

3 OHTL UTILITIES CORRIDOR

The remainder of the OHTL is proposed to be situated in a future utilities corridor – henceforth referred to as the 'OHTL utilities' – extending for 69 km from Livingstone to Murrumujuk.

3.1 Environmental context

The existing environmental context of the OHTL railway corridor is described in this section. The information from desktop databases and reports, as well as field surveys. It will be used to inform the 'likelihood of occurrence' of threatened species and to identify other potential constraints.

3.1.1 Surveys

Previous

As part of the Mapping the Future program, DENR undertook an extensive vegetation and biodiversity survey within a 93,000 ha area of Gunn Point – *Vegetation Communities of the Gunn Point Area* (Napier et al. 2020) and *Biodiversity Assessment of the Gunn Point Area* (Stokeld et al. 2020). Land unit mapping at 1:25,000 was also undertaken – as presented in *Soil and Land Resources of the Gunn Point Area* (Easey et al. 2020). Between 2018 and 2019, flora surveys were undertaken to locate threatened plants, update species habitat models, and refine mapping of significant vegetation communities. Fauna surveys targeting threatened mammals, owls and frogs were also undertaken. The study area and survey sites varied between studies, extending as far south as KP 749 km (approximately 4.5 km north of Arnhem Hwy). Section 1.8 of Stokeld et al. (2020) contains a list of prior surveys that have occurred in the region.

Proposal-specific

The OHTL utilities corridor is two-thirds remnant bushland. A field survey was undertaken between 27 September and 5 October 2021 by EcOz botanists Anna Lemon and Nicole Clark to ground-truth land units, sensitive vegetation communities and identify potential habitat for threatened species. Incidental weed records were also collected. Recent fires were also noted, along with feral animal activities and other disturbances. Cultural monitors from Larrakia Rangers were present.

Due to property access issues relating to the survey's occupation licence, a 1.8 km length of the route (KP 748 to 750) transecting Lot 572 (Hundred of Guy) was unable to be surveyed. This area is located south-west of the Black Jungle/Lambells Lagoon Conservation Reserve. Most of the section is dense bushland, with a drainage line fringed with riparian vegetation running diagonally through. There is a large rainforest patch present (3.2 ha) south-east where the drainage line ends. There is also a large patch mapped as sandsheet heath (11 ha). The presence / extent of these significant vegetation types could not be verified.

Bioregion

The OHTL utilities corridor intersects two bioregions – Darwin Coastal for 52 km in the north, and Pine Creek for 15 m in the south.

The Darwin Coastal bioregion is characterised by gently undulating plains on laterised sandstones and siltstones, with extensive and diverse floodplain associated with the lower reaches of the many large river systems. The dominant inland vegetation type is tall open forest dominated by *Eucalyptus tetrodonta* and *Eucalyptus miniata*. There are substantial areas of mangroves, and rainforest and other riparian vegetation fringing the rivers.

The Pine Creek bioregion comprises foothill environments west of the western Arnhem Land sandstone massif. The major vegetation types are *Eucalyptus* tall open forests and woodlands. There are also areas of monsoon rainforest patches, *Melaleuca* woodlands, riparian vegetation, and tussock grasslands.

3.1.2 Significant areas

Parks and reserves

The OHTL utilities corridor runs just inside the eastern boundary of the Shoal Bay Coastal Reserve for 5.1 km between KP 769 and 777 (see Figure 3-1). It also transects Black Jungle Conservation Reserve for 2.6 km KP 752 and 755 (see Figure 3-1).

Sites of Conservation Significance

The OHTL utilities corridor crosses three SOCS (see Figure 3-1):

- Shoal Bay
- Howard sand plains
- Adelaide River coastal floodplain.

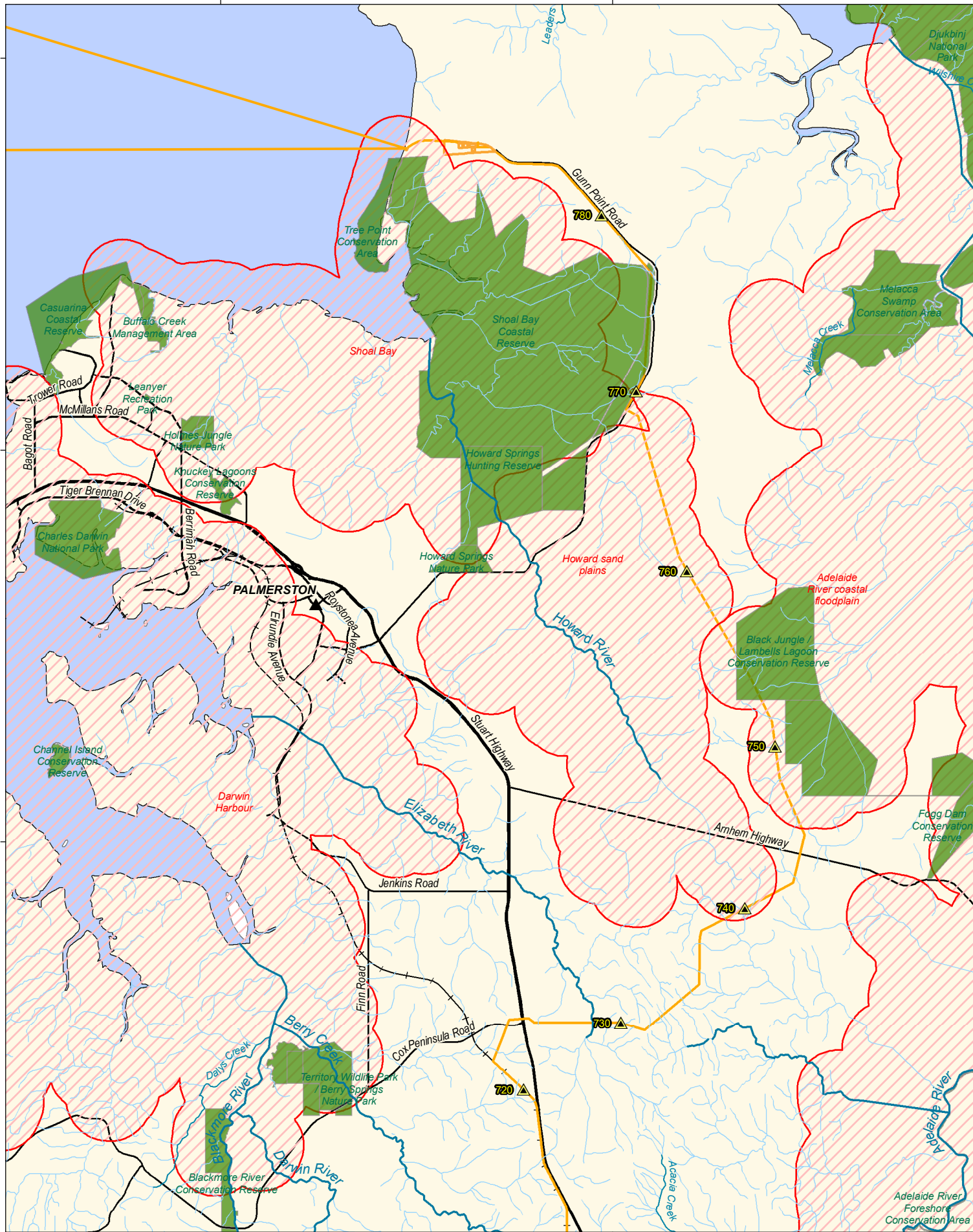
The Shoal Bay SOCS comprises the lower reaches of the Howard River and other small tidal creeks that empty into Hope Inlet and the Shoal Bay. The SOCS also includes a number of swamps and remnants of rainforest and monsoon vine forest around the margin of the tidal flats. The extensive tidal flats in Shoal Bay provide an important feeding and roosting area for migratory shorebirds in their non-breeding season. Up to 5,000 waterbirds are known to aggregate on small freshwater wetlands inland of the tidal flats late in the dry season as more extensive coastal floodplains dry out across the Top End. A high number of threatened species are reported from this site, including three plants, ten vertebrates and one invertebrate (Pavey et al. 2009c).

The Howard sand plains SOCS is intersected twice by the OHTL utilities corridor, for a total of approximately 15 km. It supports the largest and most continuous stretch of seasonally-inundated wetlands with shallow lagoons and swamps on sandy substrates of the Darwin region. The sand plains support distinctive vegetation types of Grevillea heath and paperbark forest. Many plant and animal species have adapted to, and are largely or entirely restricted to, this habitat type – including the Howard River Toadlet (*Uperoleia daviesae*). The sandy heaths also support populations of rare and endangered species, particularly the small carnivorous bladderwort plants of the genus *Utricularia* (Pavey et al. 2009b).

The Adelaide River coastal floodplain SOCS is a seasonally-inundated freshwater floodplain between the Adelaide River and Murgarella Creek; however, the areas crossed by the OHTL utilities corridor for approximately 11 km are not seasonally-inundated (they are within the SOCS' buffer). The floodplain comprises a mix of tidal and seasonal wetland habitats dominated by grass and sedge communities and fringed by open woodland with pockets of monsoon forest. The Adelaide River floodplain regularly supports large numbers of waterbirds including internationally significant numbers of many species. The upper and middle parts of the floodplain provide core nesting habitat for Magpie Geese, and the largest waterbird breeding colony in the Northern Territory is found in mangroves in the lower reaches of the Adelaide River. This colony supports about 30,000 birds and is likely to be the largest regularly-used egret colony in Australia. Significant numbers of at least three species of migratory shorebird periodically use inland wetland areas on the floodplain, such as Lake Finniss. Fourteen threatened species are reported from this SOCS including four plant and ten vertebrate species (Pavey et al. 2009a).

3.1.3 Surface water

The OHTL utilities corridor crosses several drainage lines of first or second order. Those intersected by the northern 26 km of the OHTL utilities corridor drain directly into Shoal Bay, those intersected by the middle 29 km drain into Adelaide River, and those intersected by the southern 11 km drain into Elizabeth River, which is also the only order 3 stream and perennial watercourse intersected by the OHTL utilities corridor (see Figure 3-1).



Legend

- AAPowerLink infrastructure
- Major Drainage
- Railways
- Minor Drainage
- Roads**
- Principal road
- Secondary road
- Streams
- NT Park and Reserves
- Sites of Conservation Significance
- ▲ OHTL Kilometre Point

Source: Sun Cable, Geoscience Australia, NR Maps



Figure 3-1: Map of significant areas and surface water features crossed by the OHTL Utilities Corridor

Project: Australia-Asia PowerLink

Reference: MI-Files Document ID 204951

Date: 03/11/2021

Revision: A

Scale: 1:250,000

Coordinate System: GDA2020

0 8 Kilometres

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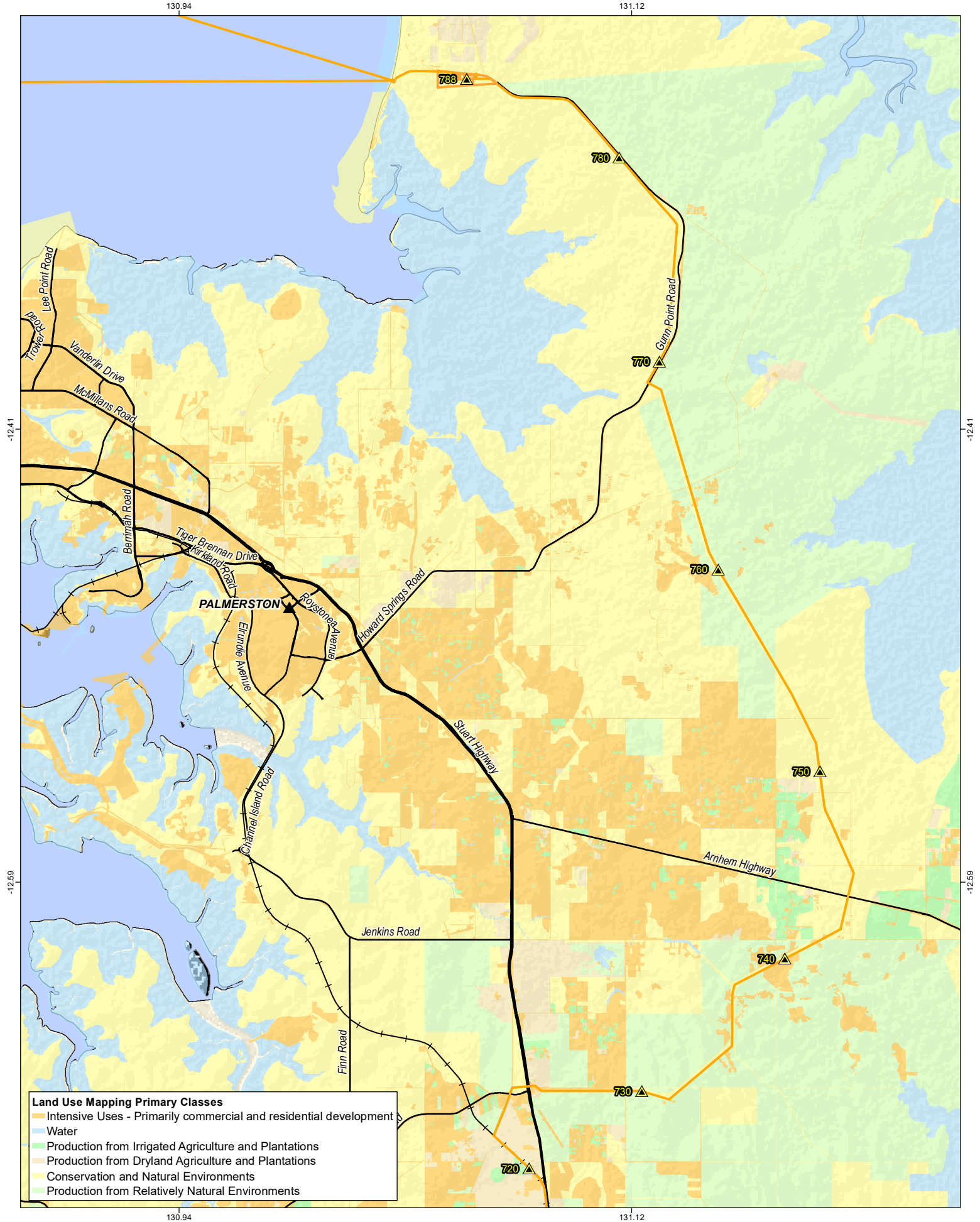
3.1.4 Land use

The majority of the OHTL utilities corridor crosses areas of remnant native cover and two conservation reserves. It also crosses a quarry and a rural residential area near its intersection with Arnhem Highway (east of Humpty Doo), and rural properties around its diversion from the Stuart Highway. According to the *Litchfield Subregional Land Use Plan* the areas crossed by the OHTL utilities corridor near Arnhem and Stuart Highways are planned to be occupied by horticulture and peri-urban developments (NT Planning Commission 2020).

3.1.5 Land systems

Figure 3-3 shows the landforms traversed by the proposed utilities corridor. The majority of the last 54 km of the OHTL utilities corridor before it reaches the Murrumujuk facilities crosses lateritic plains, with exception of one section of approximately 640 m across the Black Jungle Conservation Reserve that traverses the upper reaches of the Adelaide River coastal floodplain. The lateritic plains are associated with deeply-weathered profiles (laterite), including sand sheets and other depositional products, while the Adelaide River coastal floodplain is seasonally flooded and contains poorly-drained clay soils.

For 4.2 km between Lloyd Creek and Hughes, the OHTL utilities corridor crosses hills belonging to the Baker land system, composed of sandstone and siltstone outcrops with shallow stony soils. These delimit the Adelaide River catchment to the east, and the Elizabeth and Berry River catchments to the west. For its southernmost 8 km, the OHTL utilities corridor crosses a mosaic of lateritic plains, sandstone low rises and the alluvial floodplain of Elizabeth River. The sandstone low rises commonly present shallow soils with surface stone and rock outcrops, while the Elizabeth River floodplain is composed of seasonally-inundated swamps and drainage depressions with sandy, silty and clay soils.



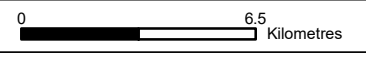
- Land Use Mapping Primary Classes**
- Intensive Uses - Primarily commercial and residential development
 - Water
 - Production from Irrigated Agriculture and Plantations
 - Production from Dryland Agriculture and Plantations
 - Conservation and Natural Environments
 - Production from Relatively Natural Environments

- Legend**
- AAPowerLink infrastructure
 - Railways
- Roads**
- Principal road
 - Secondary road
 - ▲ OHTL Kilometre Point



Figure 3-2: Map of land uses relevant to the OHTL Utilities Corridor

Project: Australia-Asia PowerLink



Scale: 1:210,000

Coordinate System: GDA2020

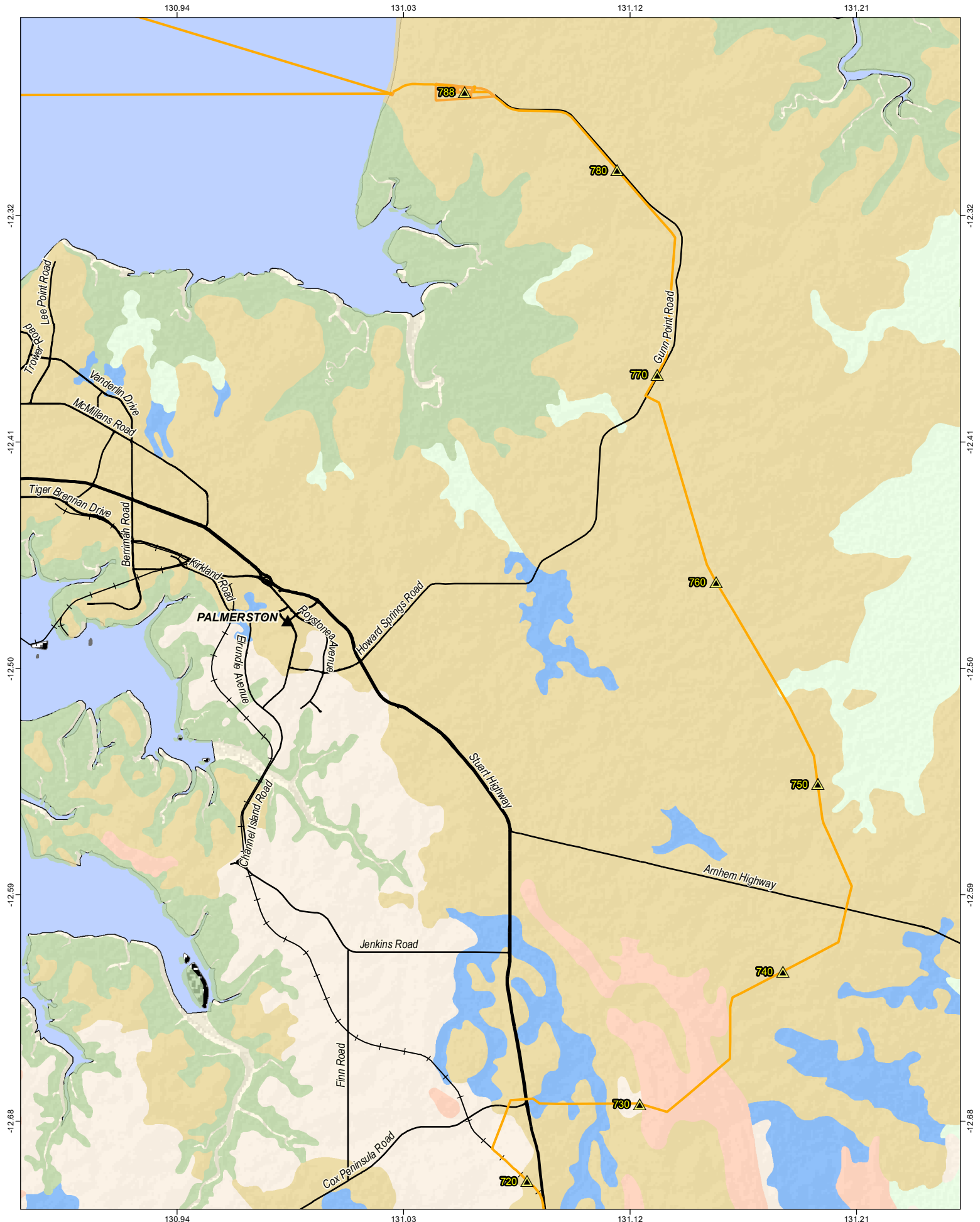
Reference: M-Files Document ID 204951

Date: 03/11/2021

Revision: A



Source: Sun Cable, Geoscience Australia, NR Maps



Legend

- AAPowerLink infrastructure
- Railway
- Roads**
 - Principal road
 - Secondary road
- ▲ OHTL Kilometre Point

Land systems

- lateritic plains and rises
- sandstone hills
- alluvial floodplains
- sandstone plains and rises
- coastal floodplains
- tidal flats

Source: Sun Cable, Geoscience Australia, NR Maps



Fig 3-3: Map of land systems relevant to the OHTL Utilities Corridor

Project: Australia-Asia PowerLink

Reference: M-Files Document ID 204951

Date: 03/11/2021 Revision: A

Scale: 1:210,000

Coordinate System: GDA2020

A4

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3.1.6 Land units

A land unit is a reasonably homogenous part of a land surface, distinct from surrounding terrain with consistent properties in landform, soil and vegetation (Jessop and King 1997). As such, each land unit has a characteristic pattern on aerial imagery. Their small scale is useful for identifying habitat features that may support threatened species and sensitive vegetation types.

Land units were verified using a combination of desktop assessment and on-ground verification. During the 2021 field survey, land units depicted in Fogarty et al. (1984) at a scale of 1:25,000 were verified by recording the landform, dominant species in the upper stratum and soil type. Where required, land units were adjusted to reflect the results presented in Table 3-1.

A short section of the OHTL utilities corridor transects the proposed Noonamah Ridge residential development (KP 729 to 732). In 2014-15, EcOz undertook environmental assessment to inform that project's Environmental Impact Statement. Data from that assessment were referred to in the land unit mapping for the OHTL utilities corridor. Land unit mapping was undertaken for the Mapping the Future program (Easey et al. 2020), with new unit descriptions developed for the project. Because that land unit mapping only covered a portion of the OHTL utilities corridor, for consistency they were not incorporated into the land unit mapping for this proposal.

There are twenty land units that intersect the proposed OHTL utilities corridor. The existing mapping was reliable with the exception of some minor line work required to refine demarcations between land units. The most common land units intersecting the OHTL utilities corridor were 2b1 (side slopes), 3a, 3b and 3c (flat to gently undulating upland surfaces). These land units were associated to mixed Eucalypt woodland located on landforms of plains or rises, with red to brown kandosol soils. Land unit 3e, 4c and 6b were also relatively common, intersecting the OHTL utilities corridor on multiple occasions. These land units were associated with plains or drainage systems with hydrosol soils indicating poorer drainage – i.e. wet season water-table.

Indicative photographs of the common land units are presented in Figure 3-4 to Figure 3-8.



Figure 3-4. Photographs of vegetation and soil consistent with land unit 2b1



Figure 3-5. Photographs of vegetation and soil consistent with land unit 3a



Figure 3-6. Photographs of vegetation and soil consistent with land unit 3b



Figure 3-7. Photographs of vegetation and soil consistent with land unit 3c



Figure 3-8. Photographs of vegetation and soil consistent with land unit 6b

Table 3-1. Summary of the land units relevant to the OHTL utilities corridor footprint

Land unit	Landform class	Landform description	Soil	Vegetation	Length (km)	
1a	Low hills	Flat hillcrests	Leptic rudosols	Open woodland to open forest of <i>Eucalyptus tetradonta</i> and <i>Eucalyptus miniata</i> over annual <i>Sorghum</i> spp. and <i>Heteropogon triticeus</i> .	0.77	
1b		Steep ridges	Leptic rudosols	Woodland of <i>Eucalyptus miniata</i> , <i>Eucalyptus tectifica</i> and <i>Corymbia foelscheana</i> over <i>Sorghum plumosum</i> .	1.15	
1c	Rises	Rises and short steep slopes	Leptic rudosols	Woodland of <i>Eucalyptus miniata</i> and <i>Corymbia bleeseri</i> over <i>Sorghum</i> species.	1.73	
2a1		Rises	Leptic rudosols	Open woodland of <i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , or <i>Corymbia foelscheana</i> , <i>Corymbia confertifolia</i> , <i>Eucalyptus tectifica</i> over mixed grasses.	0.65	
2b1		Side slopes		Brown kandosols	Open woodland to woodland of <i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Corymbia foelscheana</i> and <i>Eucalyptus tectifica</i> over <i>Sorghum</i> species.	11.08
2b2					Low open woodland to open woodland of <i>Eucalyptus miniata</i> and <i>Eucalyptus tetradonta</i> or a mix of species over sparse grasses.	2.51
3a		Plains	Flat to gently undulating upland surfaces	Red kandosols	Open forest of <i>Eucalyptus tetradonta</i> and <i>Eucalyptus miniata</i> over mixed grasses.	4.42
3b	Brown kandosols			Woodland of <i>Eucalyptus miniata</i> and <i>Eucalyptus tetradonta</i> over <i>Sorghum</i> species.	11.97	
3c	Gently undulating upland surfaces		Brown kandosols	Woodland of <i>Eucalyptus miniata</i> and <i>Eucalyptus tetradonta</i> over <i>Sorghum</i> species.	9.61	
3d			Leptic rudosols	Open woodland of <i>Eucalyptus miniata</i> and <i>Eucalyptus tetradonta</i> over <i>Sorghum</i> species.	0.80	
3e	Flat to gently undulating upland surface		Kandosolic redoxic hydrosols	Woodland of <i>Corymbia polycarpa</i> and <i>Erythrophleum chlorostachys</i> over mixed grasses; wet season watertable.	3.66	
4c	Gentle lower slopes		Kandosolic redoxic hydrosols	Open forest of <i>Eucalyptus</i> spp. over mixed grasses; wet season watertable.	1.87	
5b1	Drainage Systems		Drainage floors within upland terrain	Kandosolic redoxic hydrosols	Woodland to open forest of <i>Lophostemon lactifluus</i> , <i>Corymbia bella</i> , and <i>Melaleuca viridiflora</i> over mixed grasses.	0.08
5b2			Incised drainage floors within upland terrain		Open shrubland to open woodland of <i>Corymbia polycarpa</i> , <i>Melaleuca</i> spp. and <i>Eucalyptus alba</i> over <i>Eriachne</i> and <i>Sorghum</i> species	0.17

Land unit	Landform class	Landform description	Soil	Vegetation	Length (km)
6a2		Broad lowland plains	Chromosolic Redoxic Hydrosols	Open woodland or woodland of <i>Lophostemon lactifluus</i> , <i>Corymbia polycarpa</i> , <i>Eucalyptus alba</i> , <i>Melaleuca viridiflora</i> over <i>Eriachne burkittii</i> , <i>Sorghum stipoideum</i> .	0.24
6b			Tenosolic redoxic hydrosols	Tall shrubland of <i>Grevillea</i> spp., <i>Melaleuca</i> spp. and <i>Lophostemon lactifluus</i> over annual <i>Sorghum</i> spp. and <i>Heteropogon triticeus</i> .	4.05
8a		Upland depressions & floodways	Tenosolic oxyaquic hydrosols	Grassland of <i>Eriachne</i> spp., annual <i>Sorghum</i> sp. with scattered trees and shrubs.	0.34
8b	Swamps	Swamp depressions	Chromosolic redoxic hydrosols	Open to closed forest of <i>Melaleuca</i> spp.	1.45
Disturbed	Areas where the land units could not be confirmed because of the high levels of disturbance				5.71

3.1.7 Weeds

All incidental weeds observed throughout the corridor were recorded using a handheld GPS. Weed attributes were recorded in accordance with the *NT Weed Data Collection Manual* (WMB 2015) and included the following: species, infestation size, and density of the population.

A significant Gamba Grass (*Andropogon gayanus*) infestation was observed throughout KP 749 - 752 which had been recently burnt (see Figure 3-9). South of this, Gamba Grass was observed along the access track intersecting the corridor on both sides of the Arnhem Hwy, extending into the mining areas south of Goode Road (KP 739 - 748). Another small population was observed where the OHTL utilities corridor deviates from the OHTL railway corridor, and a larger infestation within the 700 m long stretch immediately south of Cox Peninsula Road (KP 723 - 724). A few minor patches of Hyptis (*Mesosphaerum suaveolens*) were observed within the first kilometre of the deviation from the OHTL railway corridor (KP 722 - 723). Stylo (*Stylosanthes* spp.) was observed in very minor patches and was generally restricted to the drainage areas adjacent roads. All Stylo records were outside of the OHTL utilities corridor footprint. These were observed along the track adjacent to Gunn Point Road (KP 777 - 778). All these records were outside of the corridor, approximately 20 – 30 m from the eastern boundary.

Tully Grass (*Urochloa humidicola*) is a pastoral species and environmental weed (i.e. is introduced not declared) that forms dense stands and smothers native vegetation. This species was observed as the dominant grass in the ground storey within the first 1.3 km of the proposed deviation from the OHTL railway corridor (KP 722 - 723).



Figure 3-9. Photographs of Gamba Grass observed along the OHTL utilities corridor

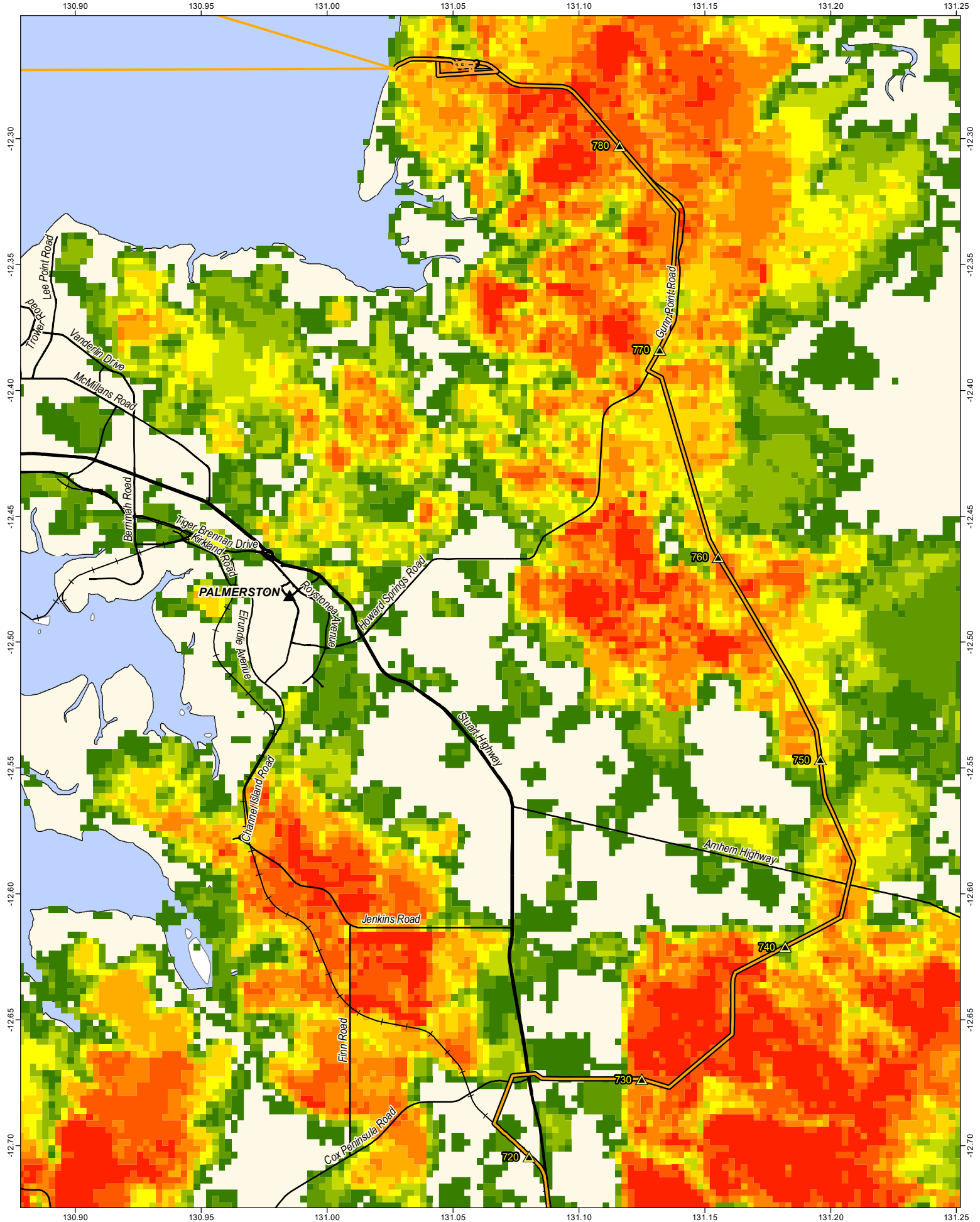
3.1.8 Fire

Fires are a regular occurrence in the Darwin Coastal bioregion. Regional fire history was obtained through the [Northern Australia and Rangelands Fire Information](#) (NAFI) website. Figure 3-10 presents fire frequency for the OHTL utilities corridor between 2011 and 2020. Areas with abundant remnant native vegetation cover – namely Wak Wak, Weddell, Koolpinyah, and south of Lloyd Creek – have been burnt almost every year during that period. The peri-urban districts around Humpty Doo, however, have only been burnt once or twice.

3.2 Significant vegetation

Based on desktop analysis, the following significant vegetation types occur within, or immediately adjacent to, the OHTL utilities corridor (see Figure 3-13 and Figure 3-14):

- Wetlands
- Riparian vegetation, including riparian rainforest
- Sandsheet heath
- Large hollow-bearing trees
- Groundwater-dependent ecosystems.



Legend

- AAPowerLink infrastructure
- Railway
- Roads**
 - Principal road
 - Secondary road

Fire Frequency 2011-2020

Number of years burnt within period	Color
1	Green
2	Light Green
3	Yellow-Green
4	Yellow
5	Light Orange
6	Orange
7	Dark Orange
8	Red-Orange
9	Red
10	Dark Red

Source: Sun Cable, Geoscience Australia, NR Maps, NAFI



Fig 3-10: Map of fire frequency (2011-2020) for the OHTL Utilities Corridor

Project: Australia-Asia PowerLink

Reference: M-Files Document ID 204951

Date: 03/11/2021 Revision: A

Scale: 1:210,000

Coordinate System: GDA2020

0 6.5 Kilometres

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3.2.1 Wetlands

An overview of tropical wetlands is provided in Section 2.2.1. The OHTL utilities corridor traverses the eastern edge of Shoal Bay - Mickett Creek wetland along its last 20 km before reaching the Murrumujuk facilities (see Figure 3-13). The wetland is an area of estuarine habitats between Shoal Bay and Mickett Creek stretching from Lee Point to Gunn Point, containing wetland marshes, mangrove woodlands, beaches, mudflats and creeks. The quality of the sites vary as much of the area is degraded.

Seven swamps were identified intersecting the OHTL corridor from satellite imagery and confirmed during field surveys – see Figure 3-13 and Figure 3-14. These swamps consisted of open/closed forests dominated by *Melaleuca* species with an understorey of *Pseudoraphis spinescens* (see, e.g., Figure 3-11). These ephemeral swamps were all dry at the time of survey, except for one (KP 769 - 770), which fringes a billabong containing *Nymphoides* spp. throughout the shallow body of water – see Figure 3-12.

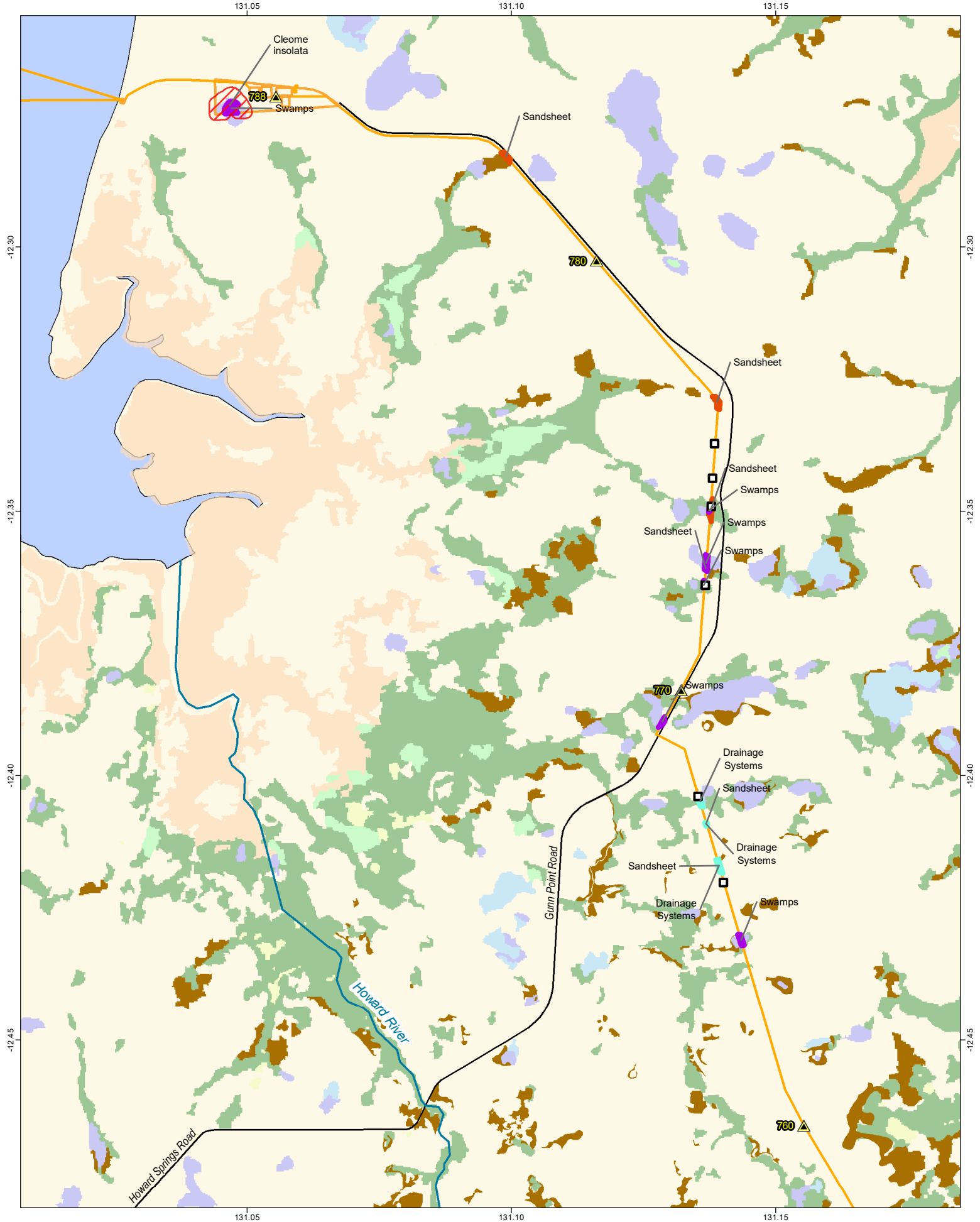


Figure 3-11. Photographs of various *Melaleuca* swamps observed between KP 774 - 763

Note: The swamp in the bottom left photo is connected to large billabong at KP 769 - 770 (see Figure 3-12)



Figure 3-12. Photograph of billabong observed adjacent to swamp (KP 769 – 770)



Legend

- AA PowerLink infrastructure
- Principal road
- Secondary road
- Veg intersected by the OHTL**
- Drainage Systems
- Riparian
- Sandsheet
- Swamps

Significant vegetation

- Floodplain
- Grassy swamp
- Mangrove forest
- Melaleuca swamp
- Riparian open forest
- Spring rainforest
- Sandsheet heath

Hollow-bearing trees

-

Source: Sun Cable, EcoZ, NTG (NR Maps)



Figure 3-13: Map of significant vegetation relevant to the OHTL Utilities Corridor (north)

Project: Australia-Asia PowerLink

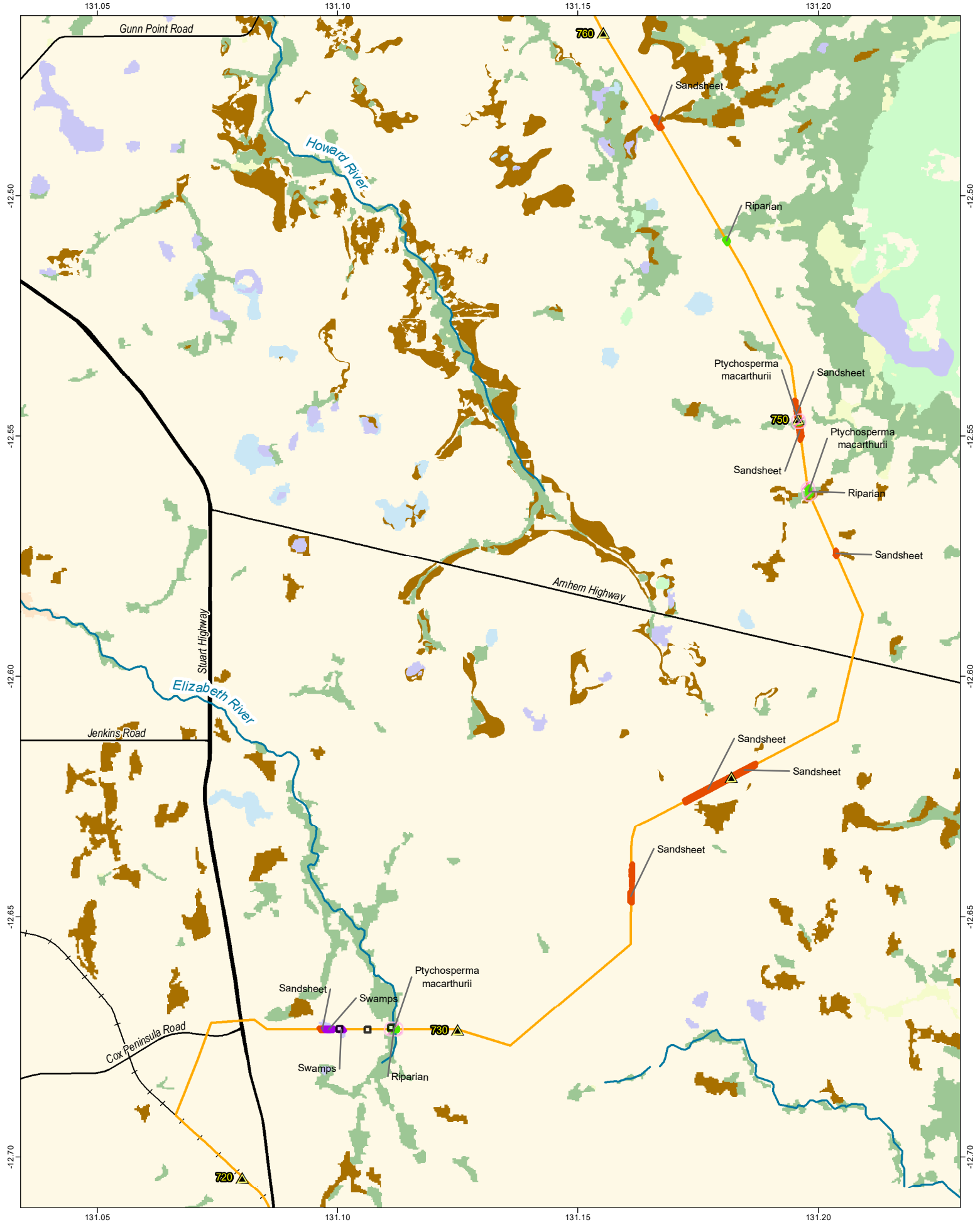
Reference: M-Files ID 204951

Date: 25/02/2022 Revision: A

Scale: 1:100,000

Coordinate System: GDA2020

A4



Legend

<ul style="list-style-type: none"> — AAPowerLink infrastructure — Principal road — Secondary road <p>Veg intersected by OHTL</p> <ul style="list-style-type: none"> ■ Drainage Systems ■ Riparian ■ Sandsheet ■ Swamps 	<p>Significant vegetation</p> <ul style="list-style-type: none"> ■ Floodplain ■ Grassy swamp ■ Mangrove forest ■ Melaleuca swamp ■ Riparian open forest ■ Spring rainforest ■ Swamps 	<p>Threatened species habitats</p> <ul style="list-style-type: none"> ■ Ptychosperma macarthurii ■ Hollow bearing trees
--	--	--

Source: Sun Cable, EcOz, Geoscience Australia, NTG (NR Maps)



Figure 3-14: Map of significant vegetation relevant to the OHTL Utilities Corridor (south)

Project: **Australia-Asia PowerLink**

0 3 Kilometres	Reference: M-Files ID 204951
Scale: 1:110,000	Date: 25/02/2022
Coordinate System: GDA2020	Revision: A

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3.2.2 Riparian vegetation

One large drainage line with a well-defined channel with a maximum depth of 1.5 m was observed within the Black Jungle section at KP 754 - 755 (see Figure 3-15, and location in Figure 3-14). Large trees (some greater than 15 m tall) fringed the creek line. The vegetation was comprised of *Erythrophleum chlorostachys*, *Ixora sp.*, *Canarium australicum* var. *australianum*, *Carallia brachiata*, *Helicia australasica*, *Syzygium sp.*, and *Acacia auriculiformis*. These are typical species recorded in monsoon forests and along creek lines. The existing vegetation description for this land unit was not consistent to on-ground observations – although mapped as a vegetation community dominated by mixed *Grevillea* species in the upper canopy, there were only minor *Grevilleas* observed on the bank of the drainage line.



Figure 3-15. Photographs of drainage channel fringed with riparian vegetation in the OHTL utilities corridor (KP 754)

One other drainage line of note was observed in the utilities corridor – Elizabeth River crossing at KP 728 - 729. The channel was relatively shallow (0.5 to 1 m deep) and gradually petered out to an open depression comprised of dense *Pandanus spiralis* with minor *Melaleuca spp.* in the landscape (see Figure 3-14 for location). Soils were sandy loams, occasionally sandy clay loams, and were dry at the time of survey indicating it is an ephemeral creek – i.e. only holds water during the wet-season. The vegetation fringing the channel was slightly taller compared to surrounding vegetation and comprised of mixed *Melaleuca spp.*, *Lophostemon lactifluus*, and dense *Pandanus spiralis* (see Figure 3-17).

There is a developing riparian channel which supports *Melaleuca spp.* and other monsoon species located at KP 750 (see Figure 3-16). Soils were sandy and parts of the channel had eroded to a depth of approximately 1 m by 3 m wide. Monsoon species were also observed in the drainage systems land unit 6b surround the channel.



Figure 3-16. Photographs of developing riparian channel with *Melaleuca* spp. and other monsoon species feeding into Black Jungle (KP 750)



Figure 3-17. Photograph of Elizabeth River at OHTL crossing location (KP 728)

3.2.3 Rainforest

Two patches of rainforest observed during the field surveys were aligned with the riparian corridors discussed in the previous section (see Section 3.2.2).

There was also a small pocket of monsoon forest with an estimated 20 x 20 m patch size present on the northern boundary of the corridor (KP 728 – 729) (see Figure 3-14 for location). The vegetation was comprised of *Melaleuca leucadendra*, *Carpentaria acuminata*, *Lophostemon lactifluus* surrounded by dense *Pandanus spiralis* (see Figure 3-18). Structurally, it was more developed compared to surrounding vegetation, with some overlap in the canopy observed.

One other possible rainforest patch was identified during the desktop assessment within Lot 572 located south of the Black Jungle CR – see Figure 3-13. This section of the corridor was inaccessible during the time of the field surveys and was unable to be assessed.



Figure 3-18. Photograph of small patch of monsoon forest within the OHTL utilities corridor (KP 728 - 729)

3.2.4 Sandsheet heath

Sandsheet heath occurs in seasonally-inundated infertile sandy soils overlaying an impermeable deposit of clay or laterite (DENR 2018d). It is often associated with other sensitive vegetation types: monsoon forest, wetlands and riparian. There are several types of sandsheet heath, with typical upper and mid stratum species including *Grevillea pteridifolia*, *Banksia dentata*, *Melaleuca nervosa*, *Lophostemon lactifluus*, and *Verticordia cunninghamii* (Liddle et al. 2013). Ground species are a mix of herbs and sedges (DENR 2018d).

Sandsheet heath are regarded as a significant vegetation type as they cover a small land area (56 km²) and are known to support a range of threatened and specialised species, such as Howard River Toadlet (*Uperoleia daviesae*) and bladderworts (*Utricularia spp.*). The Howard River Catchment has a high proportion of the sandsheet heath in the region, with other smaller areas within Elizabeth River and Adelaide River catchments.

Potential sandsheet habitats were identified prior to the field survey using high resolution satellite imagery and existing sandsheet mapping for the greater Darwin Region (Hempel 2003). These sandsheet heath patches are all associated with intermittent streams of first order draining into Adelaide River or Shoal Bay. In the field, these potential communities were verified with reference to key indicator species and sandy soils.

There are at least 14 sandsheet communities intersecting the OHTL corridor, with another two yet to be verified – see Figure 3-13 and Figure 3-14, and Table 3-2. Five intact sandsheet communities were observed; another three were adjacent highly-modified habitats within the corridor. The remaining six sandsheet communities were confirmed from previously-existing mapped habitats, with some minor extensions and modifications to these as observed from field verification and satellite imagery. Two potential patches were not verified (one previously-mapped patch, and another observed via satellite imagery), due to access constraints within Lot 572.

Table 3-2. Locations of potential sandsheet habitats within the OHTL utilities corridor

KP range	Location	No. of potential sandsheet areas
735 - 741	Southern portion of Koolpinyah Station	3*
726 - 727	Alverly Road	1
772 - 783	Gunn Point Road	4
745 - 763	Between Arnhem Hwy and Gunn Point Road	6
748 - 749	Lot 572 – not yet verified	2

**Indicates modified sandsheet*



Figure 3-19. Photographs of potential intact sandsheet heath habitats within the OHTL utilities corridor



Figure 3-20. Photographs of potential sandsheet heath habitats (disturbed) within the OHTL utilities corridor between KP 735 – 741

3.2.5 Large hollow-bearing trees

An overview of large hollow-bearing trees is provided in Section 2.2.4. Eucalypt communities with that potential are the most common vegetation type crossed by the OHTL utilities corridor. Fieldwork confirmed the existence of large hollow-bearing trees in the locations described in Table 3-3 and shown in Figure 3-13 and Figure 3-14.

Table 3-3. Location of large hollow-bearing trees within the OHTL corridor

KP	Location	Species	No. of large trees
769 - 777	Large trees observed within the Shoal Bay CR section of the corridor on three occasions.	<i>Eucalyptus tetradonta</i>	3
769 - 777	Two large trees were observed adjacent Melaleuca swamps within the Shoal Bay CR section of the corridor	<i>Lophostemon lactifluus</i>	2
757 - 766	Two large trees observed within Koolpinyah Station (northern section) adjacent a Melaleuca swamp. Of these, one large tree was observed to the south of this.	<i>Lophostemon lactifluus</i> <i>Corymbia bleeseri</i>	2



Figure 3-21. Photographs of large trees >40cm DBH; *Corymbia bleeseri* (left) and *Lophostemon lactifluus* (right)



Figure 3-22. Photographs of large trees with DBH >40cm (*Eucalyptus tetradonta*)

3.2.6 Groundwater-dependent ecosystems

The OHTL utilities corridor crosses four swamps associated to the Shoal Bay coastal floodplain, four lakes associated to the Adelaide River catchment, and the Elizabeth River – all with high potential to be aquatic GDE's. Along its whole extent, the OHTL utilities corridor crosses areas with some potential to be a terrestrial GDE's. These areas mostly correspond to Eucalypt woodlands, riparian open forests, spring forests, grassy swamps, floodplains, and heathland. Of these, the ones with high potential to be a terrestrial GDE are the riparian open forest along Elizabeth River, Melaleuca swamps and riparian open forests along seasonal streams draining into Shoal Bay, and the spring rainforests and riparian open forests fringing the Black Jungle Swamp. There is also a monsoon rainforest patch in the Black Jungle Swamp which is a recognised terrestrial GDE. This is located 3.5 km east of the OHTL utilities corridor.

3.3 Threatened species

The northern ~40 km of the OHTL utilities corridor, from ~4.5 km north of the Arnhem Highway and Murrumujuk, was surveyed in 2020 for threatened species as part of the *Biodiversity Assessment of the Gunn Point Area* (Stokeld et al. 2020). The threatened species were targeted based on the result of multiple biodiversity and habitat surveys undertaken in the area since the 1990's. Key results were that:

- The Northern Brushtail Possum (*Trichosurus vulpecula arnhemensis*) was recorded at 26% of sites.
- Three other threatened fauna species were detected on camera at sites with low fire frequency and within 750 m of a watercourse:
 - Yellow-spotted Monitor (*Varanus panoptes*) at six sites
 - Fawn Antechinus (*Antechinus bellus*) once
 - Black-footed Tree-rat (*Mesembriomys gouldii gouldii*) once.
- Targeted surveys were not undertaken for the Bare-rumped Sheath-tailed Bat (*Saccolaimus saccolaimus*), Water Mouse (*Xeromys myoides*) and Red Goshawk (*Erythrotriorchis radiatus*).
- Masked Owl (*Tyto novaehollandiae kimberli*) was recorded once using call detection.
- Howard River Toadlet was detected at four sites.

Regarding survey effort, Stokeld et al. (2020) noted that:

A number of threatened woodland species including Northern Quoll (Dasyurus hallucatus), Pale Field Rat (Rattus tunneyi), and Partridge Pigeon (Geophaps smithii) were not detected in this study. Cameras are a reliable method for the detection of these species (DENR, unpublished data). Based on the survey effort employed in this study, it is unlikely these species occur in significant numbers in the study area. Mertens' Water Monitor (Varanus mertensi) was not detected despite recent records from the study area. This species is semi-aquatic and seldom seen far from water and likely occurs in wetland habitats of Gunn Point which were not targeted in fauna surveys.

3.3.1 Likelihood of occurrence assessment

The procedure used to determine which threatened species have the potential to occur in the OHTL utilities corridor followed the same process as for the OHTL railway corridor, as described in Section 2.3.1. The results of Stokeld et al. (2020) were used to inform the likelihood of occurrence assessment, noting that the area surveyed for that study covers only a portion of the OHTL railway corridor.

The OHTL utilities corridor traverses 69 km. Consequently, it intersects two bioregions and multiple habitat types, potentially impacting a considerable number of different threatened species. However, the physical disturbance footprint of the OHTL utilities corridor is, by design, narrow and localised. Therefore, threatened species with general habitat requirements and/or wide ranges are unlikely to be significantly impacted by the development. The likelihood assessment for the OHTL therefore includes an extra layer of filtering to identify species that have restricted ranges or localised core habitat requirements. Undertaking this extra step in the likelihood of occurrence assessment avoids the need to discuss a large number of species that have an inherently low likelihood of being significantly impacted upon by proposal activities.

Table 3-4 presents all threatened species considered to have a medium or high likelihood of being present in the OHTL utilities corridor footprint, and then assesses whether they have restricted ranges or localised core habitat requirements. Those that do will be subject to a significant impact assessment in the EIS, and so are further discussed in this report.

Table 3-4. Threatened species with a reasonable (high or medium) likelihood of occurring within OHTL utilities corridor footprint

Likelihood	Species	Class	Status		Habitat type	Habitat restrictions
			EPBC	TPWC		
HIGH	Darwin Cycad (<i>Cycas armstrongii</i>)	Plant	-	VU	Savanna woodlands	-
	A herb (<i>Typhonium praetermissum</i>)		-	VU	Savanna woodlands	Restricted
	A herb (<i>Cleome insolata</i>)		-	VU	Low open Grevillea/Melaleuca woodland on sandy seasonally waterlogged soils	Restricted
	Darwin Palm (<i>Ptychosperma macarthurii</i>)		-	EN	Dense riverine rainforests on deep organic loams	Restricted
	Partridge Pigeon (eastern subspecies) (<i>Geophaps smithii smithii</i>)	Bird	VU	VU	Open woodland	-
	Howard River Toadlet (<i>Uperoleia daviesae</i>)	Amphibian	-	VU	Sandsheet heath	Restricted
	Yellow-spotted Monitor (<i>Varanus panoptes</i>)	Reptile	-	VU	Variety of habitats, including coastal beaches, floodplains, grasslands, and woodlands	-
	Mertens' Water Monitor (<i>Varanus mertensi</i>)		-	VU	Edges of watercourses, swamps, and lagoons	Restricted to watercourses
	Fawn Antechinus (<i>Antechinus bellus</i>)	Mammal	VU	EN	Top End savanna woodland	-
Northern Brushtail Possum (<i>Trichosurus vulpecula arnhemensis</i>)	VU		-	Variety of habitats, including coastal beaches, floodplains, grasslands, and woodlands	-	
MEDIUM	A herb (<i>Stylidium ensatum</i>)	Plant	EN	EN	Margins of drainage areas in damp heavy clay or peaty soil	Restricted
	A bladderwort (<i>Utricularia dunstaniae</i>)		-	VU	Sparse grasslands/sedgeland on poorly drained white sandy flats	Restricted
	Black-footed Tree-rat (Kimberley and mainland NT subspecies) (<i>Mesembriomys gouldii gouldii</i>)	Mammal	EN	VU	Top End savanna woodland and drainage areas	-
	Bare-rumped Sheath-tail Bat (<i>Saccolaimus saccolaimus nudicluniatus</i>)		VU	-	Woodland	Roosts in hollows in tall woodland
	Masked Owl (northern subspecies) (<i>Tyto novaehollandiae kimberli</i>)	Bird	VU	VU	Tall woodland	-

VU = Vulnerable, EN = Endangered, CR = Critically Endangered

3.3.2 Species of concern

As explained in the previous section, the linear nature of the OHTL utilities corridor – and the fact that disturbance within it will be localised – means that species which are wide-ranging or habitat generalists are inherently unlikely to be significantly impacted by the proposal. Therefore, species that do not have a restricted range or localised core habitat are not discussed any further.

This section discusses the remaining threatened species that could be present, clumping them by habitat where possible.

Darwin Palm

In the NT, the Darwin Palm (*Ptychosperma macarthurii*) occurs in dense wet rainforests associated with lowland springs near the margins of riverine floodplains (NTH 2021). The soils typically comprise deep organic clay loams without humus development. The species is known from eight populations in the Black Jungle region, with an extent of occurrence of 200 km² – see Figure 3-23. Within this area, it has an area of occupancy of less than 1 km² (Duff et al. 1992; Barrow et al. 1993; Liddle et al. 1996). According to Stokeld et al. (2020), within the Gunn Point study area it is unlikely that additional, undetected subpopulations exist.

The Black Jungle subpopulation is by far the largest, with Crocodile Creek containing 70% of the Northern Territory population (Liddle et al. 2006). The OHTL utilities corridor passes within 500 m of a Darwin Palm record, and transects the drainage line along which that and many other records occur downstream. No targeted surveys were undertaken for *Ptychosperma macarthurii*; however, if surveyors intersected an area that may be potentially suitable habitat, more survey effort was made. The species was not observed during the survey.

Sandsheet heath species

The following threatened species are all restricted to, or closely associated with, sandsheet heath – a habitat only found in patches within the greater Darwin region (as discussed in Section 3.2.4 and mapped in Figure 3-23):

- Howard River Toadlet (*Uperoleia daviesae*)
- a bladderwort (*Utricularia dunstaniae*)
- A herb (*Cleome insolata*)

None of these species have been surveyed to an adequate degree as to be able to confidently delineate their extent of occurrence.

The Howard River Toadlet (or Howard Springs Toadlet) is a small, endemic species that was only formally described in 2005. The species is highly-restricted to shallow drainage systems that intersect sandsheet habitat of the Darwin region (Young et al. 2005; Fisher et al. 2011). The Howard River Toadlet only occurs in the Howard and Elizabeth River catchments, and there are many records proximate to the southern and central sections of the OHTL utilities corridor. The species was only recorded at four sites (during a below average wet season) in the Gunn Point region by Stokeld et al. (2020), who noted that presence of the species at a site was associated with the occurrence of debil-debil microrelief, higher proportion of sand in the soil to a depth of 60 cm, and larger patches of sandsheet heath.

Utricularia dunstaniae is a small, annual, terrestrial bladderwort, flowering between March and May. In the NT, it is associated with 'sandsheet heath' type habitats such as *Melaleuca nervosa* woodland or *Melaleuca verticordia* shrubland in wet sand – often in shallow water, frequently where water is percolating from the ground. The species tends to occur in slightly wetter micro-habitats than other sympatric *Utricularia* species (Kerrigan and Cowie 2015). *Utricularia dunstaniae* has a scattered distribution across north-western NT and is known from the Darwin area (particularly the Howard Springs region), Kakadu National Park and Cobourg Peninsula.

Cleome insolata is a small herb with a conspicuous flower that is known to occur in low open woodlands with *Grevillea pteridifolia*, *Melaleuca viridiflora*, *Melaleuca nervosa*, *Verticordia cunninghamii* and *Pandanus*

species over *Dapsilanthus*, *Eriachne burkittii*; *Sorghum* and *Alloteropsis*, on seasonally waterlogged sandy soils (NTH 2021). This species is endemic to the NT and apparently to the Darwin region, where it is known from the Noonamah / Amys Creek area, Wishart Rd on the outskirts of Darwin, and near Shoal Bay (Westaway and Cowie 2012).

Mertens' Water Monitor

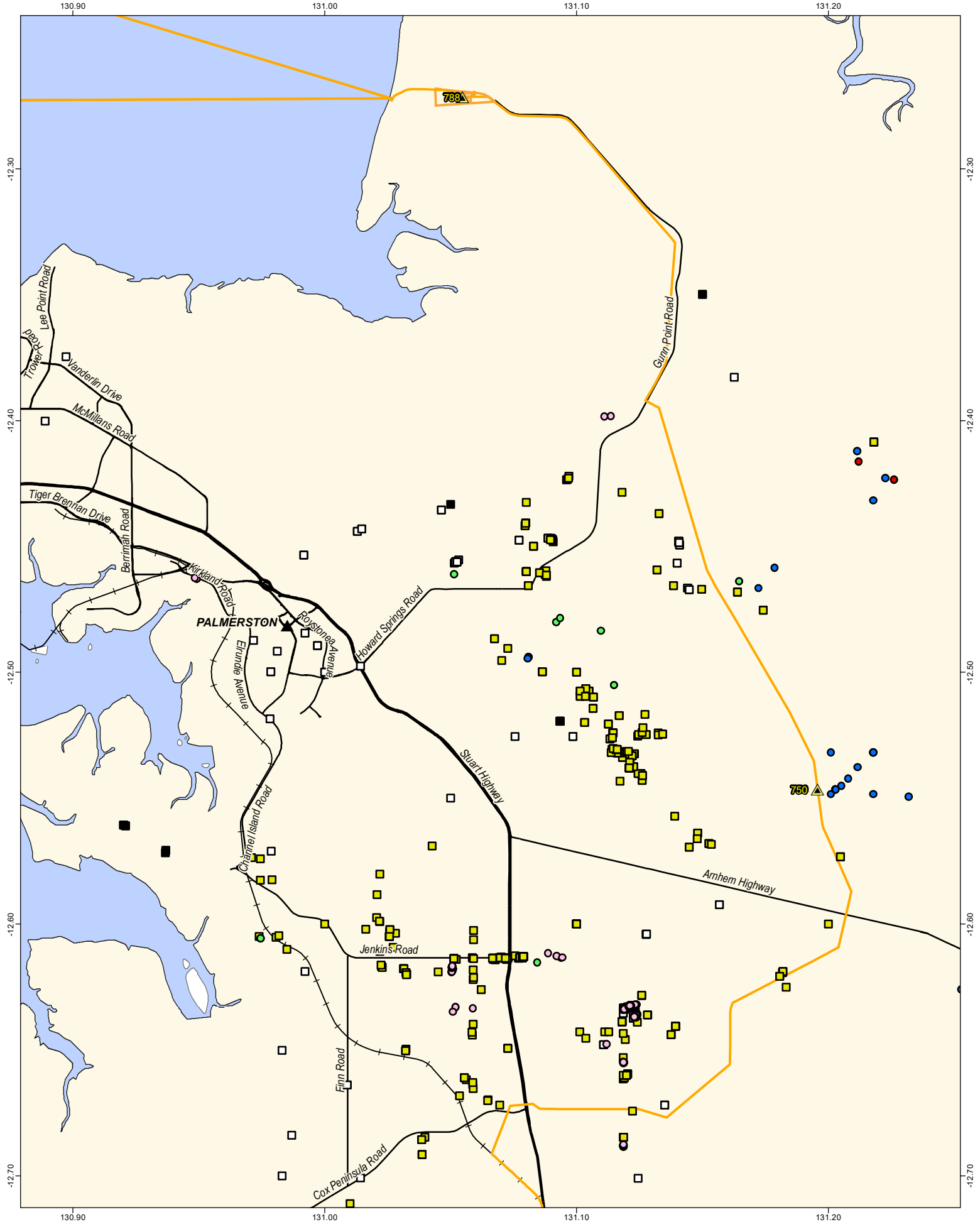
Mertens' Water Monitor has a broad geographic range, occupying coastal and inland waters across the far north of Australia from the Kimberley to the west side of Cape York Peninsula. The species has been recorded across most of the Top End and the Gulf Region in the NT, and is the common water monitor in greater Darwin (outside of Darwin suburbs and coastal area). Mertens' Water Monitor is a semi-aquatic monitor seldom seen far from water and is susceptible to Cane Toad poisoning (Ward et al. 2006). Although not recorded by Stokeld et al. (2020) in the Gunn Point region, there are many recent records from Scrubby Creek (adjacent to the OHTL utilities corridor, south of Gunn Point Rd) and for the Elizabeth River – see Figure 3-23.

Bare-rumped Sheathtail Bat

The Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus*) is a high-flying insectivorous bat that has only been detected at 11 locations. Most records occur within near-coastal habitats with one exception (Jasper Gorge) 150 km inland (Woinarski et al. 2014). There are few records of the species across this wide distribution, which suggest either that the subspecies is rare, that it has a fragmented distribution, or that records may also have been confused with closely-related species. In the NT, confirmed records have come from open Pandanus woodland fringing the sedgeland of the South Alligator River in the Kakadu lowlands (Friend and Braithwaite 1986), Eucalypt tall open forests of *E. miniata* and *E. tetradonta*, and adjacent grassy beach dunes with *Melaleuca* and *Acacia* (Churchill 2008), and more recent records from Howard Springs (Milne et al. 2009).

The Bare-rumped Sheathtail Bat forages above the canopy and roosts in groups ranging from 10 to 100 individuals in large hollow bearing trees (*Eucalyptus miniata*, *E. tetradonta* and *Melaleuca leucadendra*), where the hollow is at least 18 cm in diameter and the entrance to the hollow is at least 6 m from the ground (Churchill 2008).

There are two Bare-rumped Sheathtail Bat records adjacent to the OHTL utilities corridor recorded by an unknown source in 2005 – see Figure 3-23. There are areas with large hollow-bearing trees within the OHTL utilities corridor that may be roost sites for this species – refer to Section 3.2.5.



Legend

- AAPowerLink infrastructure
- Principal road
- Secondary road
- Railway

Threatened flora species

- Cleome insolata
- Luisia corrugata
- Ptychosperma macarthurii
- Utricularia dunstaniae

Threatened fauna species

- Bare-rumped Sheath-tailed Bat
- Howard Springs Toadlet
- Mertens' Water Monitor

Source: Sun Cable, Geoscience Australia, NR Maps

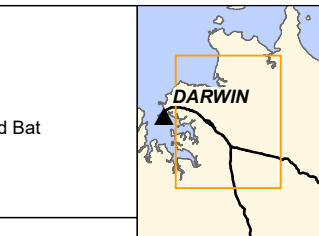


Fig 3-23: Map of restricted-range threatened species relevant to the OHTL Utilities Corridor (excluding Darwin Cycad, Typhonium praetermissum and Stylidium ensatum)

Project: **Australia-Asia PowerLink**

Reference: M-Files Document ID 204951

Date: 03/11/2021 Revision: A

Scale: 1:210,000

Coordinate System: GDA2020

0 5 Kilometres

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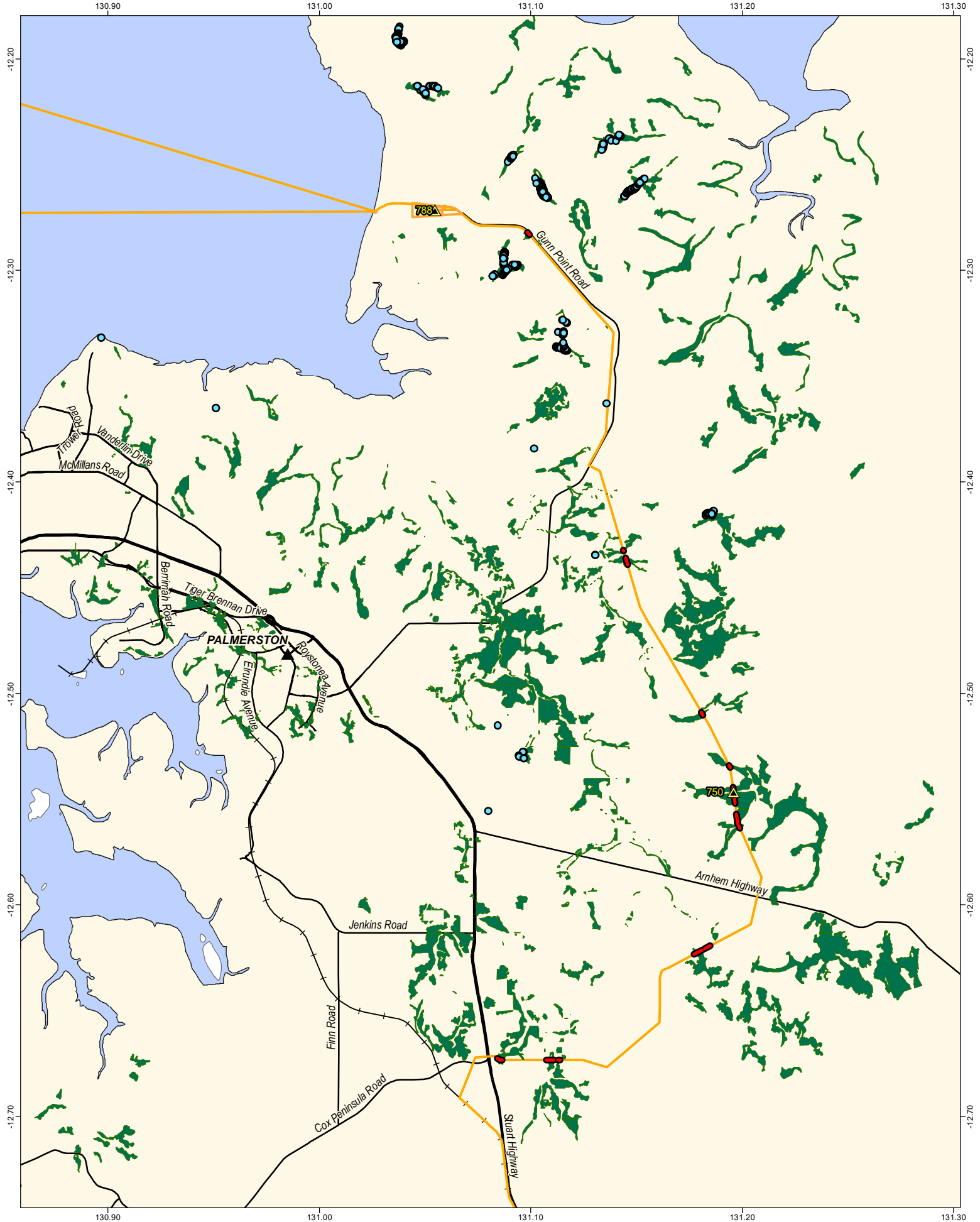
Styliidium ensatum

An overview of the ecology of *Styliidium ensatum* is presented in Section 2.3.2. The NT Government has mapped the extent of occurrence of *Styliidium ensatum* based on known recorded locations close to Darwin and a site at Hayes Creek (NTG 2016). Stokeld et al. (2020) undertook additional modelling for Gunn Point peninsula and identified 4,184 ha with a moderate or high likelihood of habitat suitability for *Styliidium ensatum* – see Figure 3-24. In the field, Stokeld et al. (2020) found this species to be widespread and locally abundant, recorded at 12 discrete sites in the Gunn Point, many close to the OHTL utilities corridor. Most of the total known population occurs in Gunn Point, with the exception of sub-populations near Hayes Creek and the Howard River.

Desktop assessment and field observations identified 20 locations of potentially-suitable habitat for *Styliidium ensatum*. These assessments were based on preferred habitat characteristics, and proximity from existing locations. The field survey within the OHTL utilities corridor occurred at a time when *Styliidium ensatum* plants are not detectable, and so to verify presence/absence a follow-up targeted flora survey is required during the optimum survey time for this species in June/July.

The following habitat characteristics were used to determine habitat suitability for the sites occurring within potential habitat (including modelled habitats):

- Margins of drainage systems; areas that are poorly drained with seasonal inundation or waterlogging and have hydrosols soils – i.e. they are saturated with water for extended periods, are generally a greyish colour and have a high organic content (Cowie and Westaway 2012).
- Shallow inundation or saturated soils in the mid dry season.
- Overstorey consisting of *Melaleuca* spp. and/or *Lophostemon lactifluus*, *Pandanus spiralis*.
- Ground layer incorporating grasses and herbs that occur in poorly drained habitats.
- Relatively-open overstorey.



Legend

- AAPowerLink infrastructure
- ▲ OHTL Kilometre Point (KP)
- Railway
- Principal road
- Secondary road
- *Stylidium ensatum* high likelihood habitat as mapped by the NT Government
- *Stylidium* high likelihood habitat as verified in the field survey

Threatened species records

- *Stylidium ensatum*

Source: Sun Cable, Geoscience Australia, NR Maps



Fig 3-24: Map of modelled *Stylidium ensatum* habitat and records relevant to the OHTL Utilities corridor

Project: **Australia-Asia PowerLink**

Reference: M-Files Document ID 204951

Date: 03/11/2021 Revision: A

Scale: 1:250,000

Coordinate System: GDA2020

0 8 Kilometres

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Darwin Cycad

The Darwin Cycad (*Cycas armstrongii*) is a small to medium-sized cycad with a slender trunk. The species occurs in open grassy woodlands where adequate draining appears to be a limiting factor. It also occurs on rocky outcrops, undulating hills and plains (Kerrigan et al. 2006). Prime cycad habitat has deep loamy, well-drained soil and the species is frequently associated with *Eucalyptus miniata* and *Eucalyptus tetradonta* (Liddle 2009). Darwin Cycads are endemic to the Top End, with abundant populations occurring throughout the greater Darwin region, often forming dense stands (Kerrigan et al. 2006). Nevertheless, their long-term conservation has to be considered because they are long-lived, have a slow reproductive rate and localised distribution (Liddle 2009).

According to the recent surveys (Astrebla 2017; Stokeld et al. 2020), the Darwin Cycad has a widespread, patchy distribution on Gunn Point Peninsula, influenced by past disturbances such as land clearing and resource extraction. Likelihood modelling by Stokeld et al. (2020) identified 7% (4,988 ha) of their study area as having a high, and 9% (6,117 ha) a moderate likelihood of supporting high density cycad stands (> 400 stems/ha). Previous field data and incidental observations provided qualified support to this heuristic model.

The high likelihood habitat is focussed either side of the central length of Gunn Point Rd which is intersected by the final ~10 km of the OHTL utilities corridor (from KP 776). These habitats contain well-developed Eucalypt open forests (Napier et al. 2020) on well-drained red earths (land units 3a, 8a and 8a1) (Fogarty et al. 1984).

During the field survey Darwin Cycads were generally observed in the commonly occurring land units (2b1, 3a, 3b and 3c) throughout the corridor. Darwin Cycads were absent or occurring in very low densities in drainage systems (6b) and other drainage areas such as swamps and riparian corridors. Land units are detailed in Section 3.1 of this report.

There were areas of high-density Darwin Cycads along the OHTL utilities corridor (KP 755 – 758). One specific area comprised of high-density Darwin Cycad population noted occurring in Eucalypt woodland on higher ground directly adjacent to the major drainage line (KP 753 – 754) (see Figure 3-25).



Figure 3-25. Photograph of high density Darwin Cycads occurring along the OHTL utilities corridor

Typhonium praetermissum

An overview of the ecology of *Typhonium praetermissum* is presented in Section 2.3.2. The NT Government has developed a habitat model for *Typhonium praetermissum* for the Greater Darwin region (Cuff and Green 2019). Approximately 19,000 ha of high to moderately suitable habitat was identified within the Gunn Point peninsula – including many patches of high likelihood habitat and two known subpopulations within the OHTL utilities corridor – see Figure 3-26. In the Gunn Point region, Stokeld et al. (2020) considered two subpopulations are likely to be of high conservation importance – the Murrumujuk subpopulation discussed in Section 4.3.2 and the Koolpinyah Central subpopulation adjacent to Gunn Point Rd.

Field surveyors looked for several characteristics (based on their field experience surveying for *Typhonium praetermissum* multiple times and understanding the preferred habitat of the plant) to assign likelihood of occurrence classes for mapped *Typhonium* habitat.

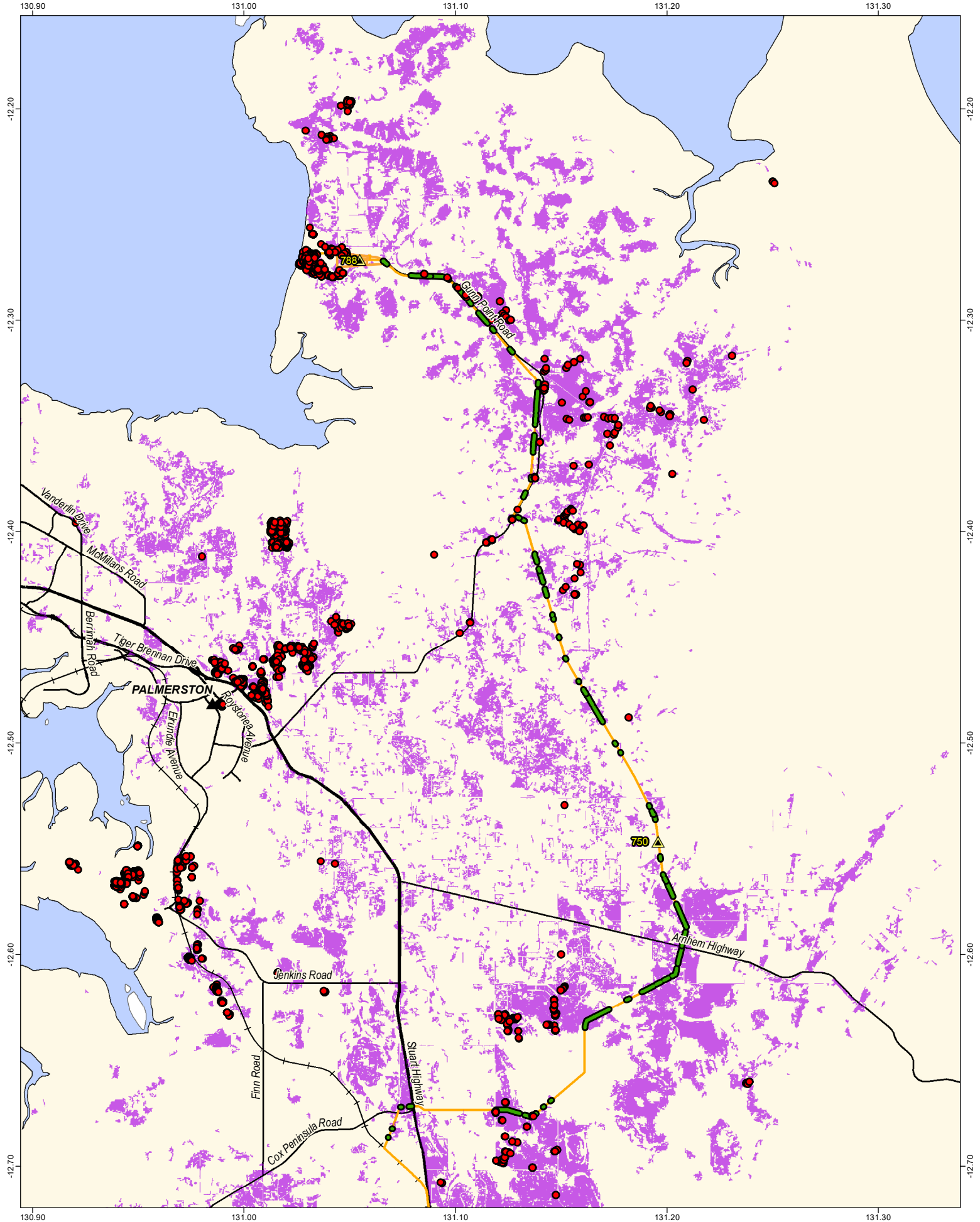
Areas that were deemed *highly suitable* fitted all typical characteristics aligned with *Typhonium praetermissum* occurrences – vegetation comprised of mixed *Eucalyptus* spp. open woodland (often unshaded), and soil types of red or brown Kandosols with lateritic gravel present on the surface and generally greater than 50% cover. Areas deemed *moderately suitable* only had one of the abovementioned desirable characteristics aligned with presence of *Typhonium* plants. Areas of low likelihood were generally unsuitable but there may have been a minor characteristic – e.g. minor scattered gravel (less than 20% cover).

Most of the areas mapped as high to moderate habitat suitability were either confirmed or demoted to moderate suitability (for areas modelled as high-likelihood) – see Figure 3-26. Areas that were not modelled as potential habitat for *Typhonium praetermissum*, but deemed potentially suitable in the field, were noted and included as such. In total, of the habitat mapped by Cuff and Green (2019) as suitable habitat, there was 114.51 ha of habitat deemed highly suitable, 155.72 ha of moderate suitability and 106.76 of low suitability. Habitat suitability for the species could not be assessed for 10.15 ha, due to access constraints (Lot 572). It can be seen from Figure 3-26 that the high likelihood habitat is spread broadly along the length of the OHTL utilities corridor.

The field survey within the OHTL utilities corridor occurred at a time when *Typhonium praetermissum* plants are not detectable, and so to verify presence/absence a follow-up targeted flora survey is required during the optimum survey time for this species in December-March.

3.4 Migratory species

As for the OHTL railway corridor, there are migratory species listed in the Protected Matters Search Tool report and the EIS Terms of Reference that may be present within the OHTL utilities corridor footprint. Whilst the migratory species relevant to this component of the proposal have very different habitats and ecologies, they are all similar in that the OHTL utilities corridor footprint neither represents important habitat for them, nor are ecologically-significant proportions of populations likely to be present. All the species likely occur – seasonally – across the footprint in numbers commensurate with the region. Habitat for these species is widespread in the region, including within the footprint.



Legend

- OHTL Route
- ▲ OHTL Kilometre Point (KP)
- Railway
- Principal road
- Secondary road
- *Typhonium praetermissum* high likelihood habitat as mapped by the NT Government
- *Typhonium* high likelihood habitat as verified in the field survey
- **Threatened species records**
- *Typhonium praetermissum*

Source: Sun Cable, Geoscience Australia, NR Maps



Fig 3-26: Map of modelled *Typhonium praetermissum* habitat and records relevant to the OHTL Utilities Corridor

Project: Australia-Asia PowerLink

Reference: M-Files Document ID 204951

Date: 03/11/2021 Revision: A

Scale: 1:250,000

Coordinate System: GDA2020

0 8 Kilometres

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4 MURRUMUJUK

The proposal facilities at Murrumujuk include the Darwin Converter Site and the Cable Transition Facilities.

The Darwin Converter Site is the terminal location for the OHTL and will convert electricity from High Voltage Direct Current (HVDC) to High Voltage Alternating Current (HVAC) to enable a future connection to the Darwin electricity system.

4.1 Environmental context

The information for this section comes from desktop databases and reports, as well as field surveys. This report only assesses the terrestrial component of the Murrumujuk facilities footprint. The marine ecology – including marine turtles – is discussed in a separate report.

4.1.1 Surveys

As discussed in Section 3.1.1, in 2018-19 DENR undertook an extensive land unit, vegetation and biodiversity survey within the Gunn Point area. Those surveys included the Murrumujuk proposal footprint, with three fauna survey sites relevant to the Murrumujuk facilities – including one within the Darwin Converter Site.

In 2017, to inform the environmental approvals for Project Sea Dragon, Astrebla Ecological Services conducted a flora survey of that proposal's site, which is immediately west of the Darwin Converter Site component of the Murrumujuk facilities, and immediately south of the Underground Cable Corridor. The survey mapped vegetation communities present on the site and immediate surrounds at a 1:10,000 scale (Astrebla 2017). A follow-up survey in 2018 targeted significant flora species – particularly *Typhonium praetermissum* (Astrebla unpublished).

A proposal-specific field survey was undertaken between 27 September and 5 October 2021 by EcOz botanists Anna Lemon and Nicole Clark to ground-truth land units, sensitive vegetation communities and identify potential habitat for threatened species. Incidental weed records were also collected. Recent fires were also noted, along with feral animal activities and other disturbances. Cultural monitors from Larrakia Rangers were present.

4.1.2 Bioregions

The Murrumujuk proposal footprint occurs in the Darwin Coastal bioregion characterised by gently undulating plains on laterised sandstones and siltstones, with extensive and diverse floodplain associated with the lower reaches of the many large river systems. The dominant inland vegetation type is tall open forest dominated by *Eucalyptus tetradonta* and *Eucalyptus miniata*. There are substantial areas of mangroves, and rainforest and other riparian vegetation fringing the rivers. None of these vegetation types are within the proposal's area of influence.

4.1.3 Significant areas

The Shoal Bay SOCS overlaps the Underground Cable Corridor and Land Sea Joint Station components of the Murrumujuk proposal footprint. The SOCS is described in Section 3.1.2.

The Land Sea Joint Station lies ~350 m to the north of Tree Point Conservation Area.

4.1.4 Surface water

The Murrumujuk proposal footprint does not contain any mapped drainage lines. One seasonal Melaleuca swamp is present in the south-western corner of the footprint – see Section 4.2.

4.1.5 Land use

The Murrumujuk proposal footprint is adjacent to an area that could support residential land use in the future. There is no current formal land use on the site. There are limited land holders in the area, it is sparsely populated, and much of the land – including the proposal footprint site – is zoned for the future development.

4.1.6 Land units

During the 2021 field survey, land units from both the Greater Darwin Region (Fogarty et al. 1984) and Gunn Point (Easey et al. 2020) at a scale of 1:25,000 were verified by recording the landform, dominant species in the upper stratum and soil type. Where required, land units were adjusted to reflect the results presented.

There are ten land units that intersect the Murrumujuk facilities footprint. These can be categorised as plains, rises, swamps, drainage systems and marine landforms (Table 4-1, Figure 4-5). The existing land unit mapping was mostly reliable, except for one land unit previously mapped as 8b within the Darwin Converter Site that was modified to land units 10b and 11b to better reflect the on-ground results. The most widespread land units are 8a, 8a1 and 8a2 (plains) (Figure 4-1 to 4-5). These land units are associated with Eucalypt open to mid woodlands, with deep red to brown kandosol soils.

Land units 1c, 2b1, 3a, 3b, and 9c are intersected by the Underground Cable Corridor from the western edge of the Darwin Converter Site to the coast. These land units are generally associated with Eucalypt mid woodlands to open forests, except for the coastal land unit 9c which comprises of dunes with small patches of monsoon forest – see Figure 4-1.



Figure 4-1. Photograph of land unit 8a1 within the convertor site at Murrumujuk



Figure 4-2. Photograph of land unit 8a2 within the convertor site at Murrumujuk



Figure 4-3. Photographs of land unit 8a within the convertor site at Murrumujuk

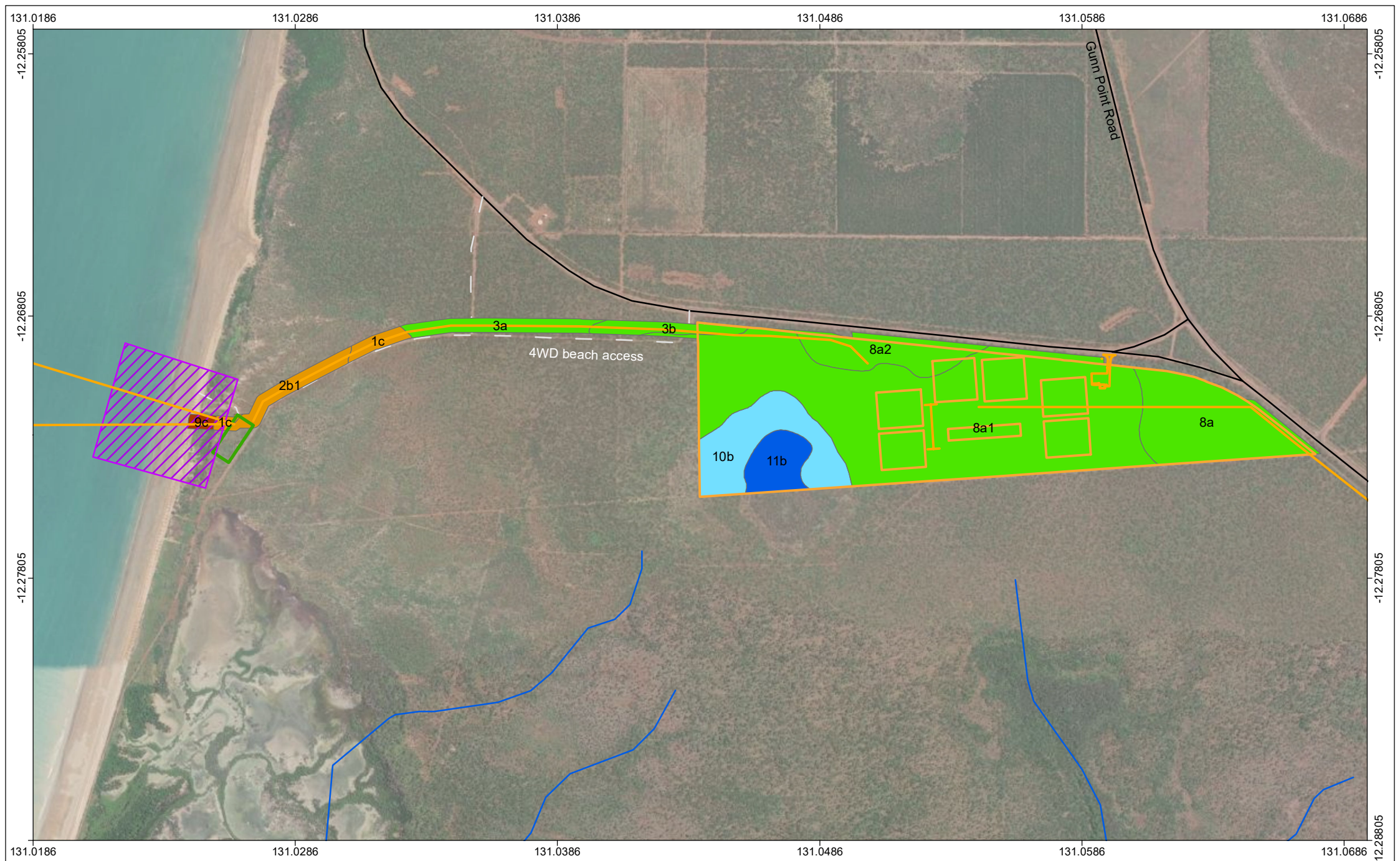


Figure 4-4. Photographs of the coastal habitats relevant to the Land Sea Joint Station and Shore Crossing

Table 4-1. Summary of the land units relevant to the Murrumujuk facilities footprint

Land unit	Landform class	Landform description	Soil	Vegetation
1c	Rises	Rises and short steep slopes	Leptic rudosols	Woodland of <i>Eucalyptus miniata</i> and <i>Corymbia bleeseri</i> over <i>Sorghum</i> species.
2b1		Side slopes	Brown kandosols	Open woodland to woodland of <i>Eucalyptus miniata</i> , <i>Eucalyptus tetradonta</i> , <i>Corymbia foelscheana</i> and <i>Eucalyptus tectifica</i> over <i>Sorghum</i> species.
3a	Plains	Flat to gently undulating upland surfaces	Red kandosols	Open forest of <i>Eucalyptus tetradonta</i> and <i>Eucalyptus miniata</i> over mixed grasses.
3b		Flat to gently undulating upland surfaces	Brown kandosols	Woodland of <i>Eucalyptus miniata</i> and <i>Eucalyptus tetradonta</i> over <i>Sorghum</i> species.
8a*		Gently undulating upland plains; local relief <2m; slopes 1-2%	Very deep; non-gravelly; red; massive gradational earths	Mid woodland to open woodland of <i>Eucalyptus tetradonta</i> , +/- <i>Eucalyptus miniata</i> over <i>Heteropogon triticeus</i> mid tussock grassland.
8a1*		Gently undulating upland plains; local relief <2m; slopes 1-2%	Moderate to very deep; gravelly; red; massive earths	Mid woodland of <i>Eucalyptus tetradonta</i> and <i>Eucalyptus miniata</i> over <i>Heteropogon triticeus</i> mid tussock grassland.
8a2*		Gently undulating upland plains; local relief <2m; slopes 1-2%	Moderate to very deep; gravelly; red and brown; massive earths	Open woodland of <i>Eucalyptus tetradonta</i> , <i>Corymbia bleeseri</i> and <i>Eucalyptus miniata</i> over <i>Sorghum intrans</i> and <i>Heteropogon triticeus</i> mid tussock grassland.
9c	Marine	Dunes and beach ridges	Tenosols	Grassland of <i>Sporobolus virginicus</i> ; some pockets of monsoon vine thickets.
10b*	Drainage Systems	Gently sloping broad drainage floors; including open spillway depressions	Shallow to deep; gravelly; red and brown; structured soils	Low or low open woodland of <i>Melaleuca viridiflora</i> , <i>Melaleuca nervosa</i> , <i>Grevillea pteridifolia</i> +/- <i>Lophostemon lactifluus</i> , <i>Asteromyrtous symphyocarpa</i> over <i>Sorghum intrans</i> and <i>Eriachne burkitti</i> mid tussock grassland.
11b*	Swamps	Seasonally flooded open depressions including upper margins of wetter swamps, wetlands, and perennial billabongs	Very deep; non-gravelly; seasonally wet structured clay soils	Community 1: mid closed forest or open forest of <i>Melaleuca dealbata</i> over <i>Pseudoraphis spinescens</i> mid tussock grassland Community 2: low woodland to low open forest of <i>M. viridiflora</i> +/- <i>M. cajuputi</i> , <i>Corymbia polycarpa</i> over <i>Pseudoraphis. spinescens</i> mid tussock grassland

* Denotes Easey et al. 2020 land unit mapping



Legend Shore Crossing AAPowerLink Infrastructure 4WD beach access Road Land Sea Joint Station		Landform Drainage Systems Marine		Plains Rises Swamps	
Source: Sun Cable, EcOz, NTG (NR Maps)				Figure 4-5: Maps of land units relevant to the Murrumbidgee facilities	
Project: Australia-Asia PowerLink		Reference: M-Files ID 204951		Revision: A	
Coordinate System: GDA2020		Date: 01/03/2022			
		Scale: 1:20,000		A4	
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4.1.7 Weeds

There are 185 records of six declared weeds species in the NT Flora Atlas for Murrumujuk and surrounding areas in Gunn Point. The majority of records are along roads and the Leaders Creek boat ramp. Gamba Grass (*Andropogon gayanus*) represents approximately three-quarters of the occurrences.

During the 2021 field survey, all incidental weeds observed for Murrumujuk and surrounding areas in Gunn Point (KP 780 – 788, and small segment along the Underground Cable Corridor) were recorded using a handheld GPS and recorded as per the *NT Weed Data Collection Manual* (WMB 2015).

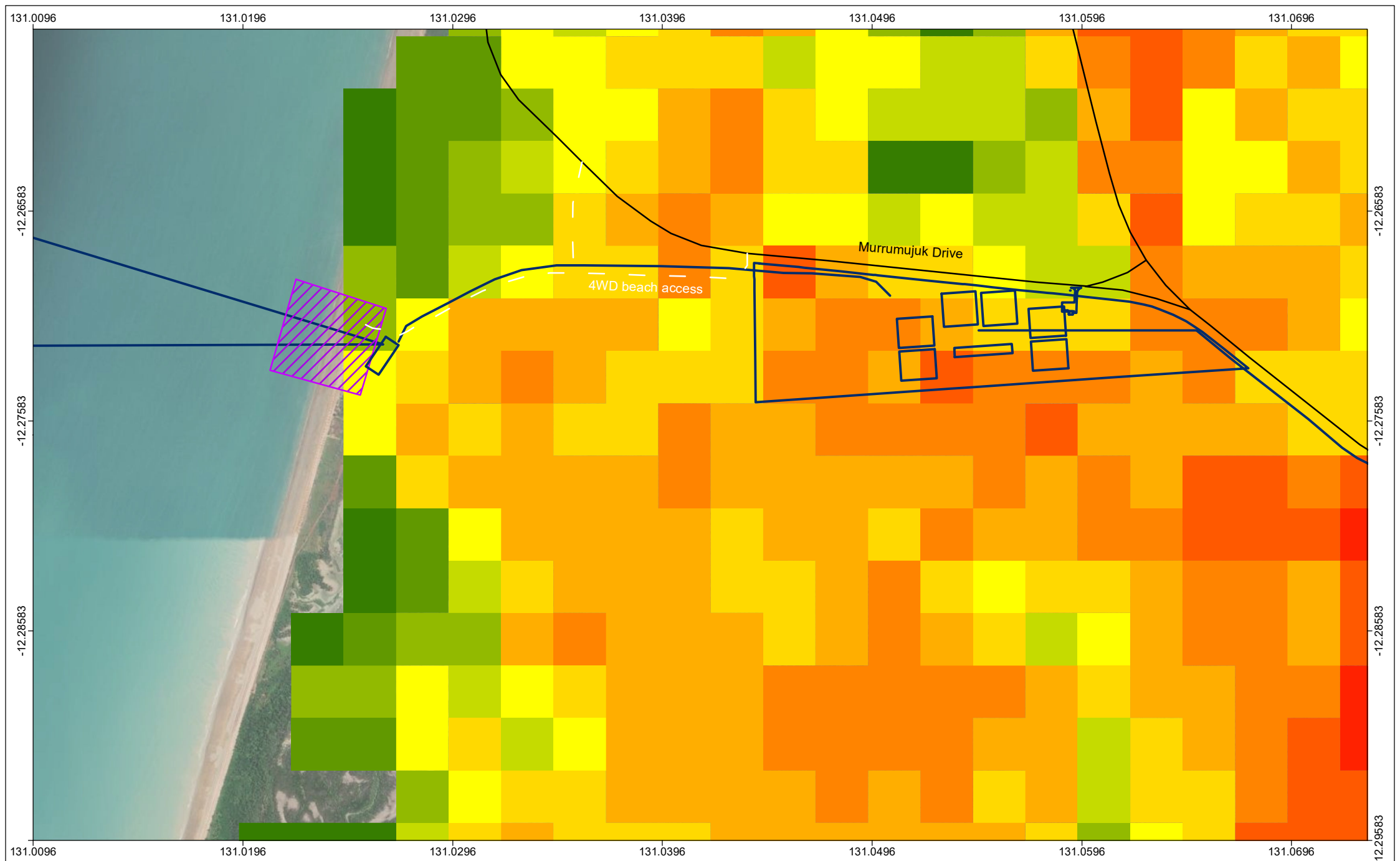
The Murrumujuk facilities footprint was relatively free of weeds at the time of survey. The largest infestation was observed on the sand dunes adjacent to the shoreline. Caltrop (*Tribulus terrestris*), Annual Mission Grass (*Cenchrus pedicellatus*) and Spinyhead Sida (*Sida acuta*) were all present at this location, but slightly outside the corridor 10 m from the northern boundary. Caltrop was observed as the dominant species in this area, forming a dense mat. Spinyhead Sida and Annual Mission Grass were isolated and in low densities (see Figure 4-6).



Figure 4-6. Photograph of Annual Mission Grass growing along drainage area

4.1.8 Fire

Fires are a regular occurrence on Gunn Point. Fire history for the Murrumujuk proposal footprint was obtained through the [Northern Australia and Rangelands Fire Information](#) (NAFI) website. Figure 4-7 presents fire frequency for the Murrumujuk proposal footprint between 2011 and 2020. It shows that the southern side of the Darwin Converter Site has burnt almost every year, compared with the more coastal areas having only burnt a few times.



Legend NT Roads 4WD beach access Road AAPowerLink Infrastructure Shore Crossing		Fire Frequency 2011-2020 Number of years burnt within the period 1 2 3 4 5 6 7 8 9 10				Fig 4-7: Map of fire frequency (2011-20) relevant to the Murrumujuk facilities		Project: Australia-Asia PowerLink Reference #: Document 204951 Revision: A	
Coordinate System: GDA2020				Date: 05/11/2021				Scale: 1:25,000 A4	
<small>Source: NTG - Roads, Flora, Land Units and Parks and Reserves Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User</small>									

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4.2 Significant vegetation

The coastline of Gunn Point is lined with mangroves and rainforest patches – the latter occurring along the coast immediately south of the Land Sea Joint Station. These rainforest patches may also contain large trees with hollows suitable for fauna. There are a few patches of sandsheet heath on the peninsula, but none are proximate to the Murrumujuk proposal footprint. There is no riparian vegetation within the Murrumujuk proposal footprint, but it is bordered to the south by the Shoal Bay coastal floodplain.

One wetland community was identified in the south-west corner of the Darwin Converter Site. The community conformed with land unit 11b (swamps) and is surrounded by land unit 10b (drainage systems). The wetland was comprised of two distinct vegetation communities (Figure 4-8):

- Mid closed forest or open forest of *Melaleuca dealbata* over *Pseudoraphis spinescens* mid tussock grassland.
- Low woodland to low open woodland of *Melaleuca viridiflora*, *Melaleuca nervosa*, *Grevillea pteridifolia* +/- *Lophostemon lactifluus*, *Asteromyrtus symphyocarpa* over *Sorghum intrans* and *Eriachne burkittii* mid tussock grassland.



Figure 4-8. Photographs of the wetland community within the Darwin Converter Site footprint

Vine thicket patches were observed within land unit 9c which supports coastal dune formation. Whilst no thicket occurs within the Underground Cable Corridor, a few patches were nearby (20 m from boundary of corridor) (Figure 4-9).



Figure 4-9. Photograph of dunes with minor patches of monsoon vine thicket within land unit 9c

4.3 Threatened species

As detailed in Section 3.1.1, in 2018-19 Gunn Point peninsula was subject to a broadscale survey for threatened fauna and habitat modelling for threatened flora (with some targeted surveys) – Stokeld et al. (2020). The results of that study – assessed in conjunction with the vegetation communities present within the Murrumujuk proposal footprint – give a good indication of which threatened species are likely to be present. Consequently, there is no need to undertake a systematic ‘likelihood of occurrence’ assessment for the Murrumujuk proposal footprint.

4.3.1 Likelihood of occurrence assessment

There are 11 threatened species that have been recorded within the Murrumujuk proposal footprint (including along Gunn Point beach), and an additional one that has a high likelihood of being present – see Table 4-2. Eight of these are threatened shorebirds recorded along Gunn Point Beach – see Section 4.4.

Table 4-2. Threatened species ‘likelihood of occurrence’ assessment summary for Murrumujuk

Likelihood	Species	Class	Status		
			EPBC	TPWC	
KNOWN	Darwin Cycad (<i>Cycas armstrongii</i>)	Plant	-	VU	
	a herb (<i>Typhonium praetermissum</i>)		-	VU	
	Yellow-spotted Monitor (<i>Varanus panoptes</i>)	Reptile	-	VU	
	Bar-tailed Godwit (western Alaskan subspecies) (<i>Limosa lapponica baueri</i>)	Bird	VU	VU	
	Bar-tailed Godwit (northern subspecies) (<i>Limosa lapponica menzbieri</i>)		CE	CE	
	Curlew Sandpiper (<i>Calidris ferruginea</i>)		VU	CE	
	Far Eastern Curlew (<i>Numenius madagascariensis</i>)		VU	CE	
	Great Knot (<i>Calidris tenuirostris</i>)		VU	CE	
	Greater Sand Plover (<i>Charadrius leschenaultii</i>)		VU	VU	
	Lesser Sand Plover (<i>Charadrius mongolus</i>)		VU	EN	
Red Knot (<i>Calidris canutus</i>)	VU		EN		
HIGH	Northern Brushtail Possum (<i>Trichosurus vulpecula arnhemensis</i>)		Mammal	VU	-

CE = Endangered, EN = Endangered, VU = Vulnerable

4.3.2 Species of concern

The physical footprint of the Darwin Converter Site is small (approx. 55 ha) and localised – primarily constituting the Converter Site and the Land Sea Transmission Corridor. The following paragraphs assess the likelihood that the species mentioned in Table 4-2 above being present in or adjacent to that footprint.

Darwin Cycad

The ecology of the Darwin Cycad (*Cycas armstrongii*) and its general presence across Gunn Point are presented in Section 3.3.2. The flora survey for the Project Sea Dragon site (Astrebla 2017) recorded an average of 887 individual Darwin Cycads per ha in *Eucalyptus tetradonta* woodland on the site. This suggests that across the 90 ha of this habitat type, there may be approximately 79,830 individuals present. Individual Darwin Cycads were also found in *Eucalyptus tectifera* and *Corymbia polysciada* low woodland and deciduous mixed species low woodland, but in much lower densities. Darwin Cycad distribution on site was often observed to be in dense clumps separated by areas with relatively few or no cycads.

As discussed in Section 3.3.2, the likelihood modelling undertaken by Stokeld et al. (2020) identified that northern Gunn Point peninsula near Murrumujuk and Leaders Creek turn-off contains extensive areas with a high likelihood of supporting high density stands of Darwin Cycad and noted how the results of Astrebla (2017) supported the modelling results. These high likelihood habitats contain well-developed Eucalypt open forests on well-drained red earths (land units 3a, 8a, 8a1 and 8a2) (Easey et al. 2017). Areas of high-density Darwin Cycads were observed within the Murrumujuk facilities during the 2021 field survey.

Typhonium praetermissum

The ecology of *Typhonium praetermissum* and its general presence across Gunn Point are discussed in Section 2.3.2. A targeted survey in 2018 for *Typhonium praetermissum* within the Project Sea Dragon site and surrounds (Astrebla unpublished) found 578 *Typhonium praetermissum* plants over 400 ha in an approximate rectangle 2.5 km wide and 1.6 km long – see Figure 4-10. It is to be noted that the survey methodology – a random meander – did not allow for a full abundance count. The survey covered the footprint of the Underground Cable Corridor, but only included the western end of the Darwin Converter Site footprint. Of the 578 records, only two were within the Darwin Converter Site footprint, and approximately ten within the Underground Cable Corridor. In comparison, approximately 146 *Typhonium praetermissum* plants were present within the proposed Project Sea Dragon footprint.

Stokeld et al. (2020) discusses this sub-population, noting it is one of the largest known of this species and likely to be of high conservation importance. The Koolpinyah Central sub-population (discussed in Section 3.3.2) is similarly large, but more dispersed. This Murrumujuk sub-population is approximately 5 km from the nearest records.

The field survey determined that the majority of the Murrumujuk site comprises either high likelihood for *Typhonium praetermissum* (96.10 ha) or moderate likelihood habitat (14.00 ha). Of this, the Underground Cable Corridor footprint was well covered by previous survey effort; however, most of the high likelihood *Typhonium praetermissum* habitat within the Darwin Converter Site has not been surveyed.

Yellow-spotted Monitor

The Yellow-spotted or Floodplain Monitor (*Varanus panoptes*) is a large ground-dwelling monitor that can grow up to 1.4 m. It occupies a variety of habitats – including coastal beaches, floodplains, grasslands and woodlands (Ward et al. 2012). The species once occupied a variety of habitats, including coastal beaches, floodplains, grasslands and woodlands, across the extent of northern Australia. However, its propensity to eat Cane Toads and die from the ingested toxins has caused a significant decline in the population (Ward et al. 2012).

Stokeld et al. (2020) detected the Yellow-spotted Monitor at six sites across the Gunn Point peninsula, including at a site 800 m north of the Land Sea Joint Station.

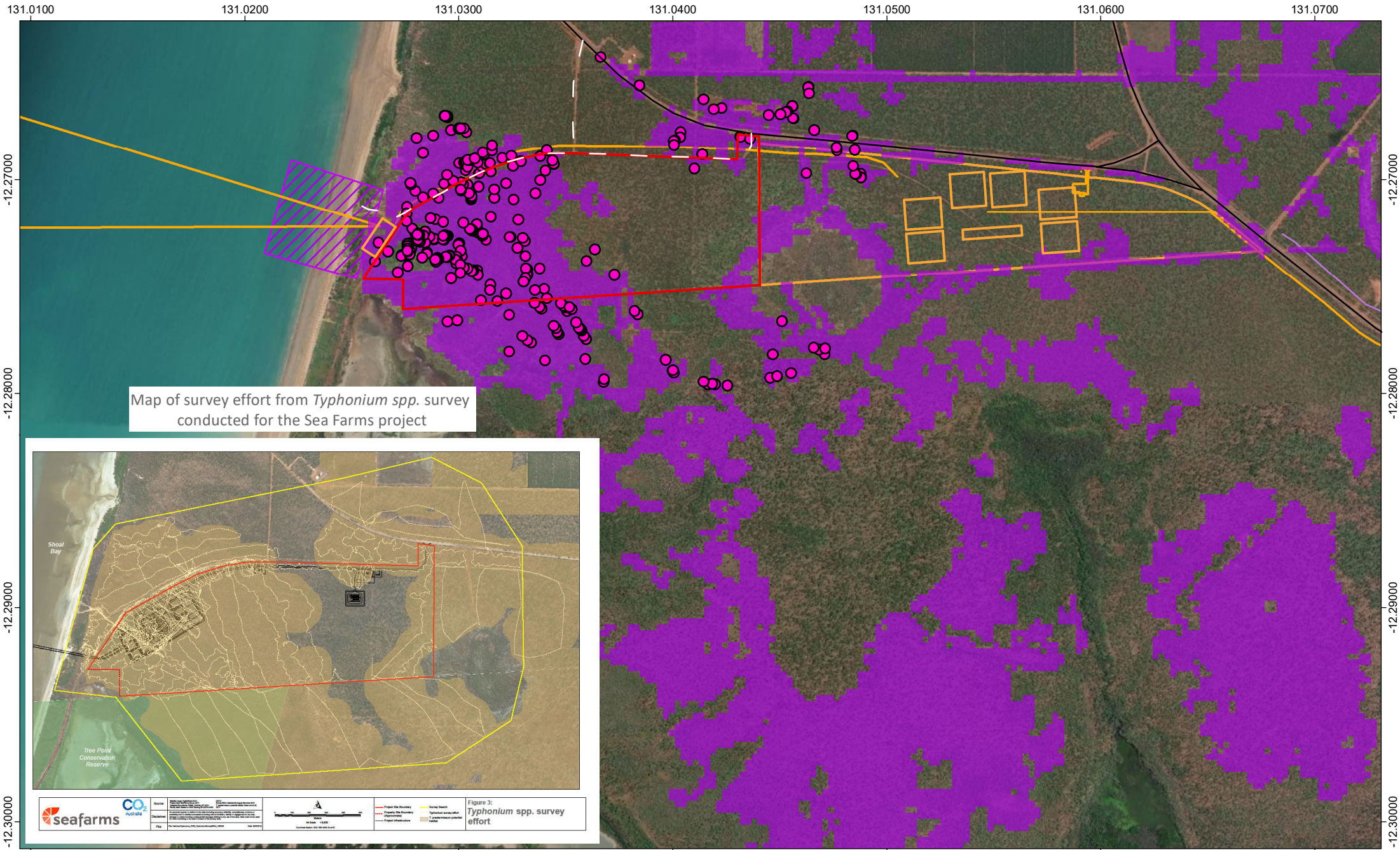


Figure 3: *Typhonium spp.* survey effort

		<p>Source: Sun Cable, Geoscience Australia, NR Maps, NTG - Roads, Flora, Land Units and Parks and Reserves</p>	
<p>Legend</p> <ul style="list-style-type: none"> AAPowerLink Infrastructure NT Roads 4WD beach access Road Sea Farms boundary <i>Typhonium praetermissum</i> high likelihood habitat as mapped by the NT Government 		<p>Threatened flora records</p> <ul style="list-style-type: none"> <i>Typhonium praetermissum</i> 	



<p>Figure 4-10: Map of <i>Typhonium praetermissum</i> records and habitat relevant to the Murrumujuk facilities</p>		
<p>Project: Australia-Asia PowerLink</p>	<p>Reference #: Document 204951</p>	
<p>Coordinate System: GDA2020</p>		<p>Date: 05/11/2021</p>
<p>0 1 Kilometres</p>		<p>Scale: 1:25,000</p>
<p>DISCLAIMER: Sun Cable Pty Ltd disclaims all liability for all claims, expenses, losses, damages, and costs any person/company may incur as a result of their /its reliance on the accuracy or completeness of this document or its capability to achieve any purpose. © Sun Cable Pty Ltd 2020.</p>		

4.4 Migratory species

There are 26 species of migratory shorebirds that have been recorded within the Gunn Point area (Palmer and Smit 2020). Of these, 18 are known from the Gunn Point Beach area. This information was collected from past aerial and ground surveys, national volunteer-based programs and targeted scientific studies. Migratory birds are considered a Matter of Environmental Significance under the *EPBC Act*. In addition, eight of shorebird species recorded from the Gunn Point Beach area are listed as under the *TPWC Act* and the *EPBC Act* – see Table 4-2.

Palmer and Smit (2020) note that:

Within the [Gunn Point] study area there is adequate information relating to the presence of shorebird and seabird species, but more limited information on their abundance (season, duration and frequency) and habitat use for feeding and roosting.

Shorebird species inhabit the coastal zone, where they typically feed on invertebrates within the intertidal zone, and roost in the surrounding beaches, reefs and mangroves. Aerial surveys and site visits conducted by Chatto (2003) confirmed that the southern Shoal Bay area has one of the highest numbers of shorebird sightings within the Gunn Point region, with the Great Knot being the most abundant species in this area. The most important part of this survey block for shorebirds was the coast between Lee Point and Tree Point, followed by Bare Sand Island and the associated chain of islands to the south-east – all outside the proposal footprint. Within the Gunn Point peninsula, the most records were for the southern Shoal Bay (including southern Gunn Point Beach) – see Figure 4-11.

Palmer and Smit (2020) suggest that species abundances could be significantly lower than observed by Chatto (2003) due to subsequent habitat loss in Asian migratory stopover sites. It has been reported by Lilleyman (2020); however, that overall migratory shorebird numbers have increased in Darwin Harbour. The area surrounding the proposal has high recreation use – see Figure 4-12, which also likely impacts on shorebird presence, as they would be regularly disturbed by recreational users when foraging or resting (Palmer and Smit 2020).

Observations during field investigations for Project Sea Dragon found few shorebirds using the intertidal zone along the adjacent beach, potentially due to a lower abundance of invertebrates in the coarse sandy substrates, and high levels of disturbance by vehicles, people and pets along the beach (Seafarms 2018).

There are only a few shorebird surveys recorded in the NT Fauna Atlas. Of those that recorded abundance, a February 1984 survey of 755 individual shorebirds was the largest. This was mostly comprised of Greater Sand Plover (320), Great Knot (250) and Red Knot (100). The count of Greater Sand Plover exceeds 0.1 % of the flyway population (which is 200). Palmer and Smit (2020) note that further studies are required to understand shorebird abundance (season, duration and frequency) and habitat use for feeding and roosting.

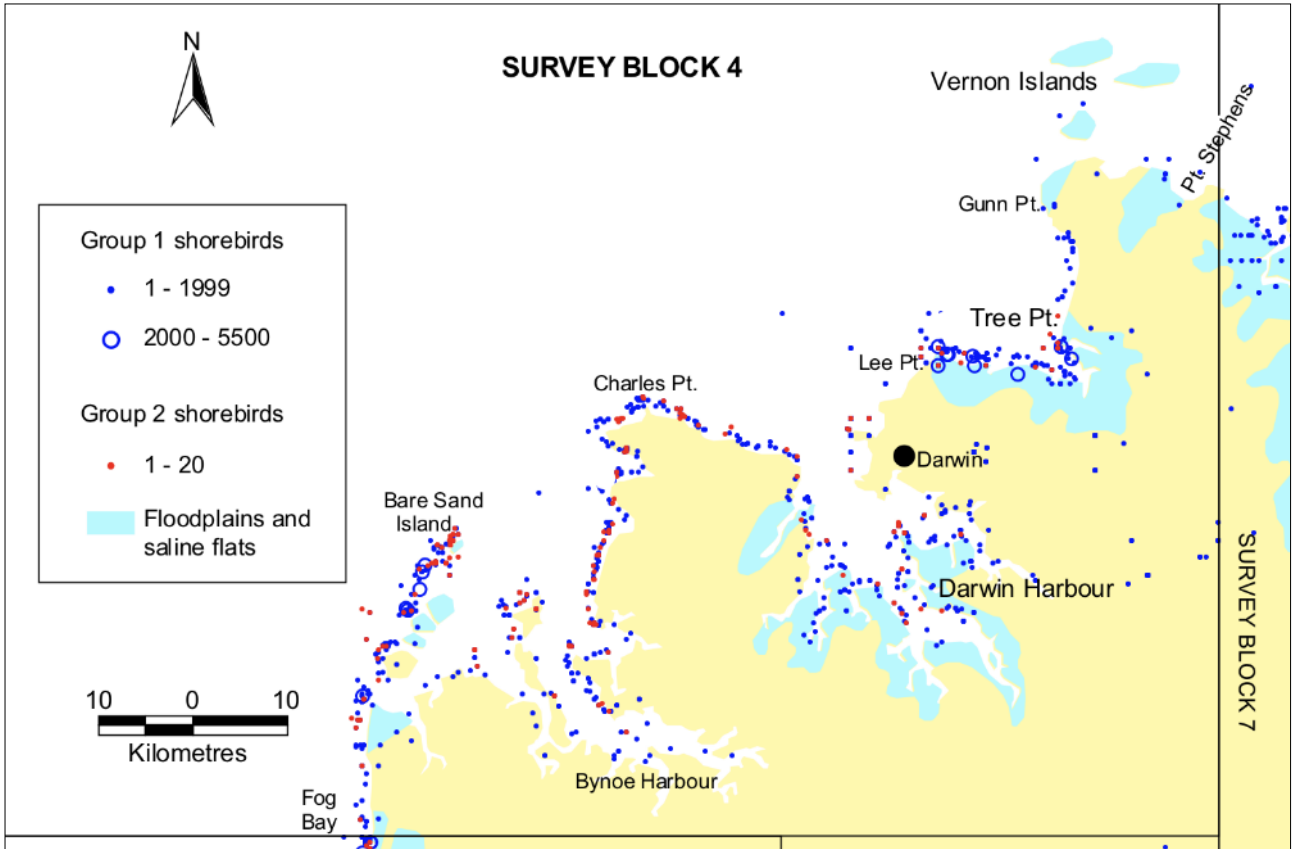


Figure 4-11. Map of Chatto (2003) shorebird survey results for the Darwin and Bynoe Harbour region



Figure 4-12. Picture of potential shorebird habitat at Gunn Point showing recreational disturbance