increasing aeration.
- Reducing feeding.
- Increasing recirculation.
- Modifying water exchange.
- Activating contingency systems.
- Increasing monitoring frequency.

Investigations will determine underlying causes and identify long-term improvements.

Fish Kill and Animal Mortality Events

Unusual mortality events require immediate investigation.

Potential causes may include:

- Water quality deterioration.
- Disease outbreaks.
- Equipment failures.
- Environmental conditions.
- Human error.

Response actions may include:

- Isolation of affected systems.
- Enhanced monitoring.
- Collection of diagnostic samples.
- Removal of mortalities.
- Consultation with specialists where required.

Mortality numbers and observations will be recorded and reviewed.

Large-scale mortality events may require notification of relevant authorities.

Disease and Biosecurity Emergencies

Disease outbreaks have the potential to affect both facility operations and surrounding environments.

Upon suspicion of a disease event:

- Affected systems may be isolated.
- Animal movements suspended.
- Enhanced biosecurity measures implemented.
- Diagnostic investigations initiated.
- Additional monitoring undertaken.

Where required, relevant government agencies will be consulted.

The primary objectives are containment, diagnosis and prevention of spread.

Seawater Intake Failure

Failure of the seawater intake system may occur due to:

- Blockages.
- Storm damage.
- Mechanical failure.
- Electrical failure.

- Marine debris.

Potential consequences include:

- Reduced water supply.
- Operational disruptions.
- Water quality deterioration.

Response measures may include:

- Activation of standby systems.
- Maintenance interventions.
- Reduced water demand.
- Temporary operational adjustments.

Routine inspections and preventative maintenance significantly reduce the likelihood of intake failures.

Pump Station Failure

The pump station is critical to operation of the Stage 2 facility.

Potential failure modes include:

- Electrical failure.
- Mechanical failure.
- Control system failure.
- Pump damage.

The facility incorporates redundancy through duty and standby pumps.

Response actions include:

- Fault diagnosis.
 - Activation of backup equipment.
 - Repair or replacement of components.
- Increased monitoring. The objective is to restore water supply as quickly as possible while protecting environmental and operational outcomes.

Power Failure

Power outages may affect:

- Aeration systems.
- Pumps.
- Water treatment.
- Monitoring systems.
- Communications.

Backup generators will provide emergency power to critical systems.

Emergency power systems will be tested routinely to ensure reliability.

During extended outages:

- Non-essential systems may be shut down.
- Stocking densities managed.
- Water quality monitored more frequently.

Fire Response

Fire risk for the Stage 2 works is considered in two parts: general facility fire risk (electrical faults, vehicles, fuel storage, equipment failures), and bushfire risk in the surrounding vegetation, which is elevated during the dry-season construction window described in Section 9.2.

- The water cartage tanks used for dust suppression (Section 9) also serve as an on-site firefighting resource, providing immediate water for knock-down of small fires and reducing reliance on off-site response in the critical early stages of an incident.
- A cleared perimeter is maintained around active work areas and stockpiles to reduce fire spread potential.
- Hot works (welding, cutting, grinding) are subject to a permit system, with a spotter and fire extinguisher on hand for the duration of the activity.
- Vehicles and machinery are fitted with appropriate fire extinguishers and maintained to reduce ignition risk.
- Total fire ban conditions and fire danger ratings are monitored daily during the dry season, with works adjusted or stood down accordingly.

Personnel safety remains the highest priority during fire events. Emergency services will be contacted where necessary.

Environmental Complaints

Environmental complaints may relate to:

- Noise.
- Dust.
- Odour.
- Waste management.
- Water quality concerns.

All complaints will be:

- Recorded.
- Investigated.
- Responded to appropriately.
- Reviewed for improvement opportunities.

Complaint records will form part of the environmental management system.

Post-Incident Investigation

All moderate and major incidents will undergo formal investigation.

Investigations will seek to identify:

- Immediate causes.
- Root causes.
- Contributing factors.
- Effectiveness of response actions.
- Opportunities for improvement.

Recommendations arising from investigations will be documented and tracked through to completion.

Training and Emergency Preparedness

Personnel will receive training appropriate to their roles.

Training may include:

- Incident reporting.
- Spill response.
- Emergency communications.
- Cyclone preparedness.
- Biosecurity response.
- First aid.
- Fire response.

Emergency exercises and drills may be undertaken periodically to test preparedness and improve response capability.

Performance Objectives

The effectiveness of the Emergency Response and Incident Management Plan will be assessed against the following objectives:

- Timely reporting of incidents.
- Effective implementation of emergency procedures.
- Protection of personnel and environmental values.
- Rapid containment of environmental impacts.
- Compliance with reporting obligations.
- Completion of incident investigations.
- Implementation of corrective actions.
- Continuous improvement in emergency preparedness.

Through implementation of this Emergency Response and Incident Management Plan, GAAC aims to maintain a high level of operational resilience and environmental protection while ensuring that incidents are managed effectively, transparently and in accordance with best-practice environmental management principles.

Stakeholder Engagement and Community Benefits

The project supports Indigenous employment, training, enterprise development and stewardship of Sea Country. Engagement with Traditional Owners, the Anindilyakwa Land Council, research institutions and government agencies will continue throughout the project lifecycle.

Training opportunities will include aquaculture husbandry, water quality monitoring, biosecurity, environmental management and seafood processing.

18. Reporting, Auditing and Continuous Improvement

The purpose of the Reporting, Auditing and Continuous Improvement Plan is to establish a structured framework for monitoring environmental performance, demonstrating compliance with regulatory obligations, evaluating the effectiveness of management measures and driving continual improvement across all aspects of the Stage 2 aquaculture facility.

The plan recognises that environmental management is an ongoing process rather than a static set of procedures. Effective environmental performance requires regular monitoring, review, auditing and adaptation to ensure management systems remain appropriate as operations evolve and new information becomes available.

The objectives of this plan are to:

- Demonstrate compliance with environmental approvals, licences and commitments.

- Verify the effectiveness of environmental management measures.
- Monitor environmental performance against established objectives.
- Identify opportunities for continual improvement.
- Promote transparency and accountability.
- Facilitate adaptive management.
- Maintain accurate environmental records.
- Support communication with regulators, Traditional Owners and stakeholders.
- Protect the environmental and cultural values of Anindilyakwa Sea Country.

This framework applies to all construction, operational, maintenance and rehabilitation activities associated with the facility.

Environmental Management System

The Environmental Management Plan forms part of a broader environmental management system implemented by GAAC.

The environmental management system integrates: • Environmental monitoring.

- Operational procedures.
- Incident management.
- Biosecurity management.
- Water quality management.
- Waste management.
- Staff training.
- Internal audits.
- Regulatory reporting.
- Continuous improvement processes.

The objective of the system is to ensure that environmental management becomes embedded within day-to-day operations rather than functioning as a separate compliance activity.

Environmental responsibilities apply to all personnel and contractors working at the facility.

Environmental Performance Monitoring

Environmental performance will be assessed through the collection and review of monitoring data from across the facility.

Monitoring programs include:

- Water quality monitoring.
- Biosecurity monitoring.
- Waste management inspections.
- Vegetation management inspections.
- Infrastructure inspections.
- Incident reporting.
- Operational performance assessments.

The monitoring program provides the evidence base required to evaluate environmental performance and support management decisions.

Monitoring outcomes will be reviewed routinely by management and incorporated into operational planning processes. Environmental performance indicators may be revised over time as additional operational information becomes available.

Compliance Monitoring

Compliance monitoring will be undertaken to verify that activities remain consistent with:

- Environmental approvals.
- Environment Protection Licence conditions.
- Environmental Management Plan commitments.
- Internal operating procedures.
- Biosecurity requirements.
- Waste management requirements.
- Water management requirements.

Compliance reviews will be conducted periodically and following significant operational changes.

Any identified non-conformance will trigger investigation and corrective action processes.

The objective is to identify and address issues before they result in environmental harm or regulatory breaches.

Environmental Inspections

Routine environmental inspections provide an important mechanism for identifying potential issues and verifying implementation of management measures.

Inspections may include assessment of:

- Pond infrastructure.
- Water treatment systems.
- Bioremediation systems.
- Intake infrastructure.
- Waste storage areas.
- Fuel and chemical storage.
- Vegetation management.
- Erosion and sediment controls.
- Rehabilitation areas.
- Biosecurity controls.

Inspection frequencies will vary depending on the activity and level of risk.

Inspection findings will be documented and corrective actions assigned where necessary.

Inspection records will be retained within the environmental management system.

Internal Environmental Audits

Internal environmental audits will be undertaken periodically to assess the effectiveness of environmental management systems and identify opportunities for improvement.

Audits may evaluate:

- Compliance with the EMP.
- Implementation of management procedures.
- Monitoring programs.
- Incident management.
- Record keeping.
- Staff awareness.

- Corrective action implementation.
- Environmental performance outcomes.

Audits will be conducted by personnel independent of the activities being assessed wherever practical.

Audit findings will be documented and reported to management.

Corrective actions arising from audits will be tracked through to completion.

External Audits and Regulatory Inspections

The facility may be subject to inspections or audits by regulatory agencies, funding bodies, certification programs or other authorised organisations.

GAAC will cooperate fully with external audits and inspections and provide access to relevant information as required.

The organisation views external reviews as valuable opportunities to verify environmental performance and identify areas for improvement. Recommendations arising from external audits will be assessed and implemented where appropriate.

Environmental Reporting

Environmental reporting provides a mechanism for communicating environmental performance to regulators, Traditional Owners, stakeholders and management.

Environmental reporting may include:

- Annual environmental reports.
- Monitoring summaries.
- Incident reports.
- Audit reports.
- Regulatory submissions.
- Internal management reports.

Reports will provide a transparent account of environmental performance and management outcomes.

Where appropriate, reporting will include discussion of:

- Environmental objectives.
- Monitoring results.
- Trends and observations.
- Environmental incidents.
- Corrective actions.
- Improvement initiatives.

Annual Environmental Performance Report

An Annual Environmental Performance Report will be prepared to summarise environmental outcomes for the reporting period.

The report may include:

Facility Overview

A summary of operational activities undertaken during the reporting period.

Environmental Monitoring Results

A summary and interpretation of monitoring outcomes including:

- Water quality.
- Biosecurity.
- Waste management.
- Rehabilitation.
- Environmental inspections.

Incident Summary

Details of environmental incidents including:

- Nature of incidents.
- Investigation outcomes.
- Corrective actions.
- Lessons learned.

Compliance Assessment

An assessment of compliance with:

- Licence conditions.
- Approval requirements.
- Environmental commitments.

Continuous Improvement Activities

A summary of environmental improvements implemented during the reporting period.

Future Priorities

Identification of environmental priorities for the following year.

The annual report will provide a comprehensive overview of environmental performance and support continual improvement.

Environmental Records Management

Accurate record keeping is essential for demonstrating environmental performance and supporting informed decision-making.

Environmental records may include: • Monitoring data.

- Inspection reports.
- Audit reports.
- Incident reports.
- Corrective action records.
- Training records.
- Maintenance records.
- Regulatory correspondence.

Records will be stored securely and retained in accordance with organisational requirements and regulatory obligations.

Electronic records will be backed up and protected from unauthorised access.

Corrective and Preventative Actions

Corrective actions are implemented to address identified issues and prevent recurrence.

Corrective actions may arise from:

- Monitoring results.
- Inspections.
- Audits.
- Incidents.
- Complaints.
- Regulatory inspections.

Corrective actions will include:

- Identification of the issue.
- Assignment of responsibility.
- Target completion dates.
- Verification of completion.

Preventative actions may also be implemented where risks are identified before incidents occur. This proactive approach supports continual improvement and risk reduction.

Non-Conformance Management

A non-conformance occurs when activities do not comply with established procedures, licence conditions or environmental commitments.

Examples may include:

- Missed monitoring events.
- Incomplete records.
- Procedure deviations.
- Equipment maintenance failures.
- Biosecurity breaches.

Non-conformances will be documented and investigated to determine causes and corrective actions.

The severity of response will be proportional to the significance of the issue.

Management Review

Environmental performance will be reviewed periodically by senior management.

Management reviews may consider:

- Monitoring outcomes.
- Audit findings.
- Incident trends.
- Compliance status.
- Stakeholder feedback.
- Operational performance.
- Emerging risks.

The purpose of management review is to ensure environmental management remains effective, adequately resourced and aligned with organisational objectives.

Management reviews will support strategic planning and continual improvement.

Adaptive Management

The Stage 2 development incorporates an adaptive management approach whereby management decisions are informed by monitoring results, operational experience and emerging knowledge.

Adaptive management recognises that environmental systems are dynamic and that management measures may need to evolve over time.

Examples of adaptive management actions may include:

- Modifying monitoring frequencies.
- Adjusting water management practices.
- Enhancing biosecurity controls.
- Expanding bioremediation capacity.
- Revising operating procedures.

The adaptive management framework allows the facility to respond proactively to changing conditions and improve environmental outcomes over time.

Continuous Improvement Framework

Continuous improvement is a core principle underpinning the operation of the facility.

Opportunities for improvement may be identified through:

- Monitoring programs.
- Incident investigations.
- Audits.
- Staff feedback.
- Stakeholder engagement.
- Research collaborations.
- Technological advancements.

Improvement initiatives will be prioritised based on environmental benefit, practicality and available resources.

The objective is to continually strengthen environmental performance and demonstrate leadership in sustainable aquaculture development.

Performance Indicators

The effectiveness of the Reporting, Auditing and Continuous Improvement Plan will be assessed against the following indicators:

- Completion of scheduled monitoring activities.
- Completion of environmental inspections.
- Completion of internal audits.
- Timely closure of corrective actions.
- Compliance with licence conditions.
- Reduction in environmental incidents over time.
- Maintenance of accurate environmental records.
- Demonstrated implementation of improvement initiatives.

These indicators provide measurable evidence of the effectiveness of the environmental management system.

Performance Objectives

The success of this plan will be measured against the following objectives:

- Demonstrated compliance with environmental obligations.
- Effective implementation of monitoring programs.
- Timely identification and resolution of environmental issues.
- Continuous improvement in environmental performance.
- Transparent reporting and accountability.
- Protection of environmental and cultural values.
- Maintenance of stakeholder confidence.
- Long-term sustainability of aquaculture operations.

Through implementation of this Reporting, Auditing and Continuous Improvement Plan, GAAC aims to establish a culture of environmental accountability, transparency and continual learning that supports both sustainable aquaculture development and the long-term stewardship of Anindilyakwa Sea Country.

19. Closure and Rehabilitation

While closure planning forms an important component of responsible environmental management and is required to ensure that potential future liabilities are appropriately considered, it is important to recognise that the Stage 2 aquaculture development is being established as part of a long-term economic transition strategy for the Anindilyakwa people.

The proposed aquaculture facility is not intended as a finite or short-term project. Rather, it represents a key component of the broader Anindilyakwa vision for developing a sustainable Blue Economy capable of supporting future generations following the eventual decline and closure of mining operations on Groote Eylandt.

For decades, mining has been the primary economic driver on Groote Eylandt. As the region moves towards a post-mining future, the Anindilyakwa people have identified aquaculture, fisheries, marine resource development and stewardship of Sea Country as critical pillars of future economic development. The Stage 2 development has therefore been designed as strategic enabling infrastructure that supports the establishment of long-term Indigenous-owned industries rather than a standalone commercial venture with a defined operational lifespan.

Significant investments have already been made in research, development, infrastructure, workforce training, partnerships and capability building to establish a foundation for future marine industries. Programs involving sea cucumber, blacklip oyster, rabbitfish, seaweed and other native marine species are intended to create enduring employment opportunities, strengthen local skills and support economic independence for future generations of Traditional Owners.

Consequently, there is currently no anticipated timeframe or strategic driver for closure of the facility. Instead, the long-term objective is for the infrastructure and knowledge developed through Stage 1 and Stage 2 to continue evolving and supporting additional aquaculture, fisheries, seafood processing, marine research, education and Blue Economy initiatives over coming decades.

Notwithstanding this long-term vision, GAAC recognises the importance of maintaining a Closure and Rehabilitation Plan as part of good environmental governance. The inclusion of closure planning within this EMP ensures that, should operational circumstances change in the future, appropriate mechanisms exist to protect environmental values, minimise liabilities and ensure responsible stewardship of Anindilyakwa Sea Country throughout the entire lifecycle of the project.

19.1 Rehabilitation of Temporary Construction Disturbance

Areas disturbed during construction but not required for permanent infrastructure — including temporary laydown areas, construction access tracks no longer required post-construction, and stockpile areas — will be reinstated and stabilised following the progressive and final stabilisation program described in Section 9.2. This includes reinstatement of topsoil, and stabilisation by mulching, matting, or revegetation, completed prior to the onset of the wet season.

19.2 The Ponds as Permanent, Long-Term Infrastructure

The grow-out ponds, bioremediation pond, and associated water infrastructure constructed under Stage 2 are not temporary works to be rehabilitated or removed once construction is complete. They represent the intended, permanent land use for this part of the Aquaculture Lease, and are core to GAAC's long-term vision for sustainable, low-trophic aquaculture production on Groote Eylandt, consistent with the closure philosophy set out above. Accordingly, no rehabilitation of the pond footprint itself is proposed or anticipated as part of, or following, the Stage 2 works.

19.3 Decommissioning Contingency

In the unlikely event that GAAC's aquaculture operations at Little Paradise were to cease at some point in the future, GAAC would consult with the NT EPA, the Anindilyakwa Land Council, and Traditional Owners at that time to agree an appropriate final land use and rehabilitation approach for the site, having regard to the approvals and land tenure arrangements then in place. Given the strategic and permanent role the ponds play in GAAC's production system, this scenario is not anticipated within any reasonably foreseeable planning horizon.

Stage 2 Environmental Protection Approval (EPA) Supporting Document

Construction Management, Erosion Control and Dust Suppression

Prepared for the Northern Territory Environment Protection Authority (NT EPA)

Prepared by: Dr. Valentin Thepot, Groote Aqua Aboriginal Corporation (GAAC)

Location: Little Paradise, Groote Eylandt, Northern Territory (Aquaculture Lease 01 and 02)

Date: September 2026

1. Introduction

This document supports GAAC's application to the Northern Territory Environment Protection Authority (NT EPA) for environmental protection approval of the Stage 2 expansion of the Groote Aqua Aboriginal Corporation aquaculture facility at Little Paradise, Groote Eylandt. It accompanies the Stage 2 Environment Protection Licence (EPL) supporting document previously submitted, and should be read alongside it.

Rather than repeating the full project background, this document focuses specifically on the construction phase of Stage 2, how the works will be staged and managed, and the practical controls that will be used to manage erosion, sediment and dust during site establishment and construction. It sets out the approach GAAC will take to ensure construction activities are undertaken with a low environmental footprint, consistent with GAAC's broader environmental management commitments for the site.

2. Overview of Stage 2 Construction Works

Stage 2 construction comprises the following key elements, staged over the construction period:

- Earthworks and lining for eight 50 m by 50 m grow-out ponds (2,500 m² each) and one supporting ~1 ha bioremediation pond.
- Installation of seawater intake infrastructure, including a cut-and-cover trench along the existing breakwater alignment, a screened intake riser designed to minimise entrainment of marine organisms, and concrete ballast blocks to secure the pipeline.
- Installation of treated water discharge infrastructure and associated pipework connecting ponds, the bioremediation pond and the outfall including a diffuser to prevent localised erosion.
- Construction of internal access tracks and service corridors required to connect the ponds and pipeline infrastructure across the site.

The pond field and bioremediation pond footprint requires approximately 3 ha of new clearing. Taking into account the additional land required for internal access roads, service corridors, and operational access around the ponds and supporting infrastructure, it is estimated that up to 4 ha of new clearing may ultimately be required as part of the remaining Stage 2 construction works.

Following advice from the NT Department of Lands, Planning and Environment (DLPE) that the clearing provisions of the Planning Act 1999 and Planning Scheme 2020 apply to the whole portion rather than being restricted to areas covered by an administrative lease, GAAC's clearing application has been amended to also include the existing cleared area that forms part of the Lease 01 and Lease 02 Stage 1 operational footprint. This existing cleared area totals approximately 2.3 ha, and was cleared under the previous administration of the site prior to GAAC's tenure. Combined with the up to 4 ha of new Stage 2 clearing, the total clearing area now the subject of GAAC's clearing application is approximately 6.3 ha.

The new Stage 2 works are located within, and immediately adjacent to, the existing Stage 1 operational footprint and previously disturbed land within the Little Paradise industrial estate, minimising the extent of new disturbance required.



Figure 1a: Site water flow diagram. Light blue arrows indicate pumped water; dark blue arrows indicate gravity-fed water. The red arrow is indicative of the general fall across the site. The waste water storage tank receives hatchery effluent (approximately 15 kL/day), which is treated by ozonation prior to entering the broader pond and bioremediation water circuit ahead of discharge.

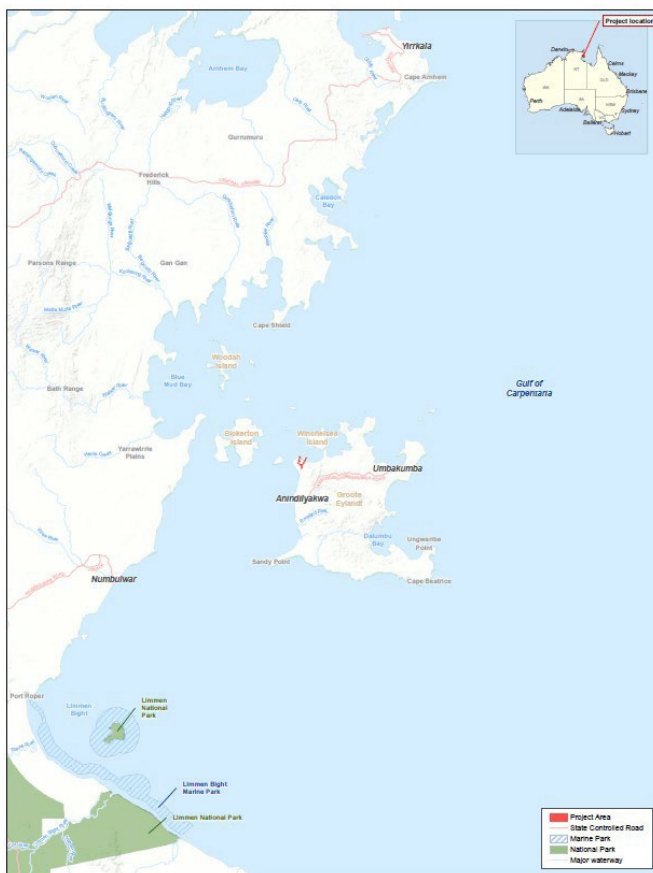


Figure 1b: Project location at Little Paradise, Groote Eylandt (Anindilyakwa), Northern Territory.

3. Construction Methodology and Staging

All excavation and bulk earthworks will be undertaken during the dry season (approximately May to October). This timing has been adopted for two reasons: it allows earthworks to be carried out on stable, workable ground rather than saturated or muddy conditions, and it substantially reduces the risk of sediment-laden runoff and erosion, since works are not exposed to the higher-intensity rainfall events that occur during the wet season.

Construction is sequenced into the following stages, with an indicative duration for each:

- Stage 2a – site establishment (approx. 2 weeks): fencing, access tracks, and demarcation of work areas installed prior to any bulk earthworks.
- Stage 2b – pond field earthworks (approx. 1.5 months): excavation and lining of all ponds and the bioremediation pond, undertaken within the dry season window.
- Stage 2c – pipeline trenching (approx. 1 month): intake and discharge lines, also undertaken within the dry season window, backfilled and stabilised progressively as work fronts move along the alignment.
- Progressive stabilisation (approx. 3 weeks): reinstatement, compaction, and mulching/revegetation of disturbed areas as earthworks are completed.
- Final stabilisation (approx. 1 week): final inspection and stabilisation of all disturbed areas ahead of handover, completed prior to the onset of the wet season.

Excavated material generated during pond construction will, where suitable, be reused on-site to form the pond embankments (bund walls), rather than being removed from site or sourced from an external borrow area. This approach has been adopted for two reasons: it reduces the volume of material handling and the overall extent of ground disturbance, limiting the impact of the works on the land; and it reflects the underlying geology of the site, which contains large sandstone boulders that would make deeper or more extensive excavation both technically difficult and considerably more costly. Minimising excavation depth and extent by reusing cut material as fill for pond walls is therefore both a practical construction efficiency and an environmental outcome.

Progressive stabilisation is a further key principle of the construction approach: as each area of earthworks is completed, disturbed surfaces will be reinstated, compacted, and either sealed (hardstand and access areas) or revegetated/mulched (temporary disturbance areas) as soon as practicable, rather than left exposed until the end of the project.

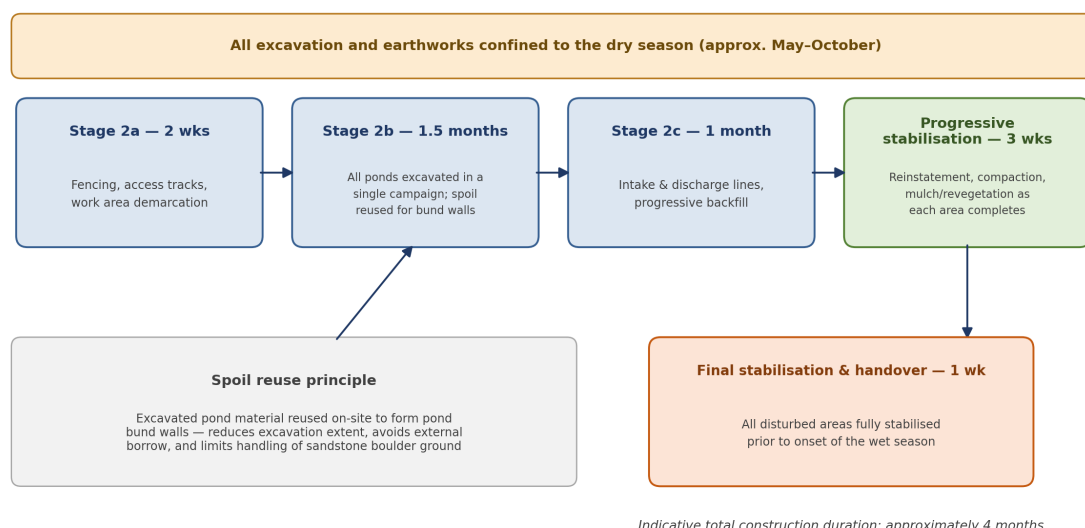


Figure 2: Stage 2 construction process and indicative timeline, from site establishment through to final stabilisation ahead of the wet season, and the spoil reuse principle applied during pond earthworks.

4. Land Disturbance and Vegetation Retention

Consistent with the approach described in GAAC's Stage 2 EPL supporting document, the design and staging of the Stage 2 construction works has been developed to minimise the area of vegetation clearing required and to retain as much native vegetation as practicable around the operational footprint, through:

- Retention of mature vegetation and shaded buffer areas around ponds and infrastructure;
- Minimisation of disturbance corridors and access widths;
- Optimised placement of ponds and infrastructure to work around existing vegetation where feasible.

Retaining vegetation around the construction and operational footprint provides direct construction-phase benefits: it reduces dust generation, provides a natural windbreak that limits the airborne movement of dust and sediment, improves infiltration and stormwater management, and reduces erosion and sediment transport from retained, vegetated ground compared to fully cleared areas.

5. Erosion and Sediment Control

Erosion and sediment control for the Stage 2 works relies principally on construction timing and methodology, rather than on intensive sediment treatment infrastructure. As set out in Section 3, all excavation and earthworks will be confined to the dry season, when rainfall and runoff volumes are minimal, and excavated material will be reused on-site to construct pond bund walls, reducing the extent and depth of excavation required. These two measures are the primary erosion and sediment controls for the project and are supported by the following additional measures:

5.1 Drainage and perimeter management

- Temporary diversion drains or bunding to direct any incidental upslope stormwater, if any, around active work areas, reducing the volume of water that contacts disturbed ground.
- Check dams or rock/log barriers retained in temporary drainage lines as a contingency measure in the event of any out-of-season rainfall.

5.2 Pond and trench earthworks

- Pond excavation undertaken within the dry-season window set out in Section 3, when rainfall and runoff volumes are minimal, limiting sediment mobilisation risk despite the ponds being excavated as a single earthworks campaign.
- Pipeline trenches for the intake and discharge lines backfilled and compacted progressively rather than left open, minimising the length of open trench exposed at any time.

5.3 Stabilisation and rehabilitation

- Disturbed areas not required for permanent infrastructure reinstated with topsoil and stabilised with mulch, matting, or revegetation as soon as practicable after works are completed in that area.
- Final inspection and stabilisation of all disturbed areas completed prior to the onset of the wet season, ahead of any handover to operations.

6. Dust Suppression Strategy

As excavation and earthworks will be undertaken during the dry season to manage erosion risk (see Section 3), dust generation potential is correspondingly higher during this period. Dust management is therefore a priority focus for the construction phase, given its potential to affect nearby vegetation, drainage lines, and the sensitive pond systems operating under Stage 1. Key measures include:

- Water cart or sprinkler application to exposed earthworks, haul routes, and stockpiles during dry, windy, or high-traffic periods.
- Minimising the area of ground cleared or left exposed at any one time, through the staged construction approach described in Section 3.

- These measures reflect the same rationale set out in the EPL supporting document regarding vegetation retention: reduced dust generation lowers the risk of sediment and contaminants entering the operational pond systems, supports biosecurity outcomes, and protects surrounding ecological values.

- All dangerous goods, including diesel and other fuels, will be stored at the existing self-bunded diesel tank located on-site adjacent to the current power generation area; no new fuel storage facilities are required for the Stage 2 construction works. Refuelling of mobile plant and equipment will be undertaken using drip trays and spill containment measures, away from drainage lines and the foreshore.
- Spill kits maintained on-site during all earthworks and construction activities, with personnel trained in spill response procedures.
- Concrete washout and any other construction wastewater contained and disposed of appropriately, rather than being released to the ground or nearby drainage lines.
- General site waste and construction debris managed and removed regularly to prevent windblown litter and material entering waterways.

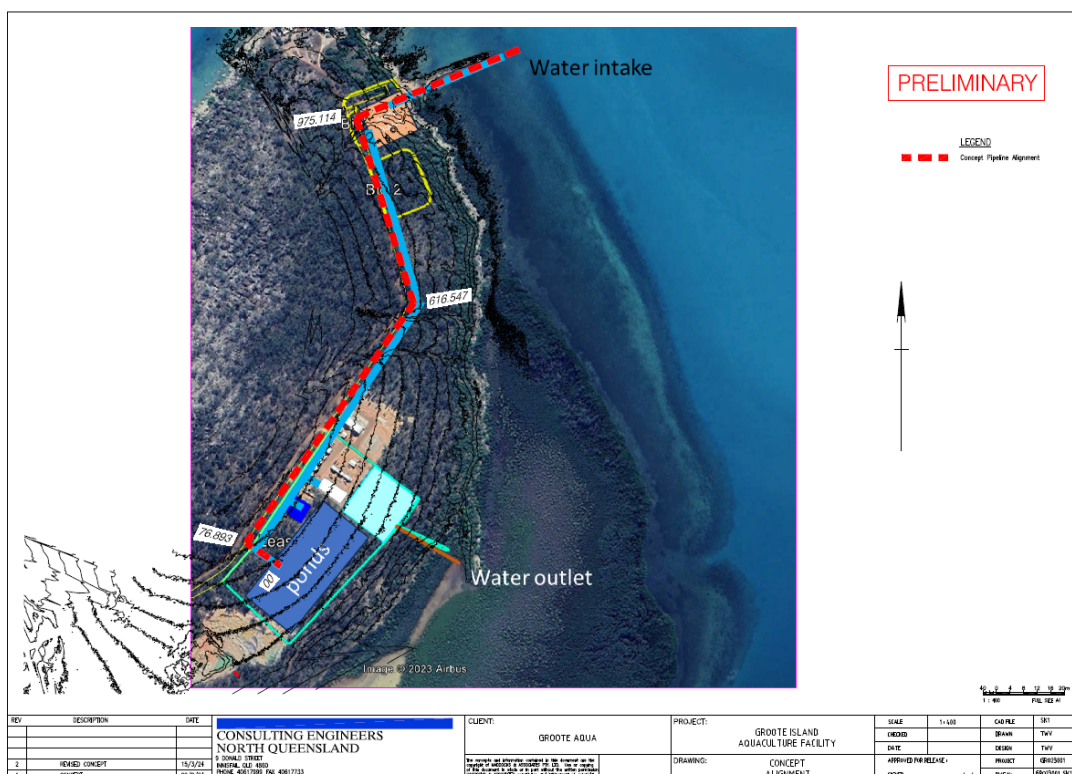


Figure 3: Concept alignment of intake and discharge pipeline infrastructure, indicating the trenched sections requiring progressive backfill and stabilisation during construction.

8. Environmental Values Considered During Construction

The construction methodology described in this document has been developed with reference to the environmental values identified in GAAC's Stage 2 EPL supporting document and the associated EPBC Act and NTEPA referral self-assessments, including:

- Coastal and marine ecosystems supporting fish, invertebrates, and other marine organisms;
- Mangrove communities providing nursery habitat, shoreline stabilisation, and nutrient cycling;
- Intertidal habitats, including mudflats and nearshore environments;
- Terrestrial vegetation providing habitat, erosion control, and landscape connectivity;
- Cultural, spiritual, and customary values associated with Anindilyakwa Sea Country.

The dry-season construction timing, staged earthworks, minimised excavation footprint, and vegetation retention measures described above have each been selected, in part, to reduce the risk of impacts to these values during the construction phase.

9. Conceptual Site Model

A preliminary conceptual site model (CSM) has been prepared for the Stage 2 construction phase, consistent with the NT EPA's Guidelines on Conceptual Site Models (November 2013). The CSM identifies the key sources, transport pathways, and receptors relevant to the construction works, and underpins the erosion, dust, and materials management controls described in Sections 5–7. It is presented in diagrammatic and table format, consistent with the approaches recognised in the NT EPA guideline, and will be refined as construction progresses and further site information becomes available.

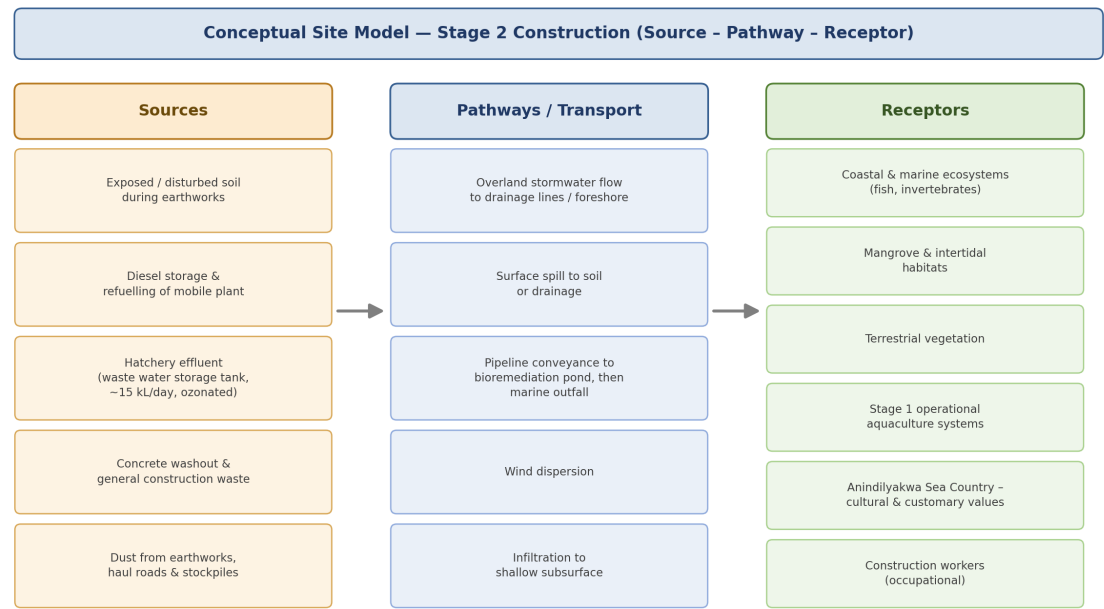


Figure 4: Conceptual site model showing the source–pathway–receptor linkages considered for the Stage 2 construction phase.

Table 1 sets out the same information in table format, identifying whether each pathway is considered potential or actual based on the controls described elsewhere in this document.

Source	Pathway (potential/actual)	Exposure route	Receptor
Exposed / disturbed soil during earthworks	Overland stormwater flow to drainage lines and foreshore (potential, likelihood reduced by dry-season timing, see Section 3)	Direct contact; sediment deposition	Coastal and marine ecosystems; mangrove and intertidal habitats
Diesel storage and refuelling of mobile plant	Surface spill to soil or drainage (potential, existing self-bunded tank and spill containment, see Section 7)	Direct contact; ingestion by biota	Soil; shallow subsurface; coastal waters
Hatchery effluent (waste water storage tank, ~15 kL/day)	Pipeline conveyance to the bioremediation pond, then marine outfall (actual, treated by ozonation prior to release)	Direct contact; dilution and dispersion in receiving waters	Coastal and marine ecosystems
Dust from earthworks, haul roads, and stockpiles	Wind dispersion (potential, elevated during dry-season works, managed per Section 6)	Inhalation; deposition on vegetation or water	Terrestrial vegetation; Stage 1 operational systems; construction workers
Concrete washout and general construction waste	Surface release to ground or drainage (potential, managed per Section 7)	Direct contact	Soil; drainage lines; coastal waters

10. Environmental Risk Assessment Summary

Table 2 summarises the environmental risks and issues identified for the Stage 2 construction works, drawing together the mitigation measures described in Sections 3–9 of this document, and the residual risk once those measures are applied. It is intended as a consolidated summary for the NT EPA's review rather than a substitute for the detail provided elsewhere in this document.

Environmental risk / issue	Potential impact	Mitigation measures	Residual risk
Erosion and sediment runoff from earthworks	Sediment-laden runoff affecting drainage lines, foreshore, and coastal/marine waters	Dry-season excavation timing; spoil reuse minimising excavation extent; diversion drains and check dams as contingency; progressive and final stabilisation; vegetation buffer retention (Sections 3–5)	Low
Dust generation during earthworks and haulage	Dust deposition on vegetation, marine waters, and Stage 1 operational ponds	Water cart/sprinkler suppression; vegetation buffers and windbreaks; vehicle speed restrictions; stockpile covering; visual monitoring with stand-down triggers (Section 6)	Low
Hydrocarbon or chemical spill (diesel storage and refuelling)	Contamination of soil, shallow subsurface, or coastal waters	Fuel stored at the existing self-bunded tank; no new fuel storage required; drip trays and spill containment during refuelling; spill kits on site; trained personnel (Sections 7, 11)	Low
Fire (bushfire risk during dry-season works)	Loss of vegetation, habitat, and site infrastructure; potential for fire to spread beyond the site	Water cartage tanks doubling as an on-site firefighting resource; cleared perimeter around active work areas; hot works permit system; daily fire danger monitoring during the dry season (Section 11)	Low
Vegetation clearing and habitat loss	Loss of native vegetation, terrestrial habitat, and landscape connectivity; increased erosion/dust potential	New clearing minimised to an estimated up to 4 ha, plus an existing cleared area of approximately 2.3 ha now included for certainty (approximately 6.3 ha total); retention of vegetation buffers around the perimeter and foreshore; optimised infrastructure placement (Section 4)	Low–Medium

Environmental risk / issue	Potential impact	Mitigation measures	Residual risk
Hatchery effluent and wastewater discharge	Nutrient or organic loading to receiving marine waters	Effluent directed to a dedicated waste water storage tank; treated by ozonation; conveyed via the bioremediation pond prior to discharge; water quality monitoring maintained (Sections 2, 9, 12)	Low
Marine and coastal disturbance during intake/discharge infrastructure works	Localised turbidity or disturbance during trenching along the breakwater and foreshore	Cut-and-cover trench methodology; dry-season timing; progressive backfill and stabilisation; screened intake minimising entrainment (Sections 2–3)	Low
Biosecurity risk to operating Stage 1 systems	Cross-contamination or pest/pathogen introduction from construction activity affecting existing ponds	Dust and sediment controls; separation of construction traffic from operational areas; site hygiene practices consistent with GAAC's EMP	Low
General construction waste and concrete washout	Litter, debris, or wash water entering drainage lines or the marine environment	Contained washout and appropriate disposal; regular site waste removal (Section 7)	Low
Incomplete stabilisation ahead of the wet season	Residual erosion and sediment risk if works or stabilisation extend into the wet season	Staged construction program with defined durations; final stabilisation inspection completed prior to wet season onset (Sections 3, 12)	Low
Data gaps in site-specific survey information	Conceptual site model and construction planning based on indicative rather than surveyed data (e.g. site topography)	Conceptual site model to be refined as monitoring data are collected (Section 9); site-specific survey/contour data to be obtained to support detailed design where required	Low–Medium

11. Emergency Response Plan

GAAC will maintain a site-specific Emergency Response Plan (ERP) for the Stage 2 construction phase, consistent with GAAC's broader Environmental Management Plan (EMP). The ERP covers fire, spills, and other incidents with the potential to cause environmental harm, and sets out the immediate response actions, roles, and notification procedures for site personnel. Key elements are summarised below.

11.1 Fire

- Dry-season construction (Section 3) coincides with the period of elevated bushfire risk in the surrounding vegetation; the ERP addresses this directly rather than treating it as a residual risk.
- The water cartage tanks used for dust suppression (Section 6) also serve as an on-site firefighting resource, providing immediate water for knock-down of small fires and reducing reliance on off-site response in the critical early stages of an incident.
- A cleared perimeter is maintained around active work areas and stockpiles to reduce fire spread potential.
- Hot works (welding, cutting, grinding) are subject to a permit system, with a spotter and fire extinguisher on hand for the duration of the activity.
- Vehicles and machinery are fitted with appropriate fire extinguishers and maintained to reduce ignition risk.
- Total fire ban conditions and fire danger ratings are monitored daily during the dry season, with works adjusted or stood down accordingly.

11.2 Spills (fuel and chemical)

- Spill kits are maintained on site at all times during construction, located at the fuel storage area and with mobile earthworks crews.

- All fuel is stored at the existing self-bunded diesel tank (Section 7); no new fuel storage is required for the Stage 2 works, limiting the number of potential spill sources on site.
- Refuelling and equipment maintenance are undertaken using drip trays and spill containment measures, away from drainage lines and the foreshore.
- Personnel are trained in spill response procedures: contain, control, clean up, and report.
- Any spill that reaches, or has the potential to reach, a drainage line or the foreshore is escalated and reported in accordance with Section 11.4 below.

11.3 Other incidents

- Severe weather: the construction program is timed to the dry season (Section 3); ahead of any forecast severe weather event, loose materials are secured and exposed earthworks areas are made safe.
- Medical emergency: first aid-trained personnel are present on site, with an evacuation plan and communication procedures maintained for the duration of construction.

11.4 Notification and reporting

- Any incident is escalated immediately to the site supervisor/EMP coordinator.
- Reportable environmental incidents, including a spill, fire, or sediment escape with actual or potential off-site impact, are notified to the NT EPA in accordance with the relevant approval conditions and GAAC's EMP incident reporting procedures.
- Records of all incidents, response actions, and corrective measures are retained on file and made available to the NT EPA on request.

12. Construction-Phase Monitoring and Compliance

During construction, GAAC will undertake the following monitoring and compliance activities:

- Regular site inspections of erosion and drainage controls, with a particular focus on confirming that all disturbed areas are fully stabilised prior to the onset of the wet season.
- Visual dust monitoring during earthworks and haulage activities, with corrective action taken where dust is observed leaving the site or affecting operational areas.
- Water quality monitoring at existing Stage 1 intake and discharge points maintained throughout construction, to confirm that construction activities are not adversely affecting water quality within the operational facility.
- Incident reporting procedures, consistent with GAAC's Environmental Management Plan (EMP), for any erosion, sediment escape, or dust event that has the potential for off-site environmental impact.

Records of inspections, maintenance, and any corrective actions will be retained and made available to the NT EPA on request.

13. Environment Protection Objectives

This section describes how relevant environment protection objectives, including the National Pollutant Inventory (NPI) objective declared under the Waste Management and Pollution Control Act 1998, and the beneficial uses and water quality objectives declared under the Water Act 1992, have been considered and incorporated into the design and management of the Stage 2 construction activities.

13.1 National Pollutant Inventory (NPI) Objective

The NPI, implemented in the Northern Territory through the Environment Protection (National Pollutant Inventory) Objective 2004 under the Waste Management and Pollution Control Act 1998, requires facilities that exceed threshold quantities of listed substances to report annual emissions and transfers to air, land, and water. The design and management of the Stage 2 works has had regard to this objective as follows:

- Fuel (diesel) is stored only at the existing self-bunded tank on site, with no new fuel storage introduced for Stage 2, limiting the quantity and number of potential sources of NPI-listed substances on site (Section 7).
- The construction methodology reuses excavated material as fill for pond bund walls rather than importing new material or disposing of spoil off-site, consistent with the NPI's objective of promoting waste minimisation, cleaner production, and resource efficiency (Section 3).
- Spill prevention, containment, and emergency response measures (Sections 7 and 11) reduce the potential for uncontrolled releases of substances to land and water.
- GAAC will review the substances used and stored on site (principally diesel) against the NPI reporting thresholds as Stage 2 moves from construction into operation, and will report in accordance with the NPI framework if those thresholds are met.

13.2 Beneficial Uses and Water Quality Objectives (Water Act 1992)

Beneficial uses and water quality objectives may be declared for NT waters under the Water Act 1992, and are used to set water quality targets that protect the community's values for a given water resource. For the coastal and marine waters adjacent to the site, the relevant beneficial uses are expected to include aquatic ecosystem protection, aquaculture, Aboriginal traditional and cultural use, and recreational use, consistent with the environmental and cultural values identified in Section 8. The design and management of the Stage 2 works has had regard to these beneficial uses as follows:

- Erosion, sediment, and dust controls (Sections 5–6) are designed to limit sediment and particulate loading to adjacent coastal waters, protecting the aquatic ecosystem beneficial use.
- Hatchery effluent is treated by ozonation and conveyed through the bioremediation pond prior to discharge (Sections 2, 9), managing nutrient and organic loading to protect both the aquatic ecosystem and aquaculture beneficial uses of the receiving waters, including GAAC's own Stage 1 operations, which rely on the same water resource.
- Dangerous goods management and spill response measures (Sections 7, 11) reduce the risk of contamination that could compromise aquaculture, aquatic ecosystem, or Aboriginal traditional use values.
- Water quality monitoring at the existing Stage 1 intake and discharge points (Section 12) provides an ongoing check that construction activities are not compromising the water quality needed to support these beneficial uses.
- The dry-season construction timing, minimised excavation footprint, and vegetation retention measures described in Sections 3–4 have each been selected, in part, to limit changes to the physical, chemical, and biological properties of the receiving waters.

Beyond the construction-phase controls above, the operational water balance of the facility itself supports a low nutrient risk profile. The treated hatchery effluent, and the water passing through the pond system carries minimal nutrient loading: seawater drawn from Bartalumba Bay passes through a 50 µm filter before entering the ponds, and no feed or additional nutrients are introduced to the ponds themselves nor that water. The only nutrient input to the system is the microalgae added in the hatchery to feed microscopic larvae and oyster spat up to approximately 5 mm, which is captured within the ~15 kL/day of hatchery effluent directed to the waste water storage tank and treated by ozonation (Section 2). Once combined with the broader pond system flow, estimated at a typical operating rate of ~130 m³/day, up to a maximum of ~520 m³/day, based on the water balance in GAAC's Stage 2 EPL supporting document, this treated effluent is diluted by a factor of approximately 9 times under normal operating flow, and up to approximately 35 times under maximum flow conditions, reducing the hatchery effluent's nutrient contribution to the bioremediation pond and outfall to a background, negligible level rather than a meaningful one. Moreover, the extractive species cultured by GAAC are low-trophic filter feeders that actively remove nitrogen, phosphorus, and suspended solids from the water column as part of their normal feeding activity, meaning the pond system functions as a net nutrient sink rather than a nutrient source. Together, these factors support the conclusion that the Stage 2 development is unlikely to cause a material change to the nutrient status of the receiving waters.

Where site-specific water quality objectives have not been declared for this water resource, GAAC's approach is to adopt the ANZECC/ANZG default guideline values as an interim performance benchmark, consistent with the approach used to set waste water discharge performance criteria under the Waste Management and Pollution Control Act 1998, until any site-specific objectives are declared or confirmed by the NT EPA.

14. Rehabilitation

This section distinguishes between the temporary disturbance associated with the Stage 2 construction works and the permanent infrastructure the works will deliver, and sets out GAAC's approach to rehabilitation for each.

14.1 Rehabilitation of Temporary Disturbance

Areas disturbed during construction but not required for permanent infrastructure, including temporary laydown areas, construction access tracks no longer required post-construction, and stockpile areas, will be reinstated and stabilised following the progressive and final stabilisation program described in Sections 3 and 5. This includes reinstatement of topsoil, and stabilisation by mulching, matting, or revegetation, completed prior to the onset of the wet season.

14.2 The Ponds as Permanent, Long-Term Infrastructure

The grow-out ponds, bioremediation pond, and associated water infrastructure constructed under Stage 2 are not temporary works to be rehabilitated or removed once construction is complete. They represent the intended, permanent land use for this part of the Aquaculture Lease, and are core to GAAC's long-term vision for sustainable, low-trophic aquaculture production on Groote Eylandt. Unlike a construction laydown area or a temporary access track, the ponds are designed and built to remain in productive use indefinitely, underpinning ongoing economic development and employment opportunities for Anindilyakwa Traditional Owners. Accordingly, no rehabilitation of the pond footprint itself is proposed or anticipated as part of, or following, the Stage 2 works. Similarly, the existing cleared area described in Section 2 — encompassing the Stage 1 operational facility, accommodation, power generation, fuel storage and laydown area — forms part of GAAC's ongoing operational footprint and is not proposed for rehabilitation.

14.3 Decommissioning Contingency

In the unlikely event that GAAC's aquaculture operations at Little Paradise were to cease at some point in the future, GAAC would consult with the NT EPA, the Anindilyakwa Land Council, and Traditional Owners at that time to agree an appropriate final land use and rehabilitation approach for the site, having regard to the approvals and land tenure arrangements then in place. Given the strategic and permanent role the ponds play in GAAC's production system, this scenario is not anticipated within any reasonably foreseeable planning horizon.

15. Conclusion

The Stage 2 construction works are designed to be staged and managed in a way that minimises the extent of disturbed ground exposed at any one time. Erosion and sediment risk is managed primarily through construction timing, restricting excavation and earthworks to the dry season, and through construction methodology, by reusing excavated material to form pond bund walls rather than removing it from site. These measures are paired with a dedicated dust suppression strategy, an emergency response plan for fire and spill events, and build on the vegetation retention and low-disturbance design principles already described in GAAC's Stage 2 EPL supporting document, while having regard to the relevant environment protection objectives under the Waste Management and Pollution Control Act 1998 and the Water Act 1992. Temporary construction disturbance will be rehabilitated, while the ponds themselves remain in place as permanent, productive infrastructure underpinning GAAC's long-term sustainable aquaculture operations. GAAC's

clearing application now totals approximately 6.3 ha, reflecting both the up to 4 ha of new Stage 2 clearing and the approximately 2.3 ha of existing cleared area across Lease 01 and Lease 02 included for certainty following DLPE advice. Together, these measures are intended to protect surrounding coastal and marine values, support biosecurity outcomes for the operating Stage 1 facility, and ensure construction of Stage 2 proceeds with a low environmental risk profile consistent with GAAC's broader environmental commitments on Groote Eylandt.

Groote Aqua Aboriginal Corporation

Stage 2 Environment Protection Licence (EPL) Supporting Document

Prepared for the Northern Territory Environment Protection Authority (NT EPA)

Prepared by: Dr. Valentin Thepot, Groote Aqua Aboriginal Corporation (GAAC)

Location: Little Paradise, Groote Eylandt, Northern Territory

Date: May 2026

1. Introduction

This document supports the application for an Environment Protection Licence (EPL) under the Northern Territory Waste Management and Pollution Control Act for the Stage 2 expansion of the Groote Aqua Aboriginal Corporation aquaculture facility at Little Paradise, Groote Eylandt.

The proposed Stage 2 development builds upon the successful Stage 1 research and development aquaculture facility and aims to transition toward a larger research and development operation capable of generating commercially relevant production, environmental, and operational data.

The project aligns with the Anindilyakwa Land Council 10 year strategic plan and strategic objective of supporting the transition from a mining-based economy toward a diversified blue economy focused on sustainable seafood production, Indigenous employment, training, and stewardship of Sea Country.

The Groote Aqua Aboriginal Corporation (GAAC) aquaculture facility is to be located in the new industrial estate of the Little Paradise hub on Groote Eylandt (Figure 1).



Figure 1: Site Context



Figure 2: Lease 2 (aquaculture; within light green lines), the current footprint of the actual aquaculture site and the service corridor (currently it only has potable water and fibre; yellow lines).

2. Project Background

GAAC has undertaken extensive research and development involving sea cucumber, seaweed, rabbitfish, blacklip oyster, and other native marine species with the objective of developing a sustainable, Indigenous-led aquaculture industry for Groote Eylandt and the wider Northern Territory.

Stage 1 focused on:

- Development of recirculating aquaculture systems (RAS);
- Species domestication and husbandry protocols for blacklip oysters, goldlined rabbitfish (*Siganus lineatus*), *Caulerpa racemosa*, and sandfish sea cucumber (*Holothuria scabra*);
- Biosecurity and water quality management;
- Hatchery and nursery trials;
- Integrated multi-trophic aquaculture systems (IMTA);
- Bioremediation systems.

Over the past three years, Stage 1 has enabled GAAC to achieve several significant technical and operational milestones. These include the successful development of protocols for the breeding and year-round production of blacklip oysters, sandfish sea cucumber, and rabbitfish under controlled hatchery conditions. These outcomes represented a critical first step toward understanding the biological, operational, and environmental requirements associated with scaling up these novel tropical aquaculture species in Northern Australia.

GAAC currently holds an Aquaculture Licence (ACL) for sea cucumber (trepang) production and has become an active industry partner in the Northern Territory blacklip oyster development program. Building on the success of Stage 1, GAAC secured funding from Aboriginal Investment NT to construct and operate a commercial scale blacklip oyster hatchery on Groote Eylandt. This hatchery will play a key role in supplying blacklip oyster spat to partner operations and Traditional Owner groups across northern Australia, including projects on the Tiwi Islands, South Goulburn Island, and Wadeye. The hatchery is intended to address one of the major bottlenecks currently limiting the development of a Northern Territory blacklip oyster industry: the reliable production and supply of high-quality spat.

The rabbitfish program also achieved several important milestones during Stage 1. This included the successful provision of rabbitfish to the Darwin Waterfront coral garden project, where the fish were used to naturally control seaweed biomass and assist with improving water quality and reef aesthetics. This work demonstrated the potential for rabbitfish to play both an aquaculture and environmental services role, consistent with GAAC's broader low trophic and circular aquaculture philosophy.

Stage 1 also demonstrated exceptionally high-water reuse rates, effective nutrient management, and strong biosecurity outcomes. Importantly, nutrients traditionally considered "waste" in conventional aquaculture systems were instead utilised within integrated bioremediation systems to support the growth of seaweed and extractive species. Seaweed biomass produced within the system subsequently provided both a biological filter and a feed source for herbivorous rabbitfish and sandfish sea cucumbers. This integrated multi-trophic approach significantly reduced nutrient discharge, improved water quality stability, and contributed to the overall environmental sustainability of the operation.

The successful operation of Stage 1 provided the technical foundation and confidence required to progress toward Stage 2. While Stage 1 allowed for the development of novel culture protocols and proof-of-concept trials, Stage 2 is required to generate more commercially relevant production, operational, environmental, and economic data prior to any future full-scale commercial development.

Through the operation of Stage 1, GAAC has also established strong partnerships and collaborations with industry, Traditional Owner groups, research institutions, government agencies, and funding bodies. These partnerships, alongside the substantial operational data generated over the past three years, have enabled GAAC to develop updated business and

strategic plans for the future growth of the organisation and the aquaculture industry on Groote Eylandt. These documents are currently undergoing finalisation, with outputs expected to be available in July 2026 upon request.

3. Existing Stage 1 Operations

The current Stage 1 facility operates using recirculating aquaculture systems (RAS) housed within shipping containers and associated raceways and tanks.

Infrastructure includes:

- Hatchery (part of RAS in Figure 3) and laboratory spaces
- RAS including mechanical, biological, and UV filtration systems
- Protein skimmers and heat exchange systems
- Bioremediation tanks
- Quarantine systems

Seawater is currently transported from Bartalumba Bay to the facility where it undergoes filtration, sterilisation, and water quality adjustment.



Figure 3: Current aquaculture site layout within blue the future planned shed containing the new hatchery (green).



Figure 4: Facilities on the aquaculture site with at the top RAS systems growing rabbitfish, sea cucumber, seaweed and maturing blacklip oysters; in the middle the blacklip oyster hatchery (in that jug there are 15 million oyster larvae) and on the bottom the lab and algae lab.

4. Stage 2 Development Overview

The Stage 2 development includes:

- Expansion of hatchery capacity from a 20’ shipping container to a 8 m by 20 m temperature controlled facility within a 30 m by 12 m shed.
- Construction of eight 50 m by 50m ponds (2500 m²; 1m deep so each 2,500m³) and a supporting ~1ha bioremediation pond for bioremediation of effluents.
- Installation of seawater intake infrastructure
- Installation of treated water discharge infrastructure

The proposed ponds are substantially smaller than conventional commercial aquaculture ponds and will support low trophic extractive species, which require little water renewal. Based on the stage 1 operations since mid-2023, the estimate water renewal rate is between 1-5% (as opposed to 15-30% in traditional fed aquaculture). This equates to 100m³-500m³ per day for the ponds. The hatchery will require less than 20m³ per day but to be safe GAAC will request 20,000L per day allocation bringing the total water requirement to 120m³ to 520m³ per day. This represents a maximum of 520m³/day or 360L per min flow rate, which may be required at certain times of the year (wet season to compensate for rainwater input or high temperature) however the normal operating flow is likely to be closer to a quarter of that (90L per minute).

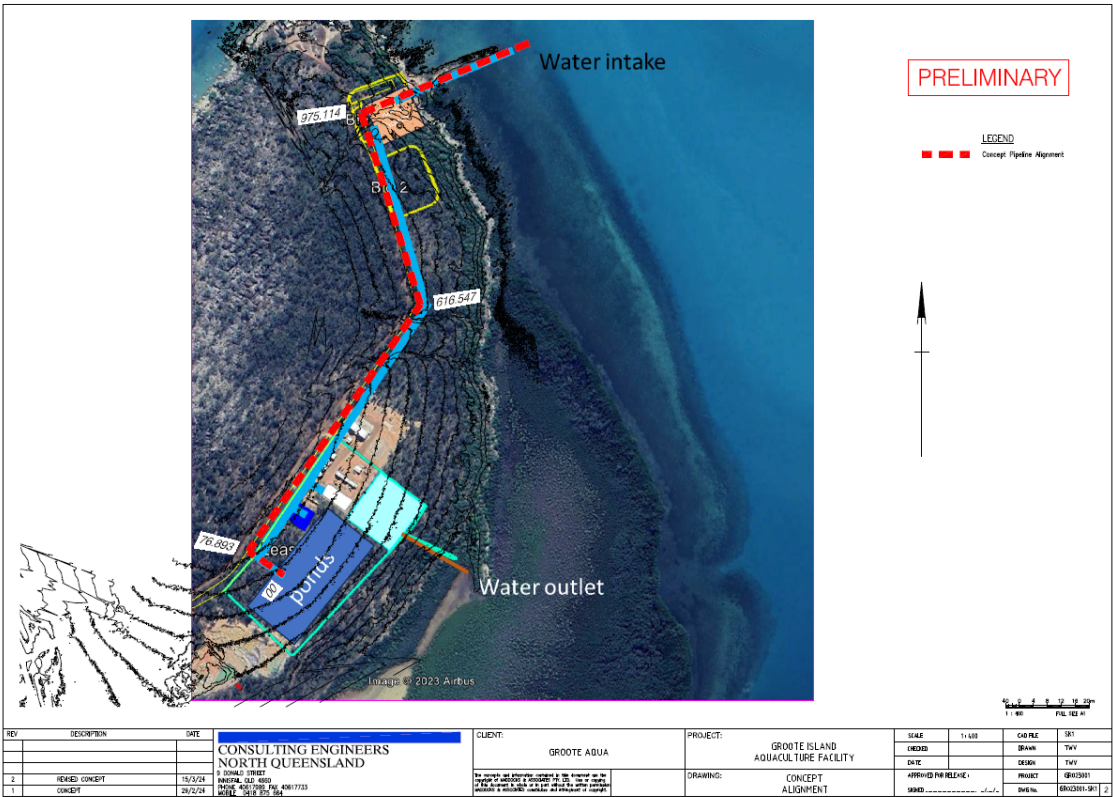


Figure 5: Concept drawing of pipeline infrastructure from the Little Paradise jetty to the site, through the ponds and outfall.

5. Water Intake and Discharge Management

5.1 Water Supply, Treatment and Discharge Management

Seawater for the proposed facility will be sourced from Bartalumba Bay via a dedicated intake pipeline connected to the existing Little Paradise Jetty infrastructure. The intake location has been selected to provide a reliable source of high-quality seawater while minimising environmental disturbance and operational risk. The intake line will be installed along the alignment of the existing breakwater within a cut-and-cover trench. The trench is expected to be excavated using a barge-mounted excavator and will be approximately 1 m deep. The pipe will be secured and protected with concrete ballast blocks, with an end slab installed to support the intake riser. The intake line should extend along the proposed alignment to provide a minimum of 2–3 m of water above the intake at low tide. The seawater intake structure will incorporate a screened intake designed to minimise the entrainment of marine organisms. The screen will utilise a triangular-profile mesh to reduce biofouling and maintain hydraulic performance. A proprietary backwash system may also be incorporated to facilitate cleaning and reduce maintenance requirements.

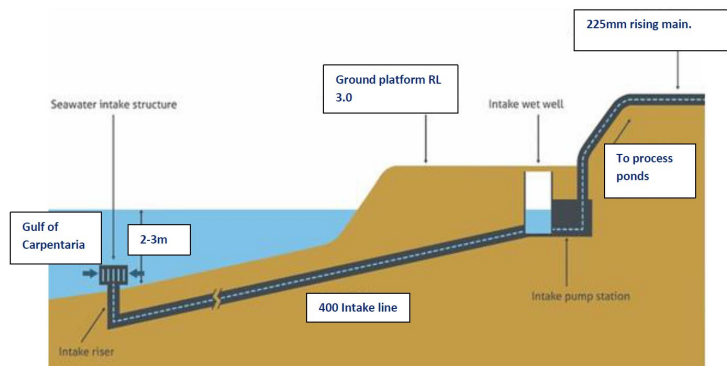


Figure 6: concept drawing of intake line and passive screen.

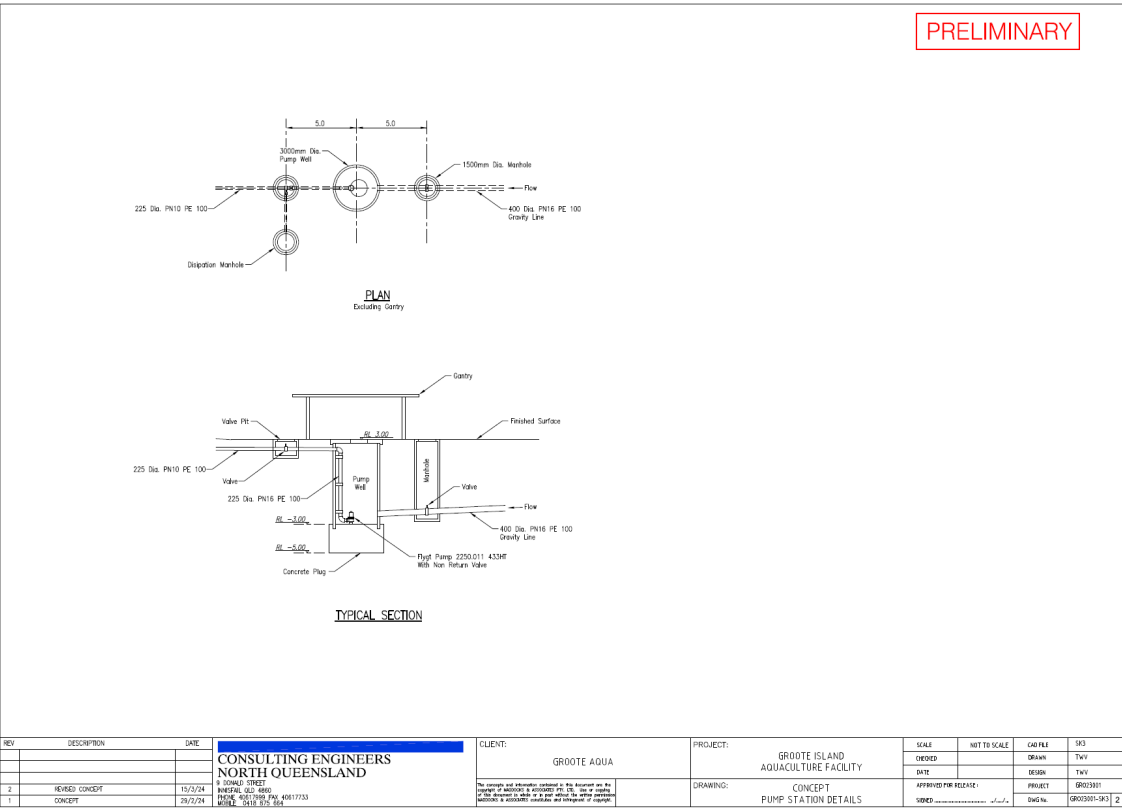
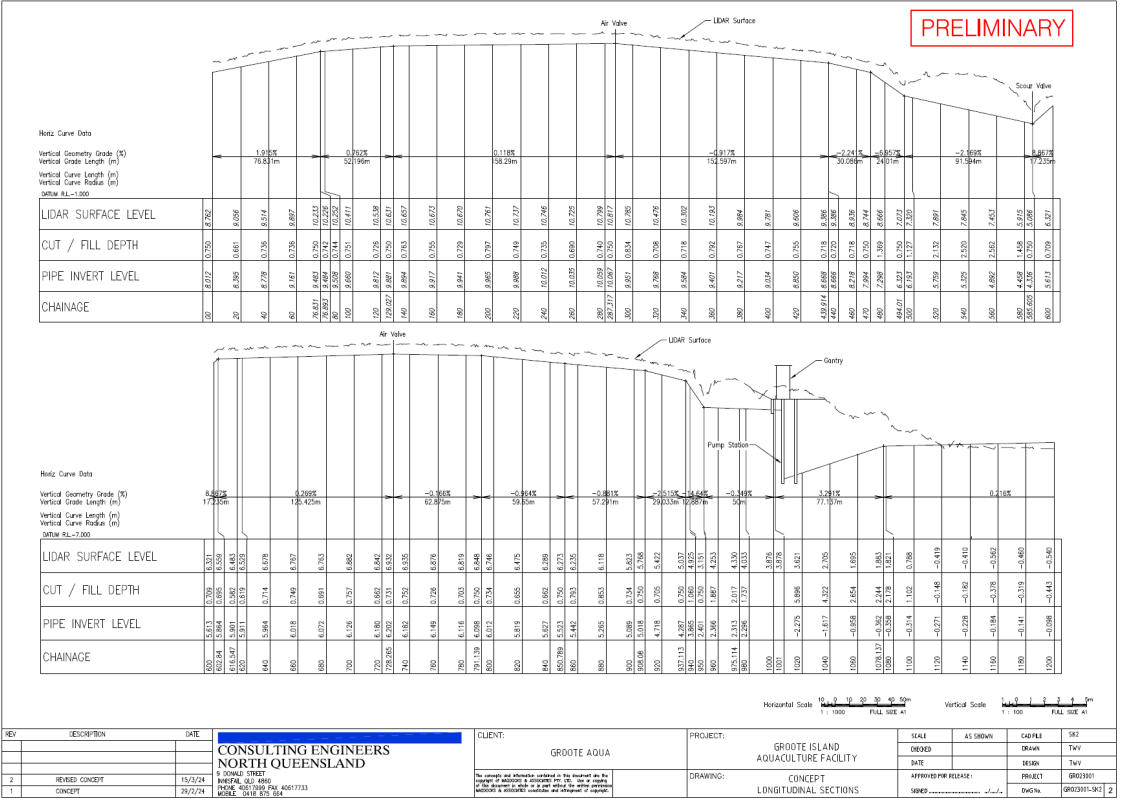


Figure 7: Drawing of pump intake and well.

Prior to entering culture systems, seawater will undergo a series of treatment processes designed to optimise water quality, improve animal health outcomes, and minimise biosecurity risks. These treatment processes include:

- Mechanical filtration through a submerged 50 µm drum filter (Le Faivre 60 series) to remove suspended solids, organic matter, and larger planktonic organisms.
- UV sterilisation to reduce bacterial, viral, and other microbial loads (Pentair 240W).
- Salinity and pH adjustment where required to maintain optimal conditions for cultured species.
- Continuous water quality monitoring, including key parameters such as temperature, salinity, dissolved oxygen, pH, and turbidity.

The facility has been designed around a precautionary biosecurity framework that minimises the risk of pathogen introduction and environmental release. As part of this framework, water intended for discharge will undergo additional treatment prior to leaving the site. This includes ozone treatment delivered through a venturi injection system coupled with a foam fractionator. The ozone treatment process provides an additional level of sterilisation by reducing microbial loads, oxidising dissolved organic compounds, and improving overall water quality before discharge.

Operational procedures and routine monitoring will be implemented to verify the effectiveness of treatment systems and ensure compliance with environmental performance objectives. Water quality monitoring will be undertaken at both intake and discharge points to assess physical, chemical, and biological parameters relevant to environmental protection.

Discharge water will only be released when monitoring confirms that environmental quality objectives have been achieved and that discharge water quality is equivalent to, or better than, the quality of the seawater entering the facility. This approach is consistent with GAAC's commitment to maintaining a low environmental footprint and protecting the ecological values of Bartalumba Bay and the surrounding Sea Country.

The proposed Stage 2 facility also incorporates integrated low-trophic aquaculture and a dedicated bioremediation pond, providing additional nutrient uptake and natural treatment capacity within the system. These measures are intended to further improve water quality, reduce nutrient loading, and demonstrate best-practice environmental stewardship in support of sustainable aquaculture development on Groote Eylandt.

5.2 Bioremediation and Nutrient Recovery

A key component of the proposed Stage 2 development is the incorporation of bioremediation systems designed to improve water quality, recover nutrients, and minimise environmental impacts associated with aquaculture operations. This approach has now been in operation for stage 1 for the past 3 years.

The project adopts an Integrated Multi-Trophic Aquaculture (IMTA) approach, whereby background nutrients naturally occurring in the seawater collected for the site are captured and utilised by a range of extractive species occupying different ecological niches. This approach mimics natural ecosystem processes and reduces the accumulation of organic matter and dissolved nutrients within the system.

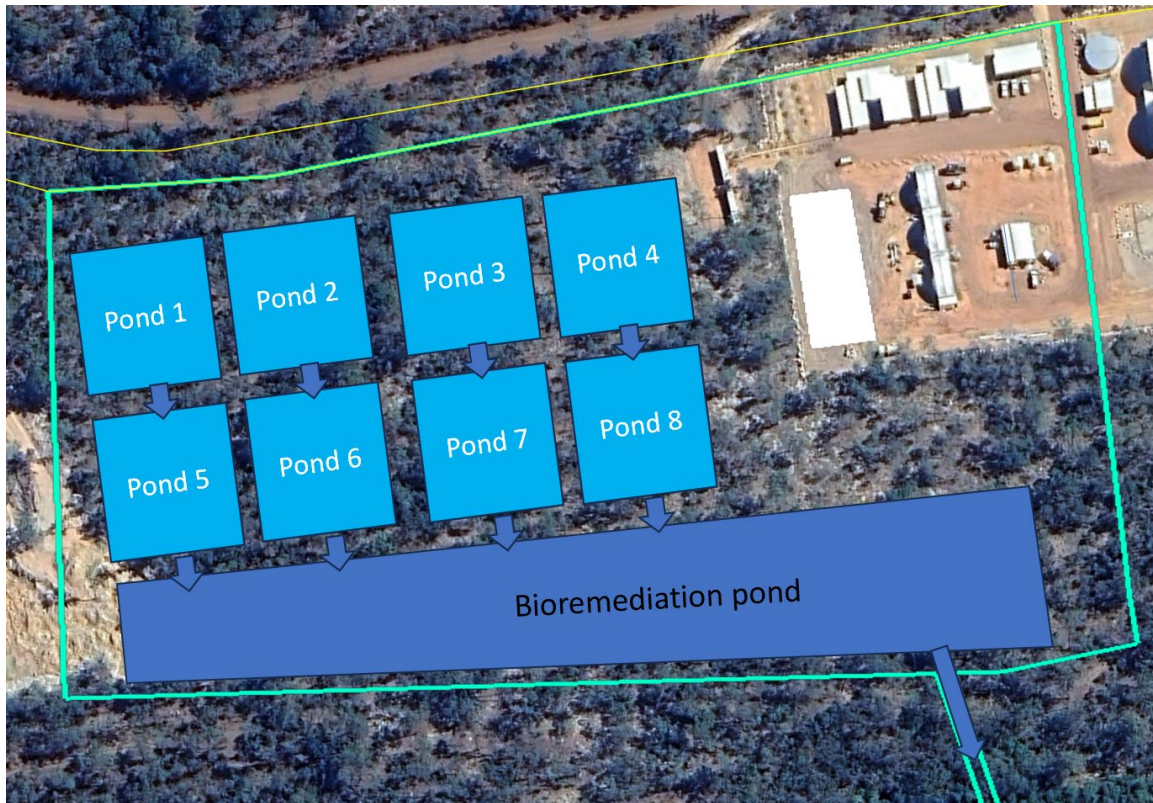


Figure 8: Representation of the ponds arrangement and gravity flows.

The bioremediation strategy developed by GAAC utilise a combination of native marine species, including sea cucumbers, seaweeds, oysters, and rabbitfish. These species provide complementary ecosystem services and contribute to improved water quality through natural biological processes.

- Sea cucumbers (trepang) consume and process organic matter that settles on pond and tank bottoms, reducing the accumulation of sediments, recycling nutrients and preventing anoxic sediments.
- Rabbitfish, a native herbivorous species, consume macroalgae and biofouling organisms, assisting with the cleaning of ponds and maintaining system balance while producing a marketable seafood product.
- Blacklip rock oysters act as natural filter feeders, removing suspended particles, phytoplankton, and organic matter from the water, thereby improving water clarity and quality.

- Seaweeds absorb dissolved nutrients, including nitrogen and phosphorus, helping to reduce nutrient concentrations in the water column while generating additional biomass that can have commercial value and/or be used to feed rabbitfish.

Importantly, these species require little to no external feed inputs relative to traditional fed aquaculture species, instead deriving nutrition from waste streams and naturally occurring productivity within the system. By converting nutrients that would otherwise pass through the system into valuable biomass, the project aims to improve overall resource efficiency and reduce environmental impacts.

The proposed 9 ponds and 1-hectare bioremediation pond will provide additional treatment capacity by integrating these extractive species within a semi-natural environment prior to any potential discharge. This bioremediation pond will act as a polishing step, allowing biological uptake of dissolved and particulate nutrients while providing additional retention time for water treatment.

The use of extractive aquaculture species significantly reduces nutrient concentrations, improve water quality, enhance system resilience, and demonstrate best-practice sustainable aquaculture principles. The approach aligns with GAAC's objective of developing environmentally responsible aquaculture industries that support economic development while maintaining the ecological integrity of Anindilyakwa Sea Country.

6. Biosecurity Management

Biosecurity is a critical component of the proposed development and is essential to protecting both the aquaculture operation and the surrounding marine environment.

GAAC has implemented, and will continue to strengthen, a comprehensive biosecurity framework based on industry best practice and lessons learned through the operation of the Stage 1 facility. Key biosecurity measures include:

- Staff training and competency requirements in biosecurity and disease prevention.
- Foot baths and disinfection stations at all entry points.
- Dedicated quarantine systems for new broodstock, larvae, and research animals.
- Routine health assessments and pathogen monitoring programs.
- Species-specific Standard Operating Procedures (SOPs) for animal handling, husbandry, harvesting, and waste management.
- Controlled site access and visitor management procedures.
- Mechanical filtration, ultraviolet (UV) sterilisation, and ozone treatment systems to minimise pathogen transfer and maintain water quality.

The facility has been designed to minimise the risk of disease introduction, amplification, and release to the surrounding environment. Water treatment processes provide multiple barriers to pathogen transmission, while operational procedures ensure rapid identification and management of any biosecurity incidents.

Environmental protection is further supported through a precautionary approach to water discharge. Water quality will be routinely monitored against relevant environmental parameters, including nutrients (ammonia, nitrite and nitrate), suspended solids, dissolved oxygen, salinity, and pH. Water will only be discharged when monitoring confirms that discharge criteria and environmental performance standards have been met.

The proposed Stage 2 development also incorporates the past 3 years of R&D from its Little Paradise site (stage 1) into a larger low-trophic integrated aquaculture systems that utilise natural biological processes to remove nutrients and improve water quality prior to any potential discharge. This approach is intended to reduce environmental risk, improve system resilience and efficiencies, and demonstrate best-practice sustainable aquaculture for Northern Australia.

Through these measures, GAAC aims to maintain high standards of biosecurity, protect the ecological values of surrounding Sea Country, and ensure the long-term sustainability of aquaculture operations on Groote Eylandt.

7. Water Quality Monitoring

Water quality monitoring will occur across intake water, culture systems, bioremediation systems, and discharge water to ensure optimal conditions for cultured species, maintain effective operation of treatment systems, and verify compliance with environmental performance objectives.

Monitoring will be undertaken daily or every second day, depending on the parameter and operational requirements, allowing for the rapid identification and management of any changes in water quality. The monitoring program will encompass key physical, chemical, and biological parameters relevant to aquaculture performance and environmental protection, including temperature, salinity, dissolved oxygen, pH, turbidity, ammonia, nitrite, nitrate, phosphate, chlorophyll, and other indicators of system health and nutrient dynamics.

To support this monitoring program, GAAC utilises a range of industry-standard water quality instrumentation, including:

- API water quality test kits for routine husbandry and operational monitoring.
- Hanna spectrophotometers for accurate measurement of nutrient concentrations and water chemistry parameters.
- YSI Pro multiparameter instruments for field measurement of temperature, dissolved oxygen, salinity, conductivity, and pH.
- Handheld fluorometers for chlorophyll and algal biomass assessments.
- Waterproof multiparameter sensors and probes for continuous and spot measurements throughout the facility.

Parameters monitored include:

- Dissolved oxygen
- Temperature
- Salinity
- pH
- Turbidity
- Calcium
- Alkalinity
- Ammonia
- Nitrite
- Nitrate
- Bacteria load (and *Vibrio* spp. Colonies)

Monitoring data will be recorded and reviewed regularly to identify trends, support adaptive management decisions, and ensure treatment systems are operating effectively. The information collected will also inform operational adjustments, biosecurity responses, nutrient management strategies, and discharge decisions.

The monitoring framework forms a critical component of GAAC's environmental management system and provides a robust evidence base to demonstrate that water quality objectives are being achieved throughout the operation of the facility.

9. Environmental Values and Sensitivities

The proposed development has been designed with careful consideration of the environmental, cultural, and ecological values present within and surrounding the project area. Environmental assessments and project planning have sought to identify potential risks early and incorporate measures that avoid, minimise, or mitigate impacts wherever practicable.

Key environmental values considered as part of the project include:

- Coastal and marine ecosystems that support a diverse range of fish, invertebrates, and other marine organisms.
- Mangrove communities that provide important nursery habitat, shoreline stabilisation, nutrient cycling, and ecosystem connectivity.
- Intertidal habitats, including mudflats and nearshore environments that support marine biodiversity and contribute to the productivity of local fisheries.
- Terrestrial vegetation communities that provide habitat, erosion control, and landscape connectivity.

- Surface water and marine water quality, which underpin the health and resilience of surrounding ecosystems and Sea Country values.
- Habitat for threatened, migratory, and protected species that may utilise the broader project area or adjacent coastal environments.
- Cultural, spiritual, and customary values associated with Anindilyakwa Sea Country, including areas used for traditional activities, knowledge transfer, and ongoing stewardship by Traditional Owners.

The development footprint has been selected to utilise an area that has already been subject to previous disturbance associated with historical aquaculture activities and existing infrastructure. Project design has focused on minimising the extent of land clearing required while maximising the use of existing access tracks, operational areas, and infrastructure corridors (clearing permit being prepared separately from this application).

Vegetation clearing will be restricted to the minimum area necessary for construction, operation, and safe access. Where possible, mature trees and native vegetation will be retained to provide natural windbreaks, shade, habitat values, and erosion control benefits. Areas not required for operational purposes will remain undisturbed.

The layout of ponds, pipelines, and supporting infrastructure has been designed to avoid sensitive habitats wherever practicable and maintain appropriate separation from adjacent coastal environments. Construction activities will be managed to minimise soil disturbance, sediment mobilisation, dust generation, and the potential for impacts on surrounding vegetation and waterways.

The project also incorporates a range of environmental protection measures, including water quality monitoring, biosecurity controls, nutrient recovery through bioremediation systems, and the use of extractive aquaculture species to reduce environmental loading. Together, these measures are intended to protect the ecological integrity of surrounding coastal and marine environments while supporting sustainable economic development opportunities for Traditional Owners.

By integrating environmental stewardship into both the design and operation of the facility, GAAC aims to demonstrate a model of sustainable aquaculture development that aligns with the long-term protection of biodiversity, ecosystem function, and the cultural values of Anindilyakwa Sea Country.

10. Land Clearing and Vegetation Management

The Stage 2 development footprint associated with the proposed R&D ponds and bioremediation pond encompasses approximately 3 ha. However, additional land will be

required for internal access roads, service corridors, and operational access around the ponds and supporting infrastructure. As such, it is estimated that up to 4 ha may ultimately require clearing as part of the Stage 2 development.

Despite this, GAAC's intention is not to undertake broadscale clearing of the entire lease area. The project has been specifically designed to retain as much native vegetation as practicable through:

- Retention of mature vegetation;
- Maintenance of shaded areas around infrastructure and ponds;
- Minimisation of disturbance corridors and access widths;
- Optimised placement of ponds and infrastructure to work around existing vegetation where feasible.

Retaining vegetation is considered to provide significant operational, environmental, and biosecurity benefits for the facility.

From an operational perspective, maintaining vegetation buffers and shaded areas is expected to help reduce localised temperature increases associated with exposed cleared land. This is particularly important in tropical aquaculture operations where elevated water temperatures can place additional stress on cultured organisms, reduce dissolved oxygen levels, and increase the likelihood of disease outbreaks and harmful algal or bacterial proliferation. Shaded areas and retained canopy vegetation contribute to a more stable microclimate around the ponds and hatchery infrastructure, helping moderate temperature extremes.

Vegetation retention is also expected to significantly reduce dust generation during the dry season. Excessive dust can negatively affect aquaculture operations through contamination of ponds, increased organic loading, fouling of sensitive hatchery systems, and potential impacts on water quality. Dust may also carry fungal spores, bacteria, and other contaminants, representing an additional biosecurity risk for sensitive hatchery and nursery systems.

In addition, retained vegetation acts as a natural windbreak. Reducing wind exposure provides several benefits including:

- Reduced evaporation rates from ponds;
- Improved pond temperature stability;
- Reduced airborne movement of dust, spores, plankton, and other potential biosecurity vectors;
- Improved operational conditions for staff and infrastructure.

From a biosecurity perspective, maintaining vegetated buffers around the facility is considered an important passive control measure. Vegetation barriers can help reduce the movement of airborne particles and biological material between operational areas and the surrounding environment. This aligns with GAAC's broader biosecurity philosophy of implementing multiple preventative barriers rather than relying on a single control measure.

Vegetation retention also supports broader environmental objectives including:

- Reduced erosion and sediment transport;
- Improved infiltration and stormwater management;
- Retention of biodiversity values;
- Maintenance of visual amenity;
- Reduced heat island effects;
- Protection of surrounding ecological values.

For these reasons, GAAC considers a selective and minimised clearing approach to be both environmentally responsible and operationally advantageous for the long-term sustainability and biosecurity of the aquaculture facility.

11. Environmental Risk Assessment

Potential environmental risks associated with the project include:

- Water quality impacts
- Nutrient discharge
- Sedimentation and erosion
- Biosecurity risks
- Habitat disturbance
- Construction-related impacts

These risks were assessed through both the EPBC Act self-assessment and the NTEPA referral self-assessment process. The project has been specifically designed over the past three years to minimise potential impacts through the use of low-trophic aquaculture species, water treatment and reuse systems, integrated bioremediation processes, comprehensive biosecurity measures, ongoing environmental monitoring, and adaptive management practices. As a result, the project is considered to present a low environmental risk while supporting sustainable aquaculture development on Groote Eylandt.

12. Emergency Response and Incident Management

GAAC maintains emergency response procedures for equipment failure, water quality incidents, disease outbreaks, chemical spills, extreme weather events, and power outages. Detailed response measures, responsibilities, communication protocols, and reporting requirements are outlined in the GAAC Environmental Management Plan (EMP). Key controls include backup aeration and oxygen systems, quarantine and isolation procedures, routine monitoring, and incident reporting processes to minimise environmental and operational risks.

13. Stakeholder Engagement and Community Benefits

The proposed Stage 2 development is intended to deliver long-term social, economic, cultural, and environmental benefits for Anindilyakwa Traditional Owners and the broader Groote Eylandt community. The project supports the strategic objective of developing sustainable industries that can contribute to economic resilience and employment opportunities as the region transitions beyond mining.

The project is expected to generate direct and indirect employment opportunities across aquaculture production, hatchery operations, environmental monitoring, processing, logistics, maintenance, and administration. A strong emphasis will be placed on Indigenous employment, workforce participation, and career development through structured training, mentoring, and on-the-job learning opportunities.

The development will also support skills development in areas including aquaculture husbandry, water quality monitoring, biosecurity, environmental management, seafood processing, vessel operations, and business administration. Partnerships with schools, training providers, research institutions, and industry organisations will help create pathways for local people to gain qualifications and experience within the growing blue economy sector.

The project is designed to support the development of Sea Country enterprises by creating opportunities for Traditional Owners to participate in aquaculture production, seafood harvesting, environmental stewardship, and associated value-adding activities. This approach aligns with the aspirations of Anindilyakwa people to generate economic opportunities while maintaining strong cultural connections to Sea Country.

More broadly, the project contributes to economic diversification on Groote Eylandt through the development of sustainable aquaculture industries based on native marine species including trepang, blacklip oysters, rabbitfish, and seaweeds. These industries have the potential to create long-term employment, support local businesses, attract investment, and establish new export opportunities for the region.

The project has been developed through ongoing collaboration and engagement with Traditional Owners, the Anindilyakwa Land Council, NT Fisheries, research organisations, government agencies, industry partners, and other stakeholders. This collaborative approach ensures that environmental, cultural, social, and economic considerations are integrated into project planning and decision-making, while supporting the long-term sustainable management of Anindilyakwa Sea Country.

Stakeholder engagement will continue throughout the construction and operational phases of the project, ensuring that feedback is incorporated into management practices and that project outcomes continue to align with community expectations and aspirations.

14. Conclusion

The proposed Stage 2 expansion of the Groote Aqua Aboriginal Corporation aquaculture facility represents a logical progression from the successful Stage 1 research and development program undertaken since 2023. Stage 1 has demonstrated the technical feasibility of culturing native marine species on Groote Eylandt, established critical infrastructure and operational expertise, developed strong partnerships with research institutions and industry, and generated the knowledge required to inform the next phase of development.

Stage 2 will provide the scale necessary to generate commercially relevant data, refine production systems, support workforce development, and progress the establishment of sustainable aquaculture industries based on native species such as trepang, blacklip oysters, rabbitfish, and seaweeds. The project is a key component of GAAC's long-term vision to support economic diversification and create meaningful employment and enterprise opportunities for Anindilyakwa Traditional Owners while maintaining strong cultural connections to Sea Country.

The development has been designed around the principles of environmentally responsible aquaculture, incorporating low-trophic and extractive species, integrated multi-trophic aquaculture (IMTA), water reuse, nutrient recovery, bioremediation, and comprehensive biosecurity measures. These systems are intended to minimise waste generation, reduce nutrient discharge, improve resource efficiency, and maintain high environmental performance standards.

Potential environmental risks have been identified and assessed through the EPBC Act self-assessment process, the NTEPA referral self-assessment process, and the development of site-specific management measures. The project incorporates a robust environmental management framework including routine monitoring, adaptive management, water quality controls, biosecurity procedures, erosion and sediment management, emergency response planning, and stakeholder engagement.

Through the implementation of these management measures and ongoing environmental monitoring, significant adverse environmental impacts are not anticipated. The project is expected to deliver positive social, economic, and environmental outcomes while demonstrating best-practice sustainable aquaculture development in Northern Australia.

GAAC remains committed to continuous improvement, collaboration with Traditional Owners and stakeholders, and the protection of Anindilyakwa Sea Country. The proposed Stage 2 development provides an important pathway towards establishing a resilient and sustainable blue economy that can support future generations beyond the life of the mining industry on Groote Eylandt.