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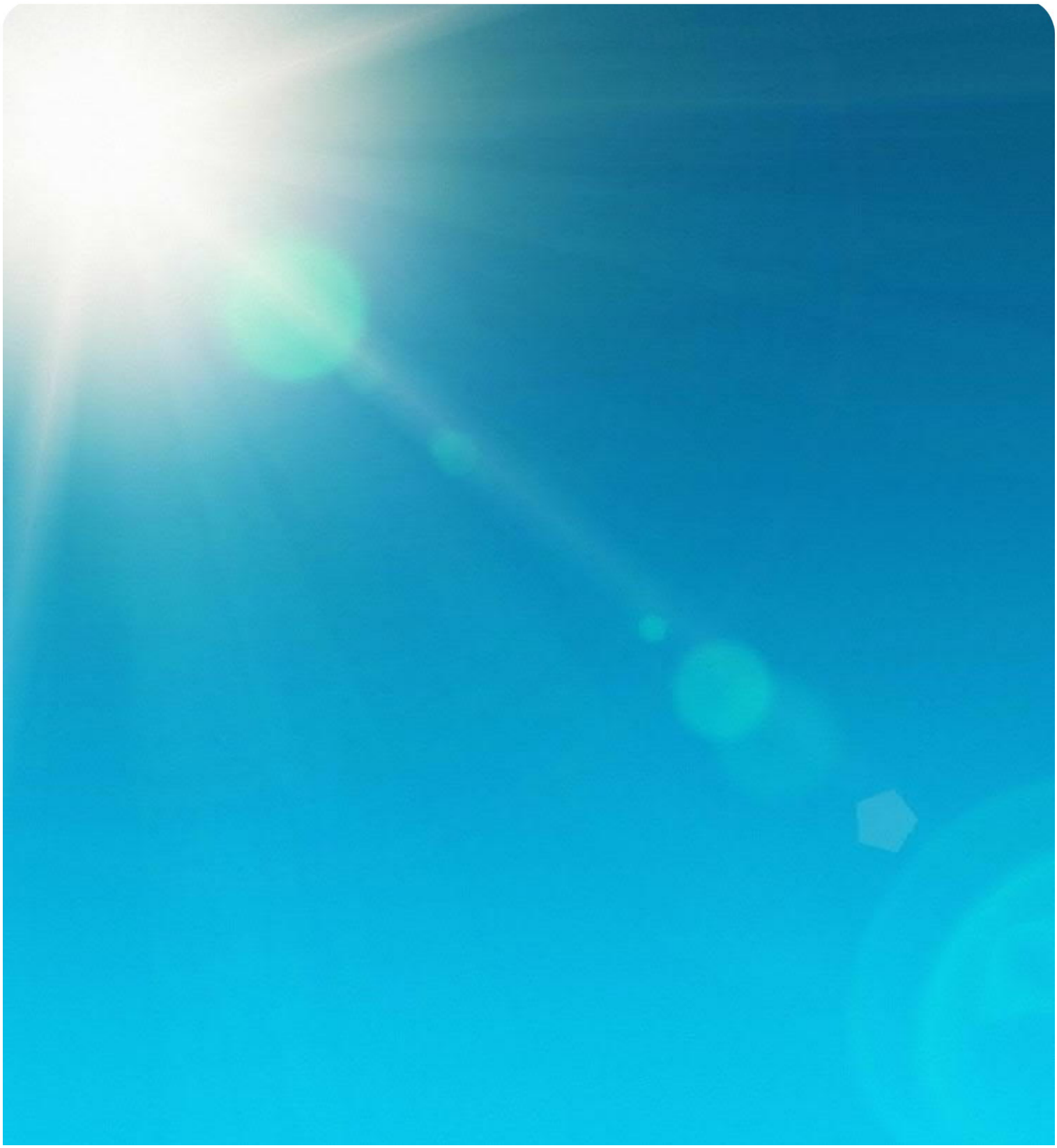
March 2022

Appendix P – Terrestrial Ecology Report – OHTL and Murrumujuk

Australia-Asia PowerLink Environmental Impact Statement



Terrestrial ecology – OHTL & Murrumujuk facilities

Australia – Asia PowerLink Proposal

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DOCUMENT CONTROL RECORD

Job	EZ20220
Document ID	204951-117
Authors	Clare Millen, Jose Carminatti Wenceslau, Nicole Clark, Anna Lemon & Glen Ewers

DOCUMENT HISTORY

Rev	Reviewed by	Approved by	Issued to	Date
1*	Tom Ewers-Reilly	Glen Ewers	Mark Branson	31 March 2021
2	Sun Cable	Glen Ewers	Sun Cable	6 December 2021
3	Sun Cable	Glen Ewers	Sun Cable	4 March 2022

** This version of the report considered the Darwin facilities being located on Middle Arm*

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EcOz Pty Ltd.
ABN: 81 143 989 039
Level 1, 70 Cavenagh Street
DARWIN NT 0800
GPO Box 381, Darwin NT 0800

Telephone: +61 8 8981 1100
Email: ecoz@ecoz.com.au
Internet: www.ecoz.com.au

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Appendix A Threatened species 'likelihood of occurrence' assessment
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Acknowledgements

The authors are grateful to Brydie Hill, Dani Stokeld, Damian Milne and Alaric Fisher (all from the Flora and Fauna Division of DEPWS) for making time to discuss various aspects of this report.

Front cover

High-resolution aerial image of a section of the OHTL proposal footprint

EXECUTIVE SUMMARY

The Sun Cable Australia-Asia PowerLink proposal has multiple terrestrial components located within the NT. This report covers the overhead transmission line (OHTL) corridor and the infrastructure at Murrumujuk on Gunn Point. The OHTL corridor has been divided into two sections:

- The first 719 km which lie within a railway corridor that has already been subjected to some previous disturbance and clearing, but which also includes remnant bushland.
- The final 69 km which will be contained with a utilities corridor, two-thirds of which is natural bushland.

The clearing of land for the OHTL and Murrumujuk components of this proposal has the potential to negatively impact upon terrestrial ecological values. The disturbance associated with the OHTL and Murrumujuk components of this proposal is relatively small-scale, localised and, for the OHTL particularly, there is some flexibility as to where it occurs. Consequently, with proper planning and design, the disturbance footprint is inherently unlikely to have a significant impact on most, if not all, ecological values. To justify this assertion, and to ensure that the impact of developing the OHTL and Murrumujuk footprints is as low as possible, it is necessary to identify which ecological values are present within the OHTL and Murrumujuk proposal footprints.

The purpose of this report is to identify and describe the relevant threatened species, significant vegetation types and threatening processes to such a degree as to be able to identify the need for any further surveys and to inform an impact assessment. To this end – using desktop and field data – this report:

a) Presents an overview of the environmental context within the OHTL and Murrumujuk proposal footprints – including significant vegetation types.

b) Uses that overview to undertake a threatened species 'likelihood of occurrence' assessment.

c) Identifies areas within the OHTL and Murrumujuk proposal footprints that have a high likelihood of supporting threatened species and/or significant vegetation types.

Based on the research undertaken for this report, there are known and potential ecological values within the footprints of the Murrumujuk facilities, OHTL railway corridor and OHTL utilities corridor, as summarised below. These will require further surveys to verify presence/significance, as well as consideration in the EIS.

OHTL railway corridor

The following protected and/or significant areas are relevant to the OHTL railway corridor footprint:

- Three conservation parks/reserves – Manton Dam Recreation Area, Litchfield National Park and Kintore Caves Conservation Reserve.
- The Arnhem Plateau Sandstone Shrubland Complex
- Yinberrie Hills Site of Conservation Significance.

The OHTL railway corridor footprint is mapped as passing through, or adjacent to, the following significant vegetation types:

- Wetlands, most notably the Adelaide River floodplain and south towards Hayes Creek
- Riparian vegetation along many of the 154 watercourses crossed by the corridor
- Dry rainforest at one location near Katherine
- Two sinkholes within 100 m of the corridor.

Physical disturbance within the OHTL railway corridor footprint will be localised and there is a substantial degree of flexibility as to where the towers can be placed. It is therefore assumed that threatened species with general habitat requirements and/or wide ranges cannot be significantly impacted upon by proposal activities. The threatened species 'likelihood of occurrence' assessment for the OHTL railway corridor

therefore focussed on identifying species that have restricted ranges or localised core habitat requirements. On that basis, the OHTL railway corridor footprint passes through, or adjacent to, habitat mapped as having a high likelihood of supporting the following threatened species:

- Seven riparian species – one raptor, two water monitors, one rat and three species of sawfish.
- Three bat species, including a proximate cave that is a significant maternity site for Ghost Bats (*Macroderma gigas*).
- Gouldian Finch (*Erythrura gouldiae*) – most notably breeding habitat around the Yinberrie Hills region
- Greater Bilby (*Macrotis lagotis*) at the southern end of the corridor.
- Three flora species in the northern end of the corridor – *Typhonium praetermissum, Stylidium ensatum* and *Helicteres macrothrix*.

OHTL utilities corridor

The following protected and/or significant areas are relevant to the OHTL utilities corridor footprint:

- Two conservation parks/reserves – Shoal Bay Coastal Reserve and transecting Black Jungle Conservation Reserve.
- Three Sites of Conservation Significance – Shoal Bay, Howard sand plains and Adelaide River coastal floodplain.

The OHTL utilities corridor footprint is mapped as passing through, or adjacent to, the following significant vegetation types:

- Wetlands
- Riparian vegetation
- Rainforest
- Sandsheet heath
- Woodland containing large hollow-bearing trees.

On the basis of the same assumptions discussed above for the OHTL railway corridor, the OHTL utilities corridor footprint passes through, or adjacent to, habitat mapped as having a high likelihood of supporting the following threatened species:

- Three sandsheet heath species – the Howard River Toadlet (*Uperoleia daviesae*) and two small flora species – *Utricularia dunstaniae* and *Cleome insolata*.
- Mertens' Water Monitor (*Varanus mertensi*) associated with watercourses.
- Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus nudicluniatus*)
- High density areas of Darwin Cycad (*Cycas armstrongii*).
- Three flora species:
    - *Typhonium praetermissum* in certain woodland communities
    - *Stylidium ensatum* along watercourses
    - Darwin Palm (*Ptychosperma macarthurii*) in the Black Jungle region.

Murrumujuk

The Underground Cable Corridor and Land Sea Joint Station components of the Murrumujuk proposal footprint overlap with the Shoal Bay Site of Conservation Significance.

One wetland community occurs in the south-west corner of the Darwin Converter Site.

Eleven threatened species have a reasonable likelihood of occurring within the Murrumujuk footprint:

- Areas of high-density Darwin Cycads.
- A significant subpopulation of *Typhonium praetermissum* is present immediately to the west of the Darwin Converter Site. Of the 578 known records, only 2 were within the Darwin Converter Site footprint, and approximately 10 are within the Underground Cable Corridor. Not all of the high likelihood habitat within the Darwin Converter Site has been surveyed.
- Yellow-spotted Monitors (*Varanus panoptes*) have been recently detected at six sites across the Gunn Point peninsula, including at a site 800 m north of the Land Sea Joint Station.
- There are 8 threatened shorebirds that have been recorded within the Gunn Point area or adjacent to the Murrumujuk footprint, these are:
    - Bar-tailed Godwit (western Alaskan subspecies) (*Limosa lapponica baueri*)
    - Bar-tailed Godwit (northern subspecies) (*Limosa lapponica menzbieri*)
    - Curlew Sandpiper (*Calidris ferruginea*)
    - Far Eastern Curlew (*Numenius madagascariensis*)
    - Great Knot (*Calidris tenuirostris*)
    - Greater Sand Plover (*Charadrius leschenaultii*)
    - Lesser Sand Plover (*Charadrius mongolus*)
    - Red Knot (*Calidris canutus*)

There are 10 other migratory shorebird species known from the Gunn Point Beach area. The area qualifies as important habitat for migratory species because there is a count of Greater Sand Plover that exceeds 0.1 % of the flyway population.

1 INTRODUCTION

Sun Cable is developing the Australia-Asia PowerLink (AAPowerLink; 'the proposal') to generate, store, transmit and deliver renewable energy. Sun Cable is proposing to establish a large-scale Solar Precinct on Powell Creek Station in the Barkly region, approximately 70 km south-west of Elliott. The electricity produced will be exported via an Overhead Transmission Line (OHTL) to Murrumujuk (near Darwin), and then on to Singapore via a Subsea Cable System.

EcOz Environmental Consultants (EcOz) was engaged by Sun Cable to provide a description of the environment and ecological values within the OHTL and Murrumujuk area of influence to inform the Environmental Impact Statement (EIS). The clearing of land for these components of this proposal has the potential to negatively impact upon terrestrial ecological values. The disturbance associated with the OHTL and Murrumujuk components of this proposal is relatively small-scale, localised and, for the OHTL particularly, there is some flexibility as to where it occurs. Consequently, with proper planning and design, the disturbance footprint is inherently unlikely to have a significant impact on most, if not all, ecological values. To ensure that the impact of developing the OHTL and Murrumujuk footprints is as low as possible, it is necessary to identify which ecological values are present within the OHTL and Murrumujuk proposal footprints.

The purpose of this report is to identify and describe the relevant threatened species, significant vegetation types and threatening processes to such a degree as to be able to identify the need for any further surveys and to inform an impact assessment. This report will also be used by Sun Cable to inform their final planning and design to avoid or mitigate any significant impacts on ecological values, such as infrastructure placement in the OHTL corridor. To this end – using desktop and field data – this report:

a) Presents an overview of the environmental context within the OHTL and Murrumujuk proposal footprints – including mapping of significant vegetation types.

b) Uses that overview to undertake a threatened species 'likelihood of occurrence' assessment.

c) Identifies areas within the OHTL and Murrumujuk proposal footprints that have a high likelihood of supporting threatened species and/or significant vegetation types.

For the purposes of identifying terrestrial ecological values, the Murrumujuk proposal footprint is the infrastructure presented in

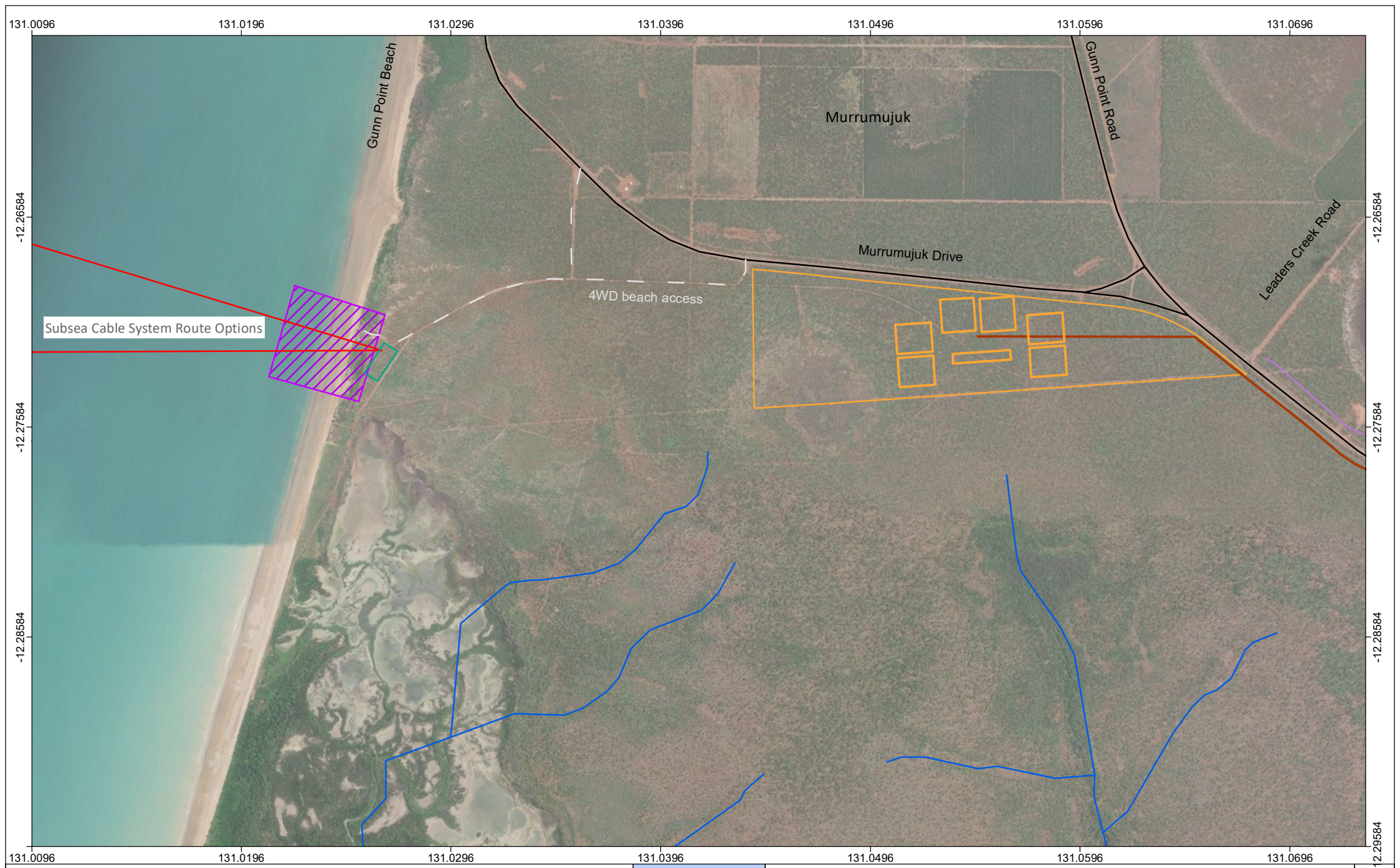
Figure 1-1 and Table 1-1. The Darwin Converter Site is on a 120 ha lot, a 66 ha portion of which will contain infrastructure.

Table 1-1. Murrumujuk proposal footprint

Component	Area (ha)
Darwin Converter Site	55
Underground Cable Corridor	10
Land Sea Joint Station	1
TOTAL	**66**

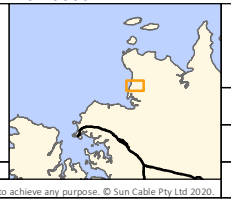
The OHTL corridor has been divided into two sections (see Figure 1-2):

- The first 719 km which lie within a railway corridor that has already been subjected to some previous disturbance and clearing, but which also includes remnant bushland.
- The final 69 km which will be contained with a utilities corridor, two-thirds of which is natural bushland.



Legend

- Darwin Converter Site
- Subsea Cable System Route options
- OHTL Route
- Shore Crossing
- LandSeaJoint
- 4WD beach access
- Road
- Streams



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

Figure 1-1: Map of Murrumujuk proposal footprint

Project: Australia-Asia PowerLink	Reference: M-Files Document ID 204951	Revision: A
Coordinate System: GDA2020	Date: 08/11/2021	
0 1 Kilometres	Scale: 1:25,000	A4

N

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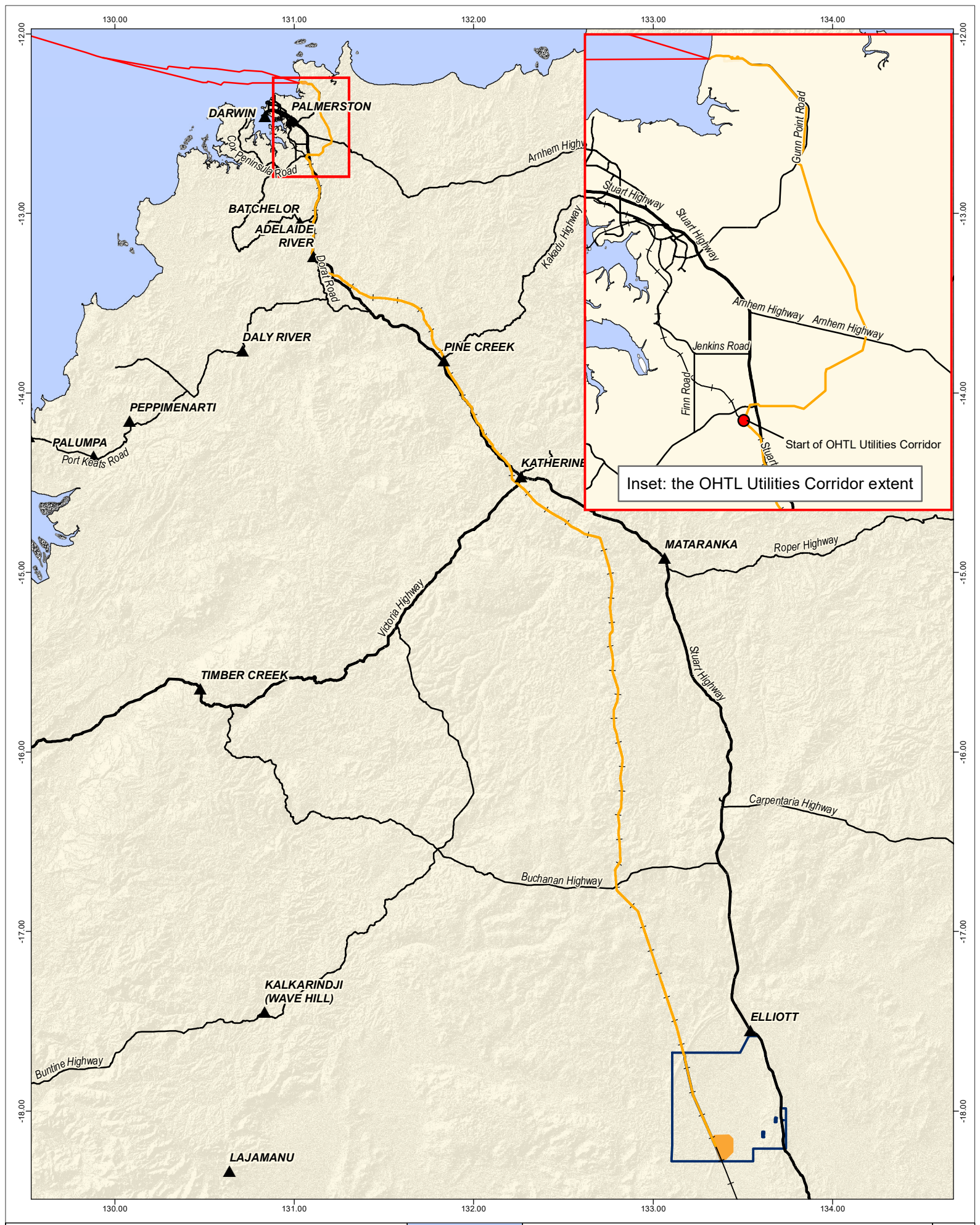

Legend

- Town
- Subsea cables
- OHTL Route
- Solar Precinct
- Powell Creek Station
- Railways

Roads

- Principal road
- Secondary road

Source: Data sources...

DARWIN

Figure 1-2: Map of the OHTL proposal footprint

N

Project: Australia-Asia PowerLink

0 30 60 90 Kilometres

Reference: M-Files Document ID 204951

Date: 08/11/2021 | Revision: A

Scale: 1:2,891,752

Coordinate System: GDA2020 | A4

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2 OHTL RAILWAY CORRIDOR

The majority of the Overhead Transmission Line (OHTL) is proposed to be situated in the existing railway corridor – henceforth referred to as the 'OHTL railway corridor' – extending for 719 km from the Solar Precinct site to Livingstone.

The information for this section comes almost entirely from desktop databases and reports. There is only proposal-specific field survey information for approximately 150 km of the southernmost end (see Section 2.1.1).

The focus on a desktop level of assessment will enable Sun Cable to consider the ecological values during final proposal design (i.e location of transmission line towers) and devise appropriate mitigate measures for design, construction and operations. Actual proposal works may not occur until a number of years after approvals, and therefore surveys that may be required for pre-construction approvals – such as weed and land type mapping – will be more relevant and accurate if undertaken when it is time for those approvals to be sought. In addition, it is highly likely that small lengths of the OHTL corridor alignment will change after the EIS process; further justification for postponing those surveys.

References throughout this report to 'KP' relate to the *kilometre point* (i.e. distance from the Solar Precinct along the OHTL corridor).

2.1 Environmental context

The existing environmental context of the OHTL railway corridor is described in this section. This information will be used to inform the 'likelihood of occurrence' of threatened species and to identify other potential constraints.

2.1.1 Previous surveys

In late 2020, EcOz undertook a targeted survey for the Greater Bilby (*Macrotis lagotis*) along the southernmost 150 km of the OHTL proposal footprint because that land system – Redsan – supports suitable habitat and traverses very close to several historic and recent records of the species. The results of that survey are presented in Section 2.3.2.

No other ecological surveys are known to have been undertaken within the OHTL railway corridor.

2.1.2 Bioregions

Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale, thus providing a useful means for simplifying and reporting on more complex patterns of biodiversity (NPWS 2003). NT bioregions are described in Baker et al. (2005).

The 788 km length of the OHTL railway corridor spans five diverse bioregions. These are described in Table 2-1 and shown in Figure 2-1.

Table 2-1. Description of bioregions that occur within the OHTL railway corridor (listed from north to south)

Bioregion	Extent	Landform	Vegetation
Darwin Coastal (DAC)	KP 736 onwards	Gently undulating plains on laterised sandstones and siltstones. Extensive and diverse floodplain associated with the lower reaches of the many large river systems.	The dominant inland vegetation type is *Eucalyptus tetrodonta* and *Eucalyptus miniata* dominated tall open forest. There are substantial areas of mangroves, and rainforest and other riparian vegetation fringing the rivers.
Pine Creek (PCK)	KP 464 – 736	Predominantly hilly to rugged ridges with undulating plains on igneous granite and metamorphic gneiss.	Mostly open mixed Eucalyptus woodlands or tall forest dominated by *Eucalyptus tetrodonta* and *Eucalyptus miniata*, with patches of monsoon rainforests, Melaleuca woodlands, riparian vegetation and tussock grasslands.
Daly Basin (DAB)	KP 402 – 501	Gently undulating plains and scattered low plateau remnants; loamy and sandy red earths on sandstones, siltstones and limestones.	*Eucalyptus tetrodonta* and *Eucalyptus miniata* dominated open forest with perennial and annual grassy understorey.
Sturt Plateau (STU)	KP 20 – 402	Flat to gently undulating plains with mainly lateritic soils. Deep sands occur in the south and cracking clays in the southeast.	Predominantly Eucalypt woodlands or tall shrublands and woodlands of bullwaddy and lancewood. Perennial grasses dominate in more open areas.
Tanami (TAN)	KP 0 – 10	Mainly red sandplains with small areas of alluvial plains, low ridges and stony rises.	Predominantly spinifex hummock grassland with a tall sparse shrub overstorey of *Hakea subarea*, desert bloodwoods, acacias and grevilleas.

2.1.3 Significant areas

The OHTL railway corridor occurs within, or proximate to, a number of significant areas in the northern portion of the OHTL.

Parks and reserves

The OHTL railway corridor runs through the Manton Dam Recreation Area, approximately 60 km south-east of Darwin. This area is used for boating, fishing and water sports. The OHTL railway corridor runs very near (~400 m) to the easternmost edge of Litchfield National Park at KP 658, and close (~2 km) to Kintore Caves Conservation Reserve at KP 466. These parks and reserves are depicted on Figure 2-1.

Sites of Conservation Significance

The NT Government has identified a number of Sites of Conservation Significance (SoCS) – the most important sites for biodiversity conservation for the NT. These are described in Harrison et al. (2009).

The OHTL railway corridor crosses through the Yinberrie Hills SOCS just north of Katherine. It is directly adjacent to the Western Arnhem Plateau SOCS, also just north of Katherine. The values of these SOCS are briefly described below.

The Yinberrie Hills SOCS is a hilly area approximately 40 km north of Katherine, and is a key site for the endangered Gouldian Finch. The ungrazed wooded hills have persistent waterholes and springs providing a feeding ground for finches through the dry season, while hollow-bearing trees support nesting in the breeding

season. Other threatened species recorded in this SOCS include Northern Quoll, Northern Crested Shrike-tit, Partridge Pigeon, the Yellow-spotted and Mertens' Water Monitors, and the threatened bladderwort *Utricularia singeriana* (Pavey et. al. 2009e).

The Western Arnhem Plateau SOCS extends from Nitmiluk National Park near Katherine, north-east almost to Maningrida in the north of the NT. Its geology, topography and biodiversity are so distinct from the surrounding landscape that it is recognised as its own bioregion – the Arnhem Plateau – and is considered to be of international significance. It contains a greater diversity of NT's endemic species than anywhere else and contains a high number (at least 32) of threatened species. It also supports a high proportion of the NT's rainforest (Pavey et. al. 2009d).

These SOCS are all depicted on Figure 2-1.

Sites of Botanical Significance

The NT Government has identified a number of Sites of Botanical Significance (SOBS) – areas in the southern half of the NT that have distinguishable vegetation features from the surrounding landscape, and therefore are considered important for plant conservation generally, and specifically for conserving significant plant taxa. The OHTL railway corridor does not fall within, or adjacent to, any SOBS.

2.1.4 Surface water

The OHTL railway corridor crosses multiple river catchments. Using high resolution aerial imagery provided by the NT Government, a virtual flyover of the entire OHTL railway corridor was undertaken in order to identify and locate all watercourse crossings. The majority of watercourse crossings are in the northern end of the OHTL railway corridor. South of Katherine there are only 22 watercourse crossings.

Stream order is a hierarchy of watercourse branches – the higher a watercourse's number at a particular point, the more the watercourse branches upstream. Of the 154 watercourse crossings, only 4 are of a stream order such that they are considered rivers – see Table 2-2. Those are the Adelaide River, Fergusson River, Edith River and Katherine River. Major rivers – stream order 4 and above – are shown in Figure 2-2.

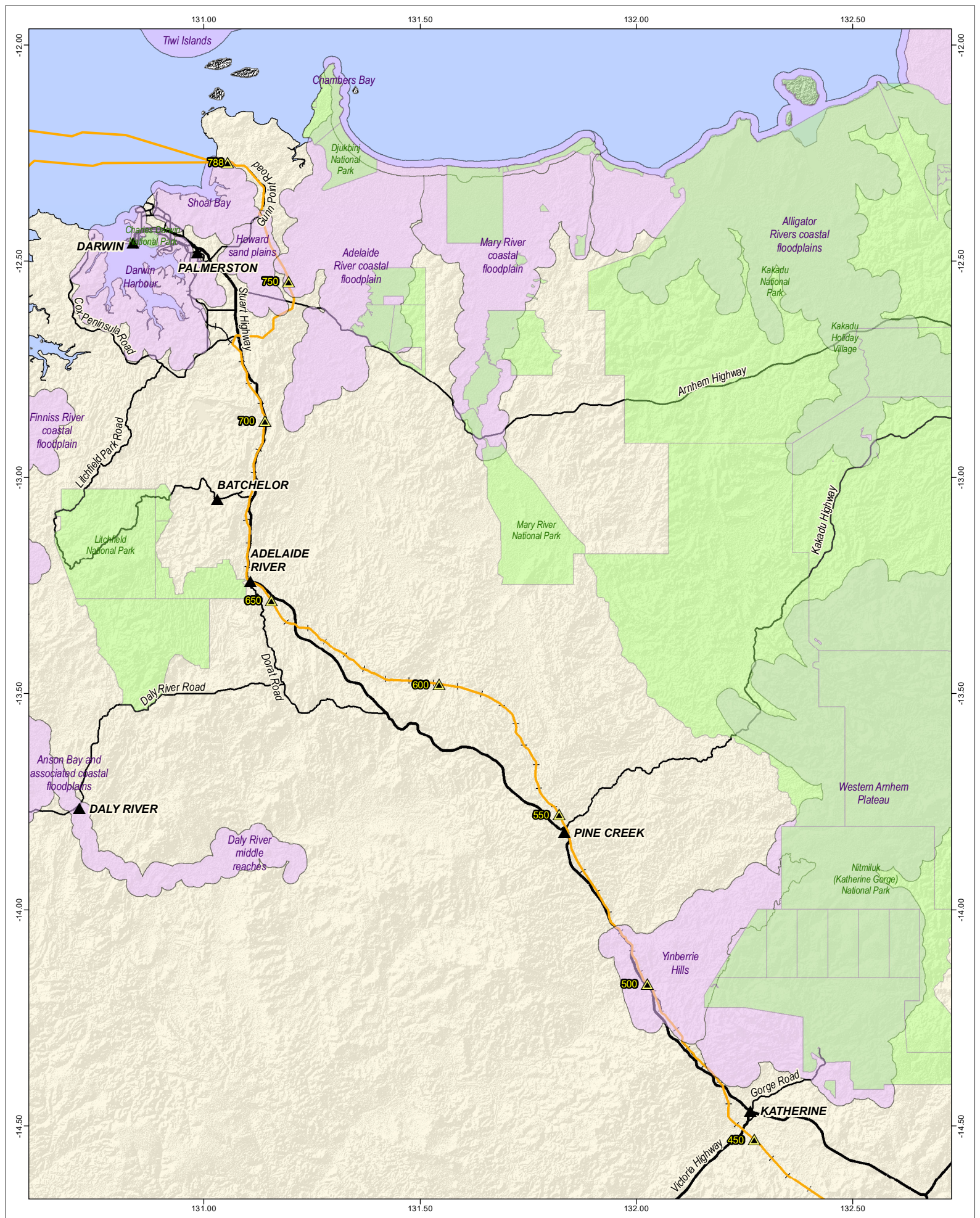
The OHTL railway corridor crosses 12 named watercourses:

Adelaide River	Margaret River	Edith River
Burrell Creek	Saunders Creek	Katherine River
Bridge Creek	Cullen River	King River
Howley Creek	Fergusson River	Elizabeth River

Unnamed tributaries of major rivers are also crossed – including those of the Elsey Creek, McKinlay River, Coomalie Creek and Manton River (these tributaries are generally narrow and ephemeral at the point of the OHTL crossing). The major perennial watercourse crossings are the Katherine River, Edith River, Fergusson River and Adelaide River, which are generally wide, defined channels with significant riparian vegetation.

Table 2-2. Summary of watercourse crossings by the OHTL railway corridor

Watercourse type	Stream order	No. of crossings
Drainage line	1	98
Intermittent stream	2	28
Creek	3	14
	4	10
River	5	3
	6	1



Legend

- Town
- AAPowerLink infrastructure
- National Parks
- Sites of Conservation Significance
- OHTL Kilometre Point (KP)
- Railways

Roads

- Principal road
- Secondary road

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

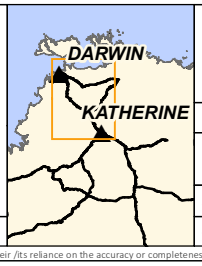


Figure 2-1: Map of bioregions and significant areas relevant to the OHLT proposal footprint

Project: Australia-Asia PowerLink

0 30 Kilometers

Scale: 1:1,200,000 | Datum: GDA2020

Coordinate System: GDA2020 | A4

Reference: M-Files ID 204951

Date: 25/02/2022 | Revision: A

N

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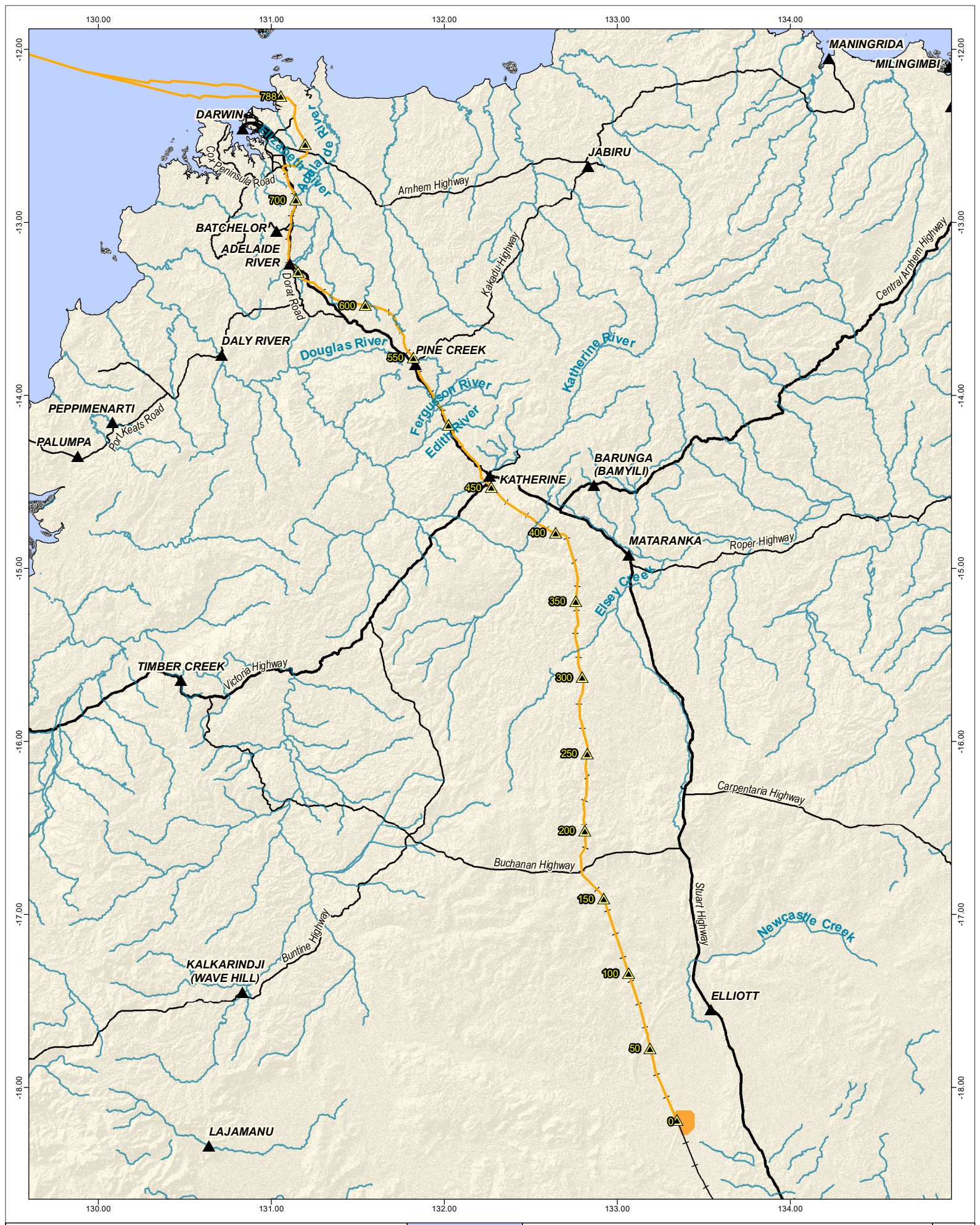

Legend

- OHTL Route
- Solar Precinct
- Major Drainage
- OHTL Kilometre Point (KP)
- Railways
- **Roads**
- Principal road
- Secondary road

Source: Sun Cable, Geoscience Australia, NR Maps

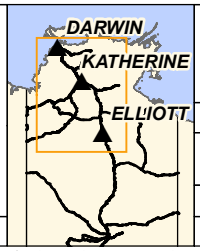

Figure 2-2: Map of major surface watercourses intersected by the OHTL proposal footprint

Project: Australia-Asia PowerLink

0 30 60 90 Kilometres

Scale: 1:3,000,000

Coordinate System: GDA2020 | A4

Reference: M-Files Document ID 204951

Date: 03/11/2021 | Revision: A

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2.1.5 Land use

The OHTL railway corridor passes through a diverse range of land uses from Elliott to Darwin. The railway line that it follows is nearly entirely located within easement parcels, leased to the AustralAsia Railway Corporation.

Based on Northern Territory Land Use Mapping (Staben and Edmeades 2017), two-thirds of the OHTL railway corridor passes through land used for grazing native vegetation. Of the remainder, ~11% is classed as traditional indigenous uses – managed resource protection, ~7% is residual native cover, and the remaining ~17% covers 55 other different land uses, most less than 1%. These land uses are depicted in Figure 2-3.

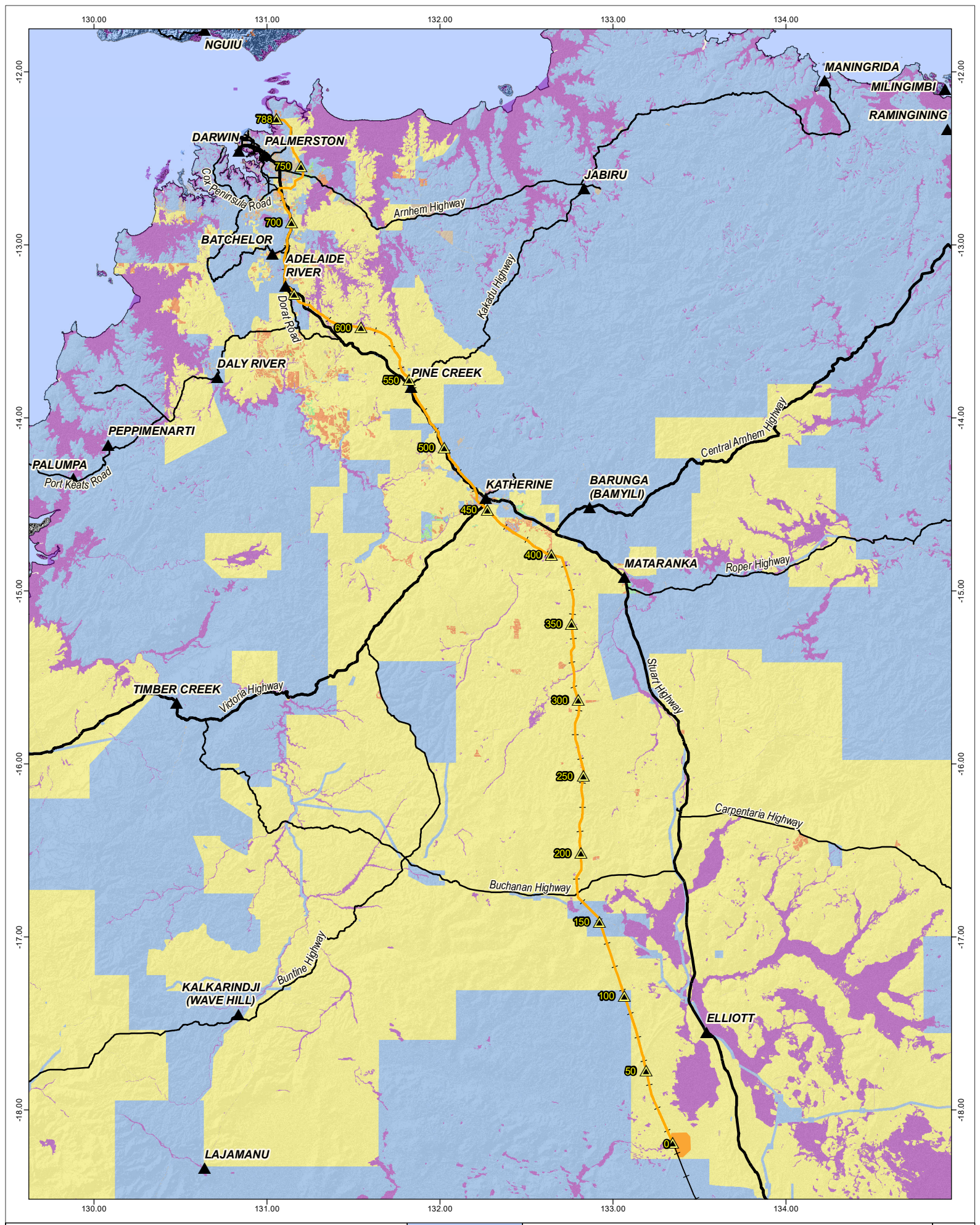
2.1.6 Vegetation

The National Vegetation Information System (NVIS) is a Commonwealth managed vegetation mapping dataset. A desktop assessment of level 3 NVIS (i.e. presenting the dominant species for each vegetation storey) shows that the OHTL railway corridor intersects with 20 native vegetation communities that fall under 6 broad community categories – as described in Table 2-3. Eucalyptus and Corymbia savanna woodlands dominate, as they do across northern Australia (see Figure 2-4).

Table 2-3. Summary of the vegetation communities relevant to the OHTL railway corridor

Broad community	Dominant species			Coverage
	Upper	Mid	Ground	
Open forest	Acacia low open forest	-	Eriachne low open tussock grassland	0.4%
	Acacia mid open forest	Acacia tall open shrubland	Chrysopogon low open tussock grassland	2.3%
	Eucalyptus mid open forest	Livistona low sparse palmland	Heteropogon tall tussock grassland	5.8%
	Macropteranthes low open forest	Acacia mid sparse shrubland	Aristida low open tussock grassland	0.9%
	Melaleuca mid open forest	Pandanus low sparse palmland	Germainia mid open tussock grassland	0.0%
	Melaleuca mid open forest	Melaleuca low open woodland	Eleocharis low open sedgeland	0.2%
Open hummock grassland	Eucalyptus low isolated trees	Acacia tall sparse shrubland	Triodia low open hummock grassland	1.6%
Open woodland	Eucalyptus low open woodland	Acacia mid open shrubland	Triodia low hummock grassland	8.5%
Tussock grassland	Eucalyptus low open woodland	Carissa mid sparse shrubland	Chrysopogon low tussock grassland	0.8%
Woodland	Acacia low woodland	-	Eragrostis low open tussock grassland	2.6%
	Acacia mid woodland	-	Eriachne mid open tussock grassland	0.1%
	Corymbia mid woodland	Eucalyptus low open woodland	Sorghum mid tussock grassland	11.5%
	Eucalyptus low woodland	Erythrophleum low open woodland	Sorghum mid tussock grassland	10.4%
		Carissa mid sparse shrubland	Chrysopogon mid tussock grassland	0.3%
	Eucalyptus mid woodland	Livistona unknown palm	Sorghum mid tussock grassland	2.8%

Broad community	Dominant species			Coverage
	Upper	Mid	Ground	
		Gardenia tall open shrubland	Heteropogon mid tussock grassland	2.6%
		Erythrophleum low open woodland	Chrysopogon low tussock grassland	4.0%
		Erythrophleum low open woodland	Sorghum mid tussock grassland	15.6%
		Flueggea mid sparse shrubland	Sehima mid tussock grassland	1.6%
		Hakea tall sparse shrubland	Heteropogon mid tussock grassland	0.4%
	Macropteranthes low woodland	-	Chrysopogon mid open tussock grassland	3.0%
		-	Panicum low open tussock grassland	1.7%
	Melaleuca low woodland	Pandanus low sparse palmland	Eleocharis mid sedgeland	0.0%
		Melaleuca mid sparse shrubland	Eulalia low open tussock grassland	0.2%
	Melaleuca mid woodland	Petalostigma tall sparse shrubland	Chrysopogon mid open tussock grassland	0.4%
		Melaleuca low open woodland	Chrysopogon mid open tussock grassland	0.2%
		Asteromyrtus low open woodland	Triodia low open hummock grassland	0.2%
Other	Pastoral/Horticulture/roads			18.6%
	Rural/Residential/roads			2.3%
	Urban/Roads			0.9%



Legend

- OHTL Route
- Solar Precinct
- Railways

Roads

- Principal road
- Secondary road

OHTL Kilometre Point (KP)

Land use mapping primary classes

- Class 1. Conservation and Natural Environments
- Class 2. Production from Relatively Natural Environments
- Class 3. Production from Dryland Agriculture and Plantations
- Class 4. Production from Irrigated Agriculture and Plantations
- Class 5. Intensive Uses
- Class 6. Water

Source: Sun Cable, Geoscience Australia, NR Maps

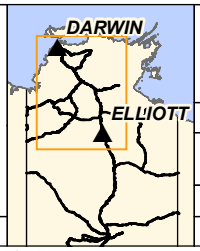


Fig 2-3: Map of land uses within the OHTL proposal footprint

Project: Australia-Asia PowerLink

0 30 60 90 Kilometers

Scale: 1:3,000,000

Coordinate System: GDA2020

A4

Reference: M-Files Document ID 204951

Date: 03/11/2021

Revision: A

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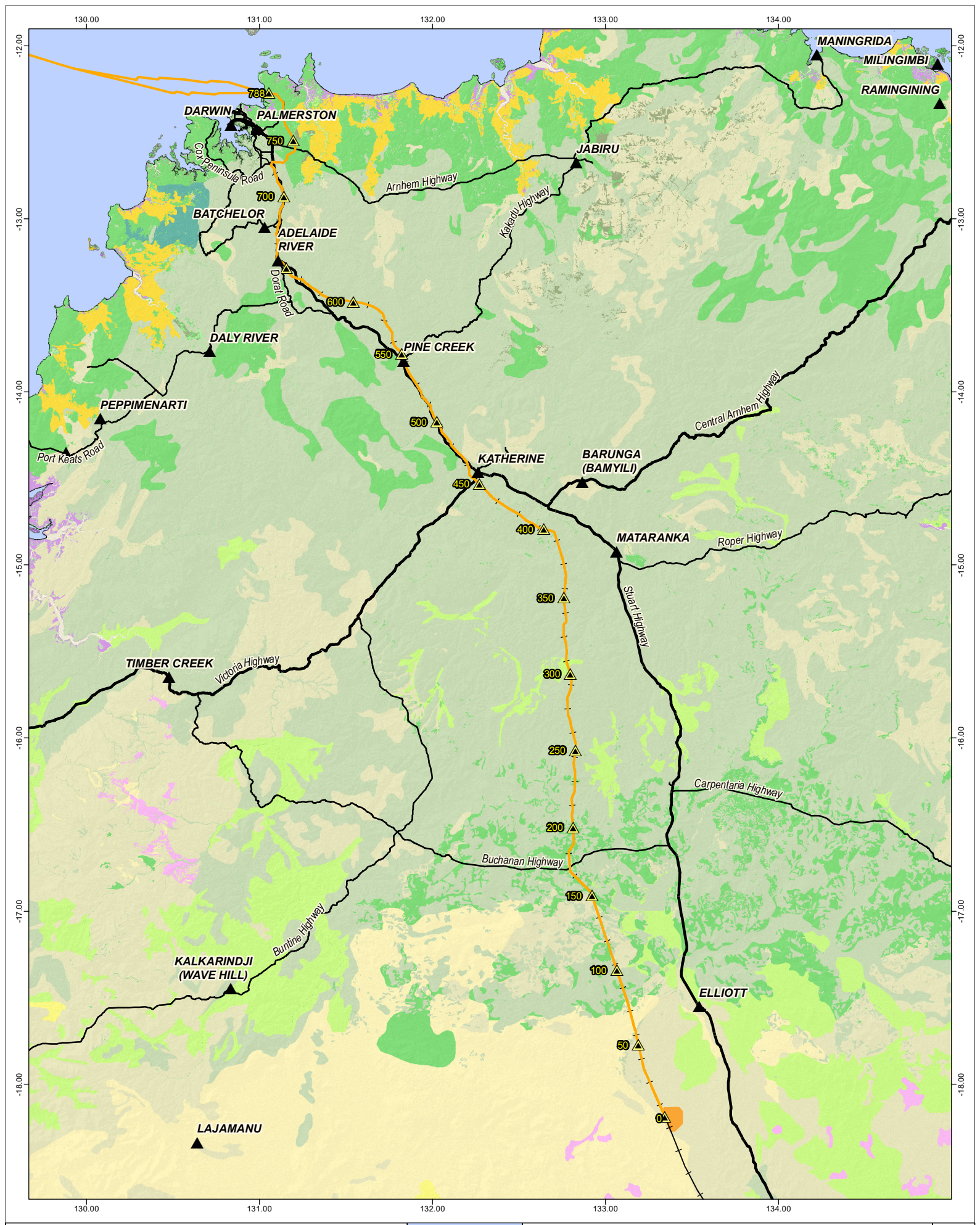

Legend

- AAPowerLink infrastructure
- Solar Precinct
- Railways

Roads

- Principal road
- Secondary road
- OHTL Kilometre Point (KP)

Broad vegetation communities

- Mid closed forest
- Open woodland
- Unknown
- Sparse tussock grassland
- Sparse samphire shrubland
- Sparse shrubland
- Tussock grassland
- Woodland
- Open forest
- Closed tussock grassland
- Inland salt lake
- Hummock grassland
- Closed forest
- Open tussock grassland
- Open hummock grassland
- Open palmland
- Open shrubland
- Forbland

Source: Sun Cable, Geoscience Australia, NR Maps

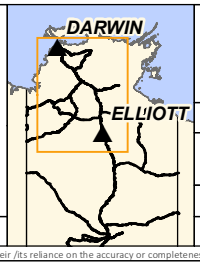

Figure 2-4: Map of broad vegetation communities within the OHTL railway corridor

Project: Australia-Asia PowerLink

0 30 60 90 Kilometres

Scale: 1:3,000,000

Coordinate System: GD2020 | A4

Reference: M-Files Document ID 204951

Date: 03/11/2021 | Revision: A

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2.1.7 Land systems

Christian and Stewart (1968) define a land system as ‘an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation’. These have been mapped by across the NT by the government and are at a significantly smaller scale than a bioregion (i.e. bioregions constitute many different land systems). Within each land system, a set of component land units is defined. In some areas of the NT, mapping has been undertaken to the level of detail of land units. However, there is no land unit mapping for the majority of the OHTL railway corridor.

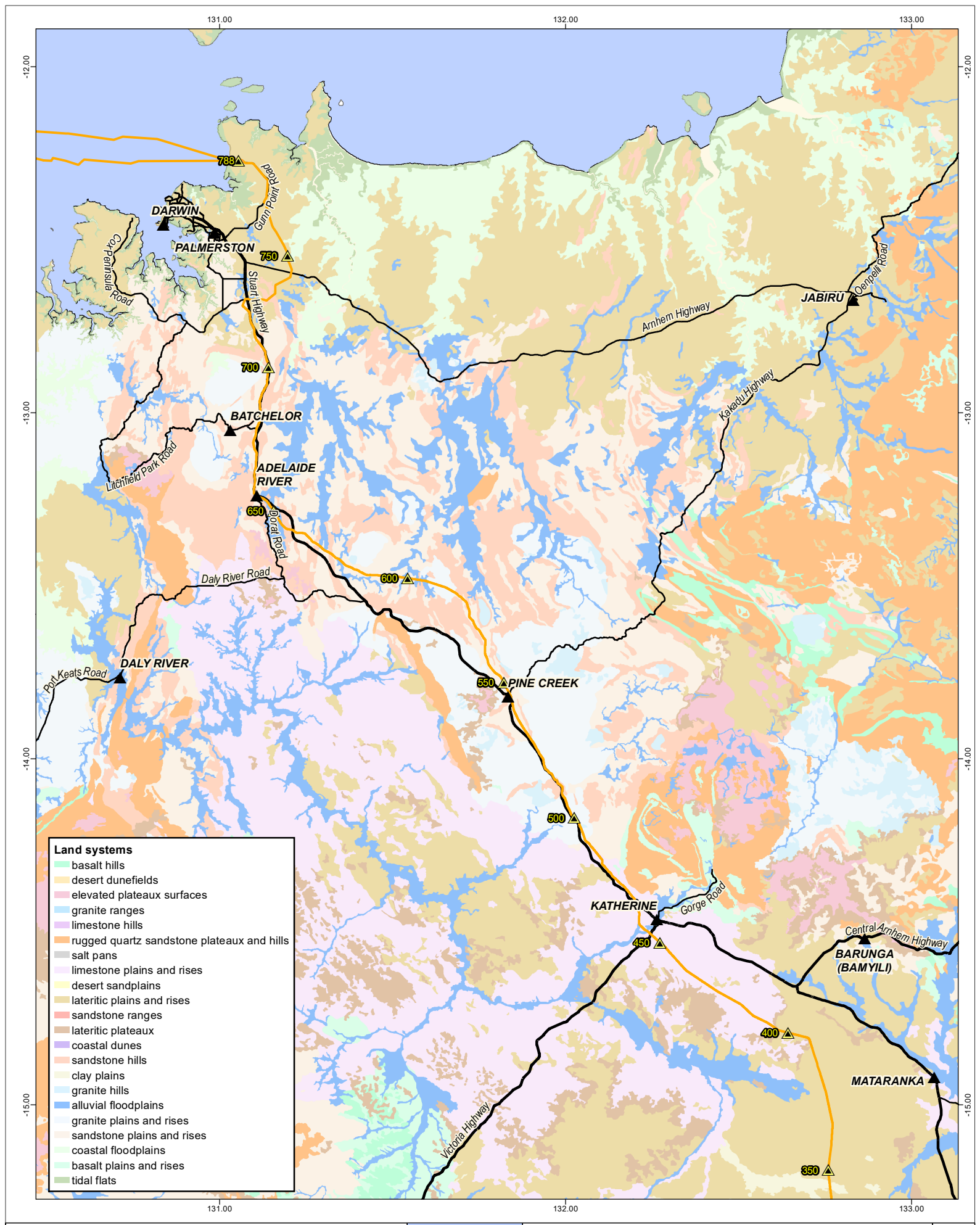
Land system surveys in the north of the NT have been undertaken in the NT at a scale of 1:250,000. Land system surveys in the south of the NT have been undertaken in the NT at a scale of 1:1,000,000. These datasets have been amalgamated to create a land systems map for the Northern Territory (Lynch et al. 2012). It shows that the OHTL railway and utilities corridor intersects 38 land systems that can be categorised within 11 classes – ranging from alluvial floodplains to desert sandplains. These are described in Table 2-4. The northern half of the OHTL railway corridor predominantly traverses lateritic plains and rises, and sandstone plains and rises (see Figure 2-5). The southern half of the OHTL railway corridor predominantly traverses lateritic plains and rises, and desert sandplains (see Figure 2-6).

Table 2-4. Summary of the landforms relevant to the OHTL railway corridor (and approximate distance intersected)

Class	Landform	Soil*	Vegetation*	Land systems	Coverage
Alluvial floodplains	Alluvial floodplains, swamps, drainage depressions and alluvial fans; sandy, silty and clay soils on Quaternary alluvium	Red, brown, yellow silty and sandy earths, brown and grey clays	Low to tall *Eucalyptus* woodland over tall grasses; mid-high woodland of *Melaleuca* spp. and *Corymbia* spp. over tall grasses; Tall grasslands of *Chrysopogon* spp., *Sorghum* spp. and *Themeda* spp.	Banyan, Effington, Fabian, Flatwood, Jundee, McKinlay, Western	3.0%
Clay plains	Level to gently undulating clay plains (black soil plains); cracking clay soils	Olive brown, brown and grey clays*	Tall sparse shrubland of *Carissa lanceolata, Ventilago viminalis*, *Terminalia volucris* with scattered trees (*Lysiphyllum cunninghamii*, *Atalaya hemiglauca*, *E. microtheca*) over *Aristida* spp, *Sorghum* sp., *Astrebla squarrosa*.*	Larrimah	0.5%
Coastal floodplains	seasonally flooded coastal floodplains; inundated 3-6 months; poorly drained clay soils	Black cracking clays overlying marine alluvium	Tall open forest of *Melaleuca cajuputi, M. leucadendra, M. viridiflora, Acacia auriculiformis* over *Eleocharis* spp., *Cyperus* spp., *Pseudoraphis spinescens*	Pinwinkle	0.1%
Desert sandplains	Level to undulating sandplains with red sands	No description*	No description*	Redsan	16.4%
Granite hills	Low hills and hills mostly on granite, gneiss, rhyolite and some schist; common rock outcrop and surface stone with shallow gritty or stony soils	Skeletal soils and minor coarse sandy yellow soils	Mid-high open woodland of *E. tetrodonta*, *E. tectifica*, *C. latifolia*, *Erythrophleum chlorostachys*, *E. miniata* over tropical tall grass (*Heteropogon triticeus*, *Chrysopogon fallax*, *Sorghum* spp.)	Currency	0.1%
Granite plains and rises	Gently undulating to undulating plains with rises and low hills on granite, schist, gneiss (deeply weathered in places); coarse grained sandy, earthy and texture contrast soils	Stony and gravelly red and yellow sandy earths.	Low to high woodland to open woodland of *Corymbia* spp. and *Eucalyptus* spp., sometimes with *Terminalia* spp. and *Xanthostemon* sp. over tall grasses (*Heteropogon* sp., *Chrysopogon* sp., *Sorghum* sp. and *Themeda triandra*) and *Eriachne* sp.	Cully	5.1%
Lateritic plains and rises	Plains and rises associated with deeply weathered profiles (laterite) including sand sheets and other depositional products; sandy and earth soils	Loamy or gravelly red and yellow earths, siliceous and earthy sands, sandy brown and earths.*	Mid to tall open woodland of *Eucalyptus* spp. and *Corymbia* spp. over tall grasses (*Chrysopogon* spp., *Themeda* spp., *Sehima* spp., *Sorghum* spp., *Heteropogon* spp., *Triodia* spp.), with some low open woodland of *Acacia* spp., *Grevillea* spp., *Melaleuca* spp. with low shrubs (*Calytrix exstipulata*, *Acacia* spp., *Grevillea* spp.) over *Sorghum* spp., *Heteropogon* spp.*	Banjo, Birrimbah, Birrimbah 1, Bulwaddy, Claravale, Elsey, Forrest, Kay, Keating, Keckwick, Keefers Hut, Knifehandle, Krans, Krokane, Sturt, Woggaman	42.1%

Class	Landform	Soil*	Vegetation*	Land systems	Coverage
Lateritic plateaux	Plateaux, scarps and some rises on deeply weathered sediments; shallow soils with rock outcrop	Shallow, skeletal sandy red and yellow earths	Mid-high forest to open woodland of *Eucalyptus* spp., *Corymbia* spp., sometimes with *Terminalia* spp. and *Lophostemon lactifluus*, over tall grasses (*Sorghum* spp., *Aristida* spp., *Triodia bitextura*, *Heteropogon* spp. and *Chrysopogon* spp.	Yujullowan	0.2%
Limestone plains and rises	Plains, rises and plateaux on weathered and unweathered Cambrian limestone, dolomite, chalcedony, shale, sandstone and siltstone with associated sand sheets; sandy and earth soils	Brown sandy and loamy soils, sandy and loamy red and yellow earths.	Low woodland to tall open forest of *Eucalyptus* spp., *Corymbia* spp., sometimes with *Erythrophleum chlorostachys* over tall grasses (*Triodia bitextura*, *Sorghum* spp., *Heteropogon* sp., *Chrysopogon* sp., *Themeda* spp., *Sehima* sp., *Panicum mindanaense*, *Eragrostis* spp., *Eriachne* spp.).	Beemla, Budbudjong, Jindara, Kimbyan, Tagoman, Wallingin	10.8%
Sandstone hills	Low hills, hills and stony plateaux on sandstone, siltstone, quartzite and conglomerate (deeply weathered in places); outcrop with shallow stony soils	Skeletal soils and outcrop with minor sandy red and yellow gradational soils and shallow gravelly lithosols*	Mid-high woodland of *Corymbia dichromophloia*, *Eucalyptus. miniata*, *C. bleeseri*, *E. tectifica*, *C. terminalis* over *Sorghum* spp., *Themeda triandra*, *Chrysopogon* spp.*	Baker	3.9%
Sandstone plains and rises	Plains, rises and plateaux on mostly on sandstone, siltstone, claystone, shale and some limestone; commonly shallow soils with surface stone and rock outcrop	Skeletal soils and shallow gravelly loams and sands; yellow and red earths*	Low to tall woodland of *Eucalyptus spp.* and *Corymbia spp*., with some *Erythrophleum chlorostachys* and *Terminalia spp.* over tall grasses (*Sorghum* spp., *Heteropogon* spp., *Chrysopogon* spp., *Eriachne* spp., *Themeda* spp.). Some low shrubland of *Eucalyptus spp*., *Xanthostemon paradoxus* and *Buchanania spp*.*	Bend, Rumwaggon	17.9%

**Soil and vegetation descriptions apply to northern NT only – these details are not available for southern NT land systems*



Legend

- Town
- AAPowerLink infrastructure
- OHTL Kilometre Point (KP)

Roads

- Principal road
- Secondary road

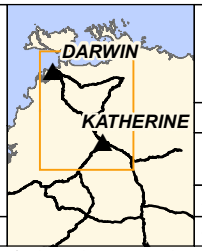


Figure 2-5: Map of land systems intersecting the OHTL railway corridor - northern section

Project: Australia-Asia PowerLink

0 10 20 30 40 Kilometres

Scale: 1:1,500,000

Coordinate System: GDA2020

A4

Reference: M Files ID 204951

Date: 03/11/2021

Revision: A

N

Source: Sun Cable, Geoscience Australia, NR Maps

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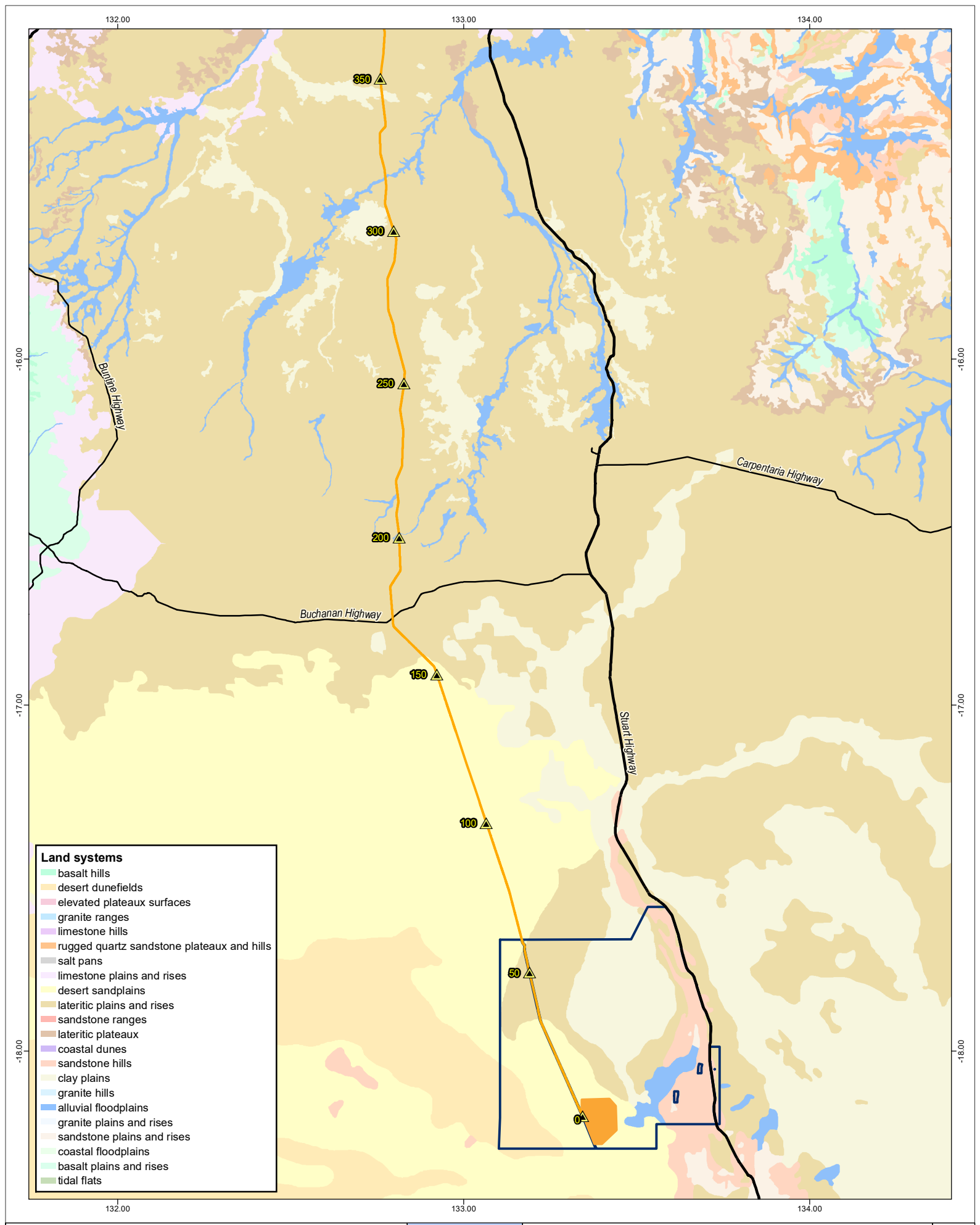

Legend

- Town
- OHTL Route
- Solar Precinct
- Powell Creek Station
- OHTL Kilometre Point (KP)

Roads

- Principal road
- Secondary road

Source: Sun Cable, Geoscience Australia, NR Maps

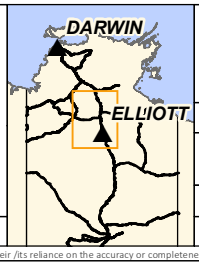

Figure 2-6: Map of land systems intersecting the OHTL railway corridor - southern section

Project: Australia-Asia PowerLink

0 10 20 30 40 Kilometres

Scale: 1:1,500,000

Coordinate System: GDA2020 | A4

Reference: M-Files ID 204951

Date: 03/11/2021 | Revision: A

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2.1.8 Weeds

Some species of introduced flora are declared to be weeds under the NT *Weeds Management Act* because of the environmental and/or economic harm they can cause. Class A weeds are to be eradicated by land owners and occupiers. Class B weeds must have their growth and spread controlled by land owners and occupiers. The remaining introduced flora species are referred to as *environmental weeds* – these are not declared weeds under the Act. The Commonwealth Government has also categorised some species as Weeds of National Significance (WoNS).

Weed distribution is often related to environmental disturbances caused by the construction of roads and tracks, cattle grazing and feral animals.

The OHTL railway corridor traverses through three weed management areas – Darwin, Katherine and Tennant Creek – see Figure 2-7. Each area has its own Regional Weed Strategy 2021-2026 (DEPWS 2021a, 2021b and 2021d) which focus on weeds that are most important to the region, categorising them as either:

- *Priority weeds* (requiring priority management action)
- *Opportunistic weeds* (requiring management because they commonly appear after control of priority weeds)
- *Alert weeds* (has the potential to have a high level of impact to the region should it become established, and the likelihood of the species naturalising and spreading in the region is perceived to be high).

A field survey has not yet been conducted along the OHTL railway corridor due to access constraints. Instead, data from the Weed Management Branch clipped to 60 m either side of the railway line was interrogated. Those data include recent survey results from rail corridor environmental manager, Centrogen (DEPWS 2021).

Figure 2-7. Map of NT weed management regions (DEPWS 2021a)

The results are that 35 weed species have been recorded within the 120 m wide search corridor. Of these records, five are WoNS, 19 are declared weeds and 4 are listed as Priority 1 in an RWS – as listed in Table 2-5. The remainder are *environmental weeds* – introduced flora species that are not listed under any legislation – which are not presented in Table 2-5. In general, weed records are within watercourses, alluvial flats, disturbed areas (i.e. roadsides, fences and water-points), and on drainages or depressions. Sandplains and rocky rises generally do not support significant infestations of declared weed species.

The three species with the most records across all three regions are Gamba Grass (*Andropogon gayanus*), Hyptis (*Mesosphaerum suaveolens*) and Mission Grass (of which there are two *Cenchrus* species, which are WoNS but not declared). The largest number of records are from within the Darwin Weed Management Region. In the Katherine Region, Rubber Bush (*Calotropis procera*), Hyptis and Gamba Grass are the top three recorded species. Although few in number, there are records in the OHTL railway corridor within the Katherine WMR of Rubber Bush (*Calotropis procera*) – a Priority species in the adjacent Tennant Creek WMR.

Table 2-5. Weed species relevant to the OHTL railway corridor

Common name	Botanical name	*EPBC*	WoNS	Declared weed (Weeds Act) classification	Statutory WMP	Weed Management Region	Regional Priority Category	No. of records *(within search area)*
Gamba Grass	*Andropogon gayanus*	Y	Y	A/B (zoned)	Y	Darwin Katherine Tennant Creek	2 2 1	451 142 -
Neem	*Azadirachta indica*	-	-	B	Y	Darwin Katherine Tennant Creek	3 2 2	4 61 -
Rubber Bush	*Calotropis procera*	-	-	B (zoned)	-	Darwin Katherine	3 2	18 211
Mission Grass, Perennial	*Cenchrus polystachios*	Y	-	B	-	Darwin Katherine	2 3	29 12
Olive Hymenachne	*Hymenachne amplexicaulis*	Y	Y	B	-	Darwin Katherine	2 3	2 4
Thatch Grass	*Hyparrhenia rufa*	-	-	A	-	Darwin Katherine	3 1	- 1
Knob Weed	*Hyptis capitata*	-	-	B	-	Katherine	-	27
Bellyache Bush	*Jatropha gossypiifolia*	-	Y	A/B (zoned)	Y	Darwin Katherine Tennant Creek	2 2 1	- 1 -
Devils Claw	*Martynia annua*	-	-	A	-	Darwin Katherine	2	- 1
Hyptis	*Mesosphaerum suaveolens*	-	-	B	-	Darwin Katherine	4	9 109
Mimosa	*Mimosa pigra*	-	Y	A/B (zoned)	Y	Darwin Katherine	2 1	8 -
Parkinsonia	*Parkinsonia aculeata*	-	Y	B	-	Darwin Katherine Tennant Creek	2 3 2	- 4 -

Common name	Botanical name	*EPBC*	WoNS	Declared weed (Weeds Act) classification	Statutory WMP	Weed Management Region	Regional Priority Category	No. of records *(within search area)*
Candle Bush	*Senna alata*	-	-	B	-	Darwin Katherine	4	1 1
Sicklepod	*Senna obtusifolia*	-	-	B	-	Darwin Katherine Tennant Creek	- 4 4	3 8 -
Sida Sp	*Sida sp*	-	-	B	-	Darwin Katherine	4	8 21
Snakeweed	*Stachytarpheta spp.*	-	-	B	-	Darwin Katherine	4	2 -
Grader Grass	*Themeda quadrivalvis*	-	-	B	Y	Darwin Katherine Tennant Creek	2 2 5	4 10 -
Caltrop	*Tribulus cistoides*	-	-	B	-	Darwin Katherine Tennant Creek	- - 4	1 3 -
Chinee Apple	*Ziziphus mauritiana*	-	-	A	Y	Darwin Katherine	3 2	- 48

2.2 Significant vegetation

In the NT, sensitive vegetation types are those considered significant under the *Land Clearing Guidelines* (DEPWS 2021d) due to their unique and/or inherently high biodiversity values. They are rainforest, vine thicket, closed forest or riparian vegetation, mangroves, monsoon vine forest, sandsheet heath and vegetation containing large trees with hollows suitable for fauna.

Based on desktop analysis, the following significant vegetation types occur within, or immediately adjacent to, the OHTL railway corridor:

- Wetlands and riparian vegetation, including riparian rainforest
- Dry rainforest
- Large hollow-bearing trees
- Sinkholes
- Groundwater-dependent ecosystems.

Finally, the *EPBC Act* allows for the listing of *threatened ecological communities* – of which there is only one in the NT, the Arnhem Plateau Sandstone Shrubland Complex. The OHTL railway corridor intersects land classed as possibly supporting this community.

2.2.1 Wetlands

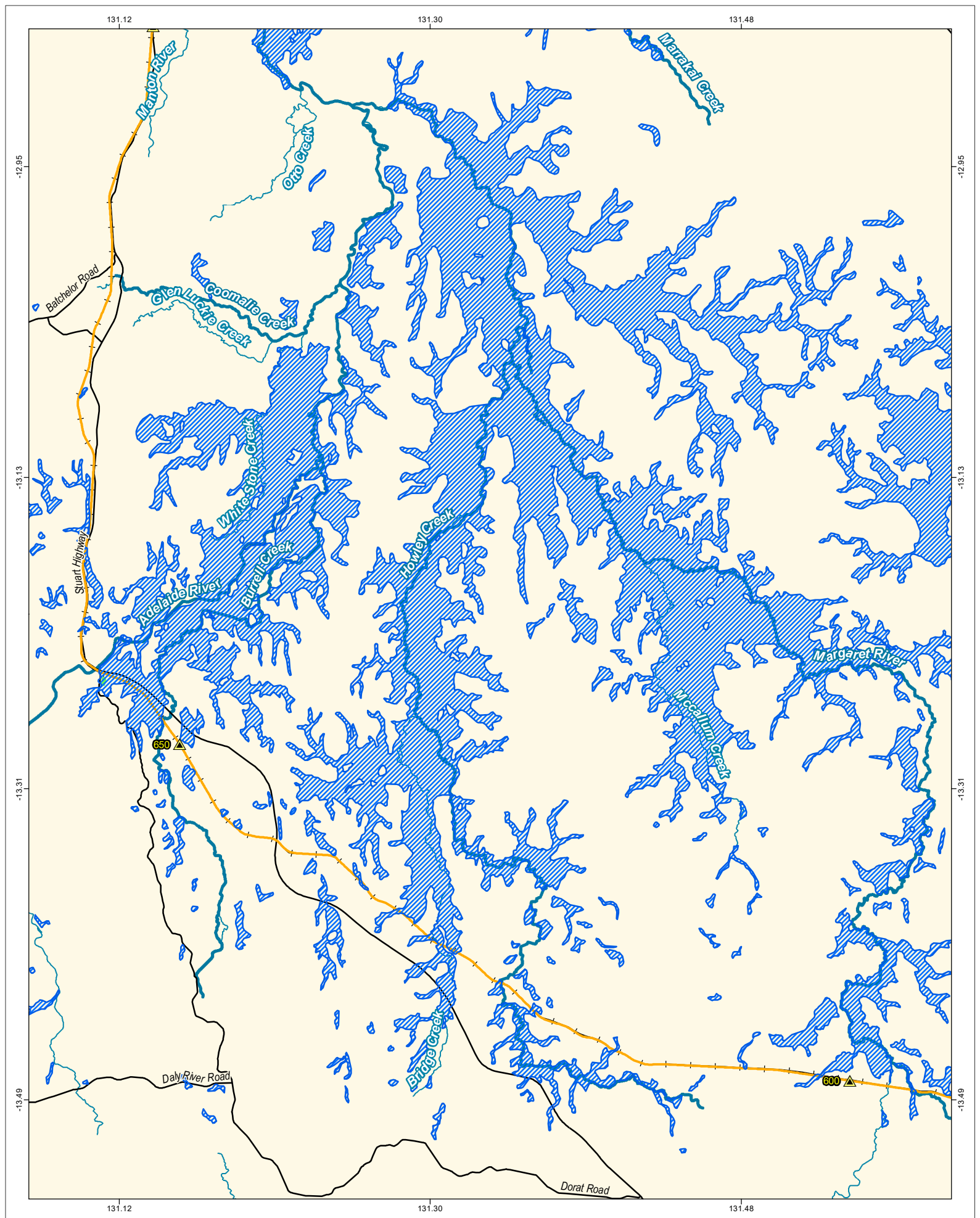
In the Top End, wetlands are generally considered to be floodplains, lakes, billabongs and swamps. They support distinct vegetation communities that rely on either permanent or seasonal surface water supply (Brock 1995). These areas often support a shallow watertable. They are considered as a sensitive vegetation type as they provide essential habitat for a diverse range of flora and fauna (including threatened and migratory species) and can be easily impacted upon by poor land management and planning.

Wetlands that occur in arid Northern Territory are defined as follows by Duguid et al. (2005):

> *Wetlands are areas of permanent or temporary surface water or waterlogged soil. They may be dry for decades but inundation or waterlogging must be reoccurring and of sufficient duration to be used by macroscopic plants and animals that require such conditions during their lifecycles. They may be natural or artificial, with still or running water which can be fresh or saline. In the inland they may be of any depth or size.*

Wetlands in the arid zone include waterholes, swamps, claypans, salt lakes, springs and artificial water sources (such as dams and sewage ponds). Watercourses also fall under the arid zone definition of wetlands; however, these have been covered in the section above. They can vary in size and are dry most of the time; nevertheless, these areas may be important for species conservation. They may support important populations of endemic or threatened species, as well as isolated and relic populations of more widespread species (Duguid et al. 2005) that are important for local biodiversity reasons.

The Australian Hydrological Geospatial Fabric (Geofabric) developed by the Bureau of Meteorology, is a specialised suite of hydrological spatial data products. It contains a hydro area layer that outlines areas that are subject to inundation – such as flats and floodplains. Figure 2-8 depicts an approximately 70 km section of the OHTL railway corridor that intersects with significant floodplain areas – the largest of which is the Adelaide River floodplain. Aerial imagery suggests that other sections the OHTL railway corridor intersect smaller potential wetland areas along its length.



Legend

- Towns
- OHTL
- Major Drainage
- Minor Drainage
- Railways
- Roads
- OHTL Kilometre Point (KP)

Hydrological area

- Land Subject To Inundation

Source: Sun Cable, Geoscience Australia, NR Maps

DARWIN

Figure 2-8: Map of significant wetland habitats relevant to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 10 Kilometres

Reference: M-Files Document ID 204951

Date: 08/11/2021 | Revision: A

Scale: 1:300,000

Coordinate System: GDA2020 | A4

N

SUN CABLE

2.2.2 Riparian vegetation

Riparian vegetation is 'a distinct forest community occurring on the banks of rivers or streams that directly influences the adjacent water body' (DENR 2018). When in good condition, riparian vegetation is considered a sensitive vegetation type as it supports a unique selection of habitat features that are relied upon by a range of flora and fauna species. Riparian vegetation provides refuge habitat and habitat corridors; improves water quality by filtering terrestrial run-off; stabilises banks and reduces erosion; and supports terrestrial and aquatic habitats by maintaining natural light, temperature and oxygen levels within waterways (DENR 2018).

In the arid zone, riparian areas that support permanent or semi-permanent waterholes are of particular conservation importance (due to scarcity of surface water in the region).

The OHTL railway corridor crosses numerous watercourses, as detailed in Section 2.1.4. Many support riparian vegetation, with the extent of that vegetation usually increasing with stream order (i.e. large rivers will support a wider corridor of riparian vegetation than a lower order ephemeral creek). The major rivers have the thickest fringes of the most riparian vegetation.

2.2.3 Rainforest

The OHTL railway corridor intersects patches of riparian rainforest associated with higher order watercourses between Darwin and Katherine area. According to mapping by Russell-Smith (2000), the OHTL railway corridor only coincides with dry rainforest (i.e. not riparian) at one location – running adjacent for 130 m to an approximately 1.3 ha patch on the east side of the railway easement 5.8 km north-west of Katherine (KP 463) – see Figure 2-9.

2.2.4 Large hollow-bearing trees

Tree hollows provide valuable habitat for fauna. In the NT, a Eucalypt forest that has either five or more Eucalypt stems growing greater than 50 cm in diameter at breast height (dbh) per hectare, and/or 30 or more Eucalypt stems greater than 40 cm dbh per ha is considered to be of high value for biodiversity because of the likelihood that they have hollows (NRETAS 2010).

Large, hollow-bearing trees may occur within the OHTL railway corridor – especially in the Top End – but it is not possible to determine their locations or densities from desktop resources.

2.2.5 Sinkholes and groundwater-dependent ecosystems

Groundwater-dependent ecosystems (GDE's) refer to 'natural ecosystems that require access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services' (Richardson et al. 2011). Groundwater is especially important to ecosystems in parts of the country that have extended dry periods, during which evaporation markedly exceeds precipitation and so surface water is scarce (Eamus et al. 2006). In these areas, GDE's provide essential habitat for a diverse range of flora and fauna, and can be easily impacted by poor land management and planning.

Based on definitions from Eamus et al. (2006), the Atlas of Groundwater Dependent Ecosystems maps three types of GDE – *subterranean*, *aquatic* (i.e. ecosystems dependant on surface expression of groundwater) and *terrestrial* (i.e. ecosystems dependent on the sub-surface presence of groundwater, often accessed when roots penetrate via the capillary fringe which lies above the saturated zone of the water table). The Atlas classes each mapped GDE according to the degree of certainty that it is, indeed, a GDE.

Subterranean GDE's have not been mapped in the NT – with sinkholes and caves being the best proxy for identifying their likely presence. A sinkhole is a cavity in the ground, caused by water dissolving the rock away over time. They are particularly common in limestone or dolomite formations, and are often circular, ranging up to tens of metres in diameter. Sinkholes are most common in the Top End, particularly in the Katherine region (DLRM n.d.). They contribute to groundwater recharge, effectively operate as islands within terrestrial ecosystems, and may support species (such as land snails) with highly restricted

distributions (DENR 2020). The OHTL railway corridor passes through the Katherine region which is known to contain sinkholes and cave systems. Only two sinkholes are recorded within 100 m of the OHTL railway corridor:

- A cave with a 2 m wide opening which is ~60 m from the OHTL railway corridor near where it intersects the Stuart Hwy north of Katherine (KP 467)
- A broad depression which is ~90 m from the OHTL railway corridor near Morey Rd just north of Katherine (KP 462).

Much of the OHTL railway corridor has the potential to contain terrestrial and aquatic GDE's. However, apart from riparian, rainforest and wetland habitats (which are all addressed elsewhere in this section), those GDE's have areas significantly greater than the disturbance footprint required for the OHTL infrastructure (i.e. the pads for each OHTL tower are very small compared with the area of the GDE in question). The inherent risk of an impact to those GDE's from construction and operation of the OHTL is very low, and therefore these is little value delineating or detailing those GDE's any further.

2.2.6 Arnhem Plateau Sandstone Shrubland Complex

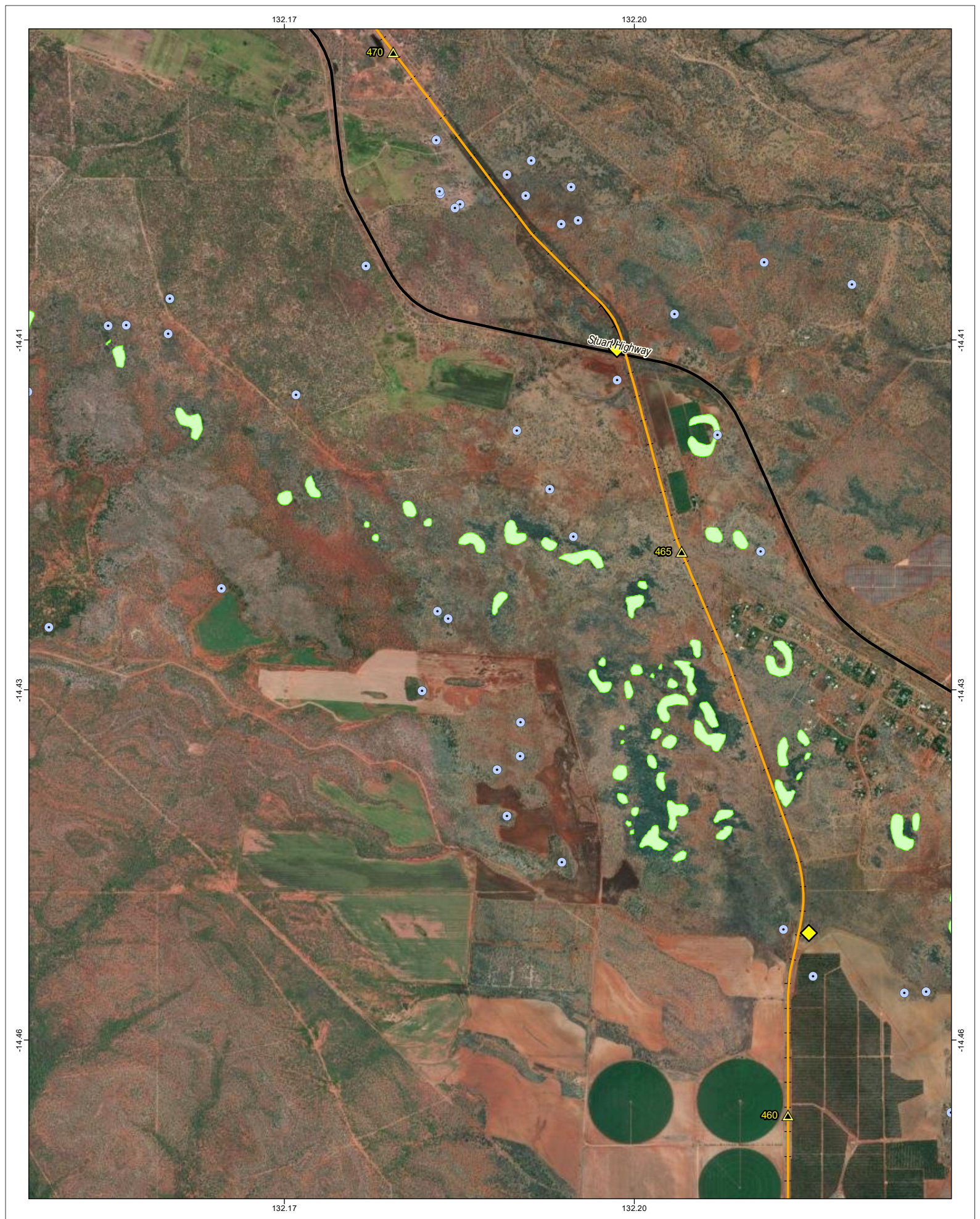
The EPBC Protected Matters Search Tool (PMST) report identified one Threatened Ecological Community (TEC) that may occur within the proposal footprint – the Arnhem Plateau Sandstone Shrubland Complex, which is listed as Endangered under the *EPBC Act*. This is one of 77 TEC's that are listed nationally, and is the only such listing in the NT. The TEC is restricted to massive sandstone environments of the Arnhem plateau and outliers. It is distributed from Katherine Gorge to the vicinity of Oenpelli, with portions of these landscape protected in Kakadu NP and Nitmiluk NP. The TEC is comprised mostly of native shrubs, grasses and animals living in rocky country, with a range of endemic plant species, some of which are listed as Vulnerable under the *TPWC Act*.

Blake (2004) has mapped the likely and possible extents of this complex. From that map it can be seen that the OHTL railway corridor intersects land classed as possibly supporting this TEC in three locations north-west and south-east of Katherine (see Table 2-6 and Figure 2-10).

Table 2-6. Arnhem Plateau Sandstone Shrubland Complex

Start KP	Finish KP	Length (km)
480	487	7.0
415	437	22.0
363	411	48.0

However, it can be seen from aerial imagery that the OHTL railway corridor does not intersect with sandstone environments. Moreover, both of the modelled areas are a significant distance from habitat known, or likely, to support the Arnhem Plateau Sandstone Shrubland Complex – especially the large area south-east of Katherine. Consequently, there is a low likelihood that the Arnhem Plateau Sandstone Shrubland Complex is present within the OHTL railway corridor.



Legend

- Town
- OHTL Route
- Railways

Roads

- Principal road
- Secondary road

- Sinkhole within 100m of pipeline
- Sinkhole
- Rainforest
- OHTL Kilometre Point

Source: Sun Cable, Geoscience Australia, NR Maps

Figure 2-9: Map of dry rainforest and sinkholes adjacent to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 1 Kilometres

Reference: M-Files Document ID 204951

Date: 03/11/2021 | Revision: A

Scale: 1:40,000 | Datum: GDA2020

Coordinate System: GDA2020 | A4

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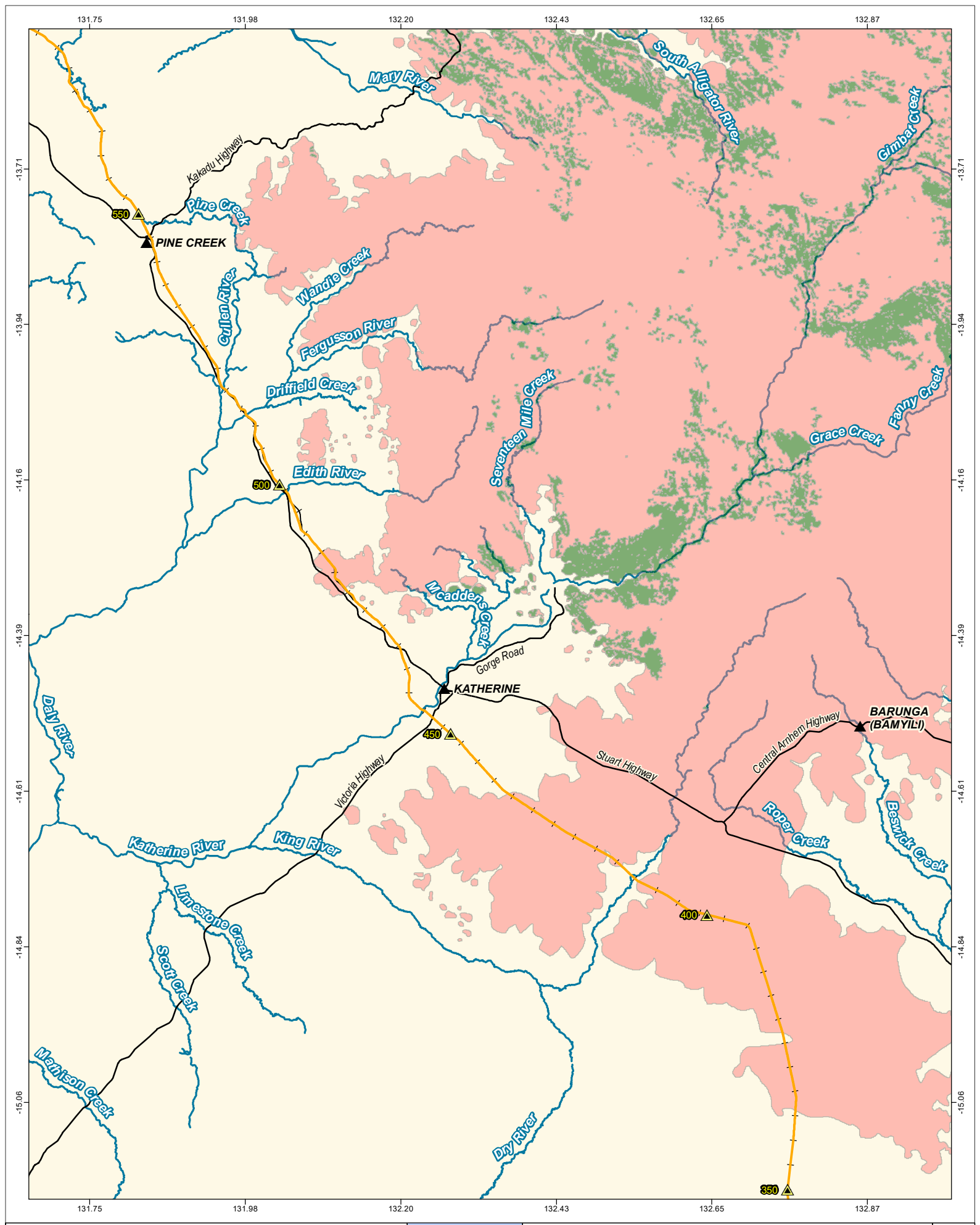

Legend

- OHTL Route
- Major Drainage
- Railway

Arnhem Plateau Sandstone Shruband Complex

- Habitat likely to occur
- Habitat may occur

Fig 2-10: Map of the Arnhem Plateau Shrubland Complex relevant to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 10 20 Kilometres

Reference: M-Files Document ID 204951

Date: 03/11/2021 | Revision: A

Scale: 1:750,000

Coordinate System: GDA2020 | A4

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Source: Sun Cable, Geoscience Australia, NR Maps

SUN CABLE

2.3 Threatened species

This section outlines the procedure and results of the threatened species 'likelihood of occurrence' assessment conducted for this report. In late 2020, a targeted survey occurred for the Greater Bilby (*Macrotis lagotis*) along the southernmost 150 km of the OHTL railway corridor. No other surveys for threatened species have been undertaken within the OHTL railway corridor. For reasons given below, the assessment of threatened species within the OHTL railway corridor is therefore predominantly based on desktop datasets and resources.

The purpose of this assessment is to identify those species that may need to be included within the proposal's impact assessment, and those that can be reasonably excluded from further consideration because they are unlikely to occur within the proposal footprint. The assessments for the Murrumujuk and OHTL components differ because of the level of proposal and habitat information available.

Note: This process is not an impact assessment; that will be undertaken in the EIS.

The International Union for the Conservation of Nature nominates a set of criteria used to identify species at risk of extinction. These criteria are used to define categories of risk (see Figure 2-11) which are used by the NT Government to determine which threatened species are listed under the *Territory Parks and Wildlife Conservation Act* (*TPWC Act*), and by the Commonwealth Government to determine which threatened species are listed under the *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). This report focusses on species that are listed as Vulnerable, Endangered or Critically Endangered under either Act.

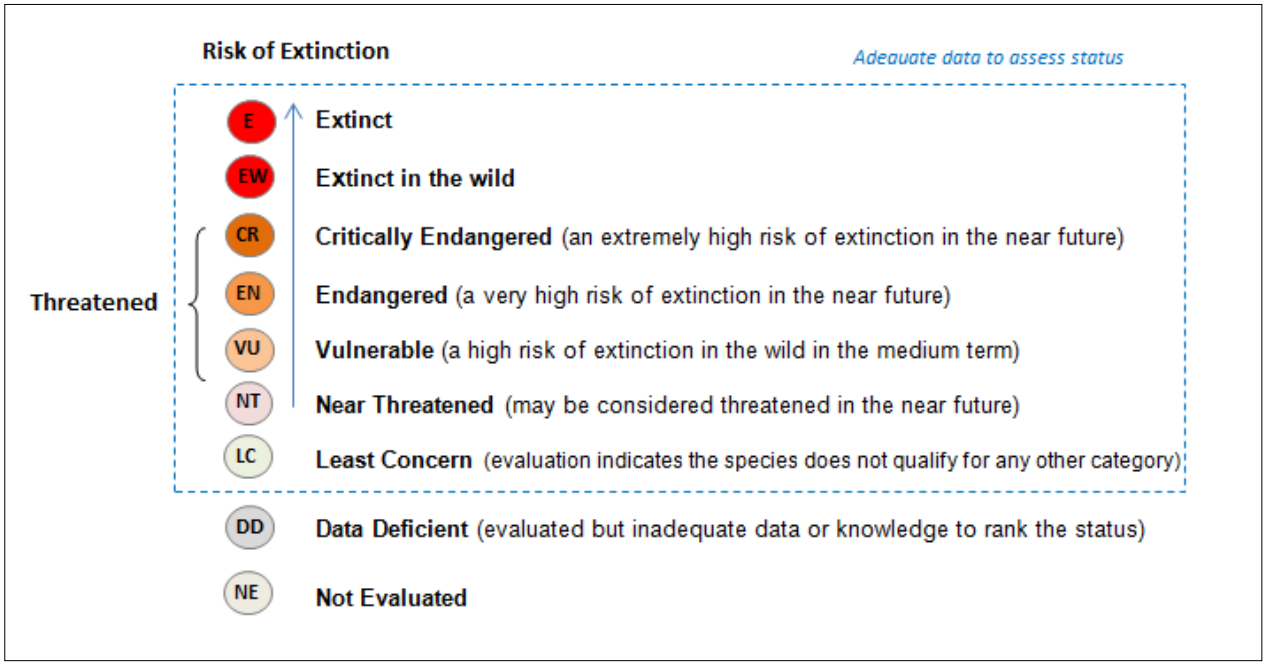


Figure 2-11. The IUCN categories of risk for species

2.3.1 Likelihood of occurrence assessment

The procedure used to determine which threatened species have the potential to occur in the OHTL railway corridor is described below.

- Species records from the latest version of the NT Atlas were clipped to the five bioregions intersected by the OHTL railway corridor. These were Daly Basin, Mitchell Grass Downs, Pine Creek, Sturt Plateau and Tanami. Bioregions give a broad area with largely similar habitat characteristics and species assemblages. Clipping data to them ensures all potential species are captured in order to undertake a proposal-specific 'likelihood of occurrence' assessment. The results were then supplemented by the list of species prescribed in the EIS Terms of Reference.
- EPBC Protected Matters Search Tool (PMST) was used to generate a report using a 20 km buffer from the OHTL railway corridor. This PMST is an online enquiry tool managed by the Commonwealth Department of the Environment and Energy which interrogates a range of existing flora and fauna data, as well as predictive modelling to speculate on the presence of species within a search area. The PMST uses a grid system to determine which protected matters it encapsulates for a particular search. The PMST report (Appendix B) was generated on 11 October 2021.
- For each threatened species, the likelihood of it occurring within the OHTL railway corridor was then assessed based on desktop information that relates to habitat requirements, distribution, number and dates of proximate records (obtained from NT Atlas and/or Atlas of Living Australia), and the ecological information described in Sections 2 and 4.2 of this report. Likelihood ratings were defined as per Table 2-7.

The results are detailed in Appendix A.

Table 2-7. Ratings for the desktop threatened species likelihood of occurrence assessment

Rating	Definition
HIGH	It is expected that this species occurs within the OHTL railway corridor because there is core habitat and recent proximate records.
MEDIUM	Species may occur within the OHTL railway corridor because there is suitable habitat; however, there is evidence that lowers its likelihood of occurrence (known range contraction of the species in the region, no recent records with the search area, substantial loss of habitat within the OHTL railway corridor since previous records, species is naturally-rare or occurs at a low density etc.).
LOW	Species may occur, as a vagrant, within the OHTL railway corridor; only marginally-suitable habitat is expected.
NONE	There is strong evidence that this species will not occur within the OHTL railway corridor (i.e. there is no suitable habitat and/or the species is considered to be regionally-extinct).

The OHTL railway corridor traverses 719 km. Consequently, it intersects a large number of habitat types, and therefore potentially impacts a considerable number of different threatened species. Nevertheless, the physical disturbance footprint of the OHTL is, by design, small and localised – the towers are ≥ 300 m apart, have small clearance footprints and run adjacent to an existing railway line. Therefore, threatened species with general habitat requirements and/or wide ranges are unlikely to be significantly impacted by the proposed development. The likelihood assessment for the OHTL railway corridor 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. A meeting was held with Alaric Fisher (Executive Director, Flora and Fauna Division, DEPWS) in October 2020 to confirm that this approach aligned with the expectations of the department.

Table 3-4 presents all threatened species considered to have a medium or high likelihood of being present in the OHTL railway corridor, 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 2-8. Threatened species with a reasonable (high or medium) likelihood of occurring within OHTL railway corridor

Likelihood	Species	Class	Status		Habitat type	Habitat restrictions
			EPBC	TPWC		
HIGH	Greater Bilby (*Macrotis lagotis)*	Mammal	VU	VU	Hummock grasslands on sandy soils	Restricted to desert sandplains
	Black-footed Tree-rat (Kimberley and mainland NT subspecies) *(Mesembriomys gouldii gouldii)*		EN	VU	Top End savanna woodland and drainage areas	-
	Northern Brushtail Possum (*Trichosurus vulpecula arnhemensis*)		VU	-	Top End savanna woodland	-
	Northern Leaf-nosed Bat (*Hipposideros stenotis)*		-	VU	Roosts in rocky outcrops, caves, disused mines	Restricted roosting habitat
	Ghost Bat (*Macroderma gigas)*		VU	-	Roosts in rocky outcrops, disused mines	Restricted roosting habitat
	Darwin Cycad (*Cycas armstrongii)*	Plant	-	VU	Top End savanna woodland	-
	A herb (*Typhonium praetermissum)*		-	VU	Top End savanna woodland	Restricted habitat & range
	A shrub (*Helicteres macrothrix)*		EN	EN	*E. tectifica*, *E. miniata* or *E. tetrodonta* woodland on clayey or sandy soils	Restricted habitat & range
	A trigger plant (*Stylidium ensatum*)		EN	EN	Margins of drainage depressions and poorly-drained grassy flats	Restricted habitat
	Gouldian Finch (*Erythrura gouldiae)*	Bird	EN	VU	Snappy gum communities (for nesting)	Restricted nesting habitat
	Partridge Pigeon (eastern subspecies) *(Geophaps smithii smithii)*		VU	VU	Open woodland	-
	Plains Death Adder *(Acanthophis hawkei)*	Reptile	VU	VU	Floodplains and cracking soil plains	-
	Mertens' Water Monitor *(Varanus mertensi)*		-	VU	Edges of watercourses, swamps and lagoons	Restricted to watercourses
	Mitchell's Water Monitor (*Varanus mitchelli)*		-	VU	Edges of watercourses, swamps and lagoons	Restricted to watercourses
MEDIUM	Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus (nudicluniatus))*	Mammal	VU	-	Woodland	Roosts in hollows in tall woodland

Likelihood	Species	Class	Status		Habitat type	Habitat restrictions
			EPBC	TPWC		
	Fawn Antechinus (*Antechinus bellus)*		VU	EN	Top End savanna woodland	-
	Pale Field-rat *(Rattus tunneyi)*		-	VU	Riparian	Restricted to watercourses
	Red Goshawk (*Erythrotriorchis radiatus*)	Bird	VU	VU	Riparian and surrounds	Restricted nesting habitat
	Crested Shrike-tit (northern subspecies) *(Falcunculus frontatus whitei)*		VU	-	Woodland	-
	Masked Owl (northern subspecies) (*Tyto novaehollandiae kimberli)*		VU	VU	Tall woodland	-
	Floodplain Monitor (*Varanus panoptes)*	Reptile	-	VU	Wide ranging	-
	Northern River Shark (*Glyphis garricki)*	Fish	EN	EN	Aquatic	Restricted to certain rivers
	Speartooth Shark (*Glyphis glyphis)*		CR	VU	Aquatic	Restricted to certain rivers
	Freshwater or Largetooth Sawfish (*Pristis pristis)*		VU	VU	Aquatic	Restricted to certain rivers

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

2.3.2 Species of concern

As explained in the previous section, the linear nature of the OHTL railway 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, grouping them by habitat where possible.

Note: The EIS Terms of Reference require consideration of the Estuarine Crocodile (*Crocodylus porosus*) – listed as migratory under the *EPBC Act*. Estuarine Crocodiles are likely to be common in the higher order rivers and creeks traversed by the OHTL corridor as far south as Mataranka.

Riparian species

Seven species with a medium or high likelihood of occurring within the OHTL railway corridor are restricted to – or have core habitat in – riverine or riparian habitats.

Of these, the Red Goshawk (*Erythrotriorchis radiatus*) is the least restricted, in that the species can have a home range of up to 200 km^2 (Czechura and Hobson 2000). A solitary and secretive species that is sparsely distributed across much of northern Australia, the Red Goshawks preferred habitat is tall, open Eucalypt forest and riparian areas. The species nests in large trees – frequently the tallest and most massive in a tall stand – and invariably within 1 km of permanent water (Debus and Czechura 1988; Aumann and Baker-Gabb 1991). Red Goshawks are generally confined to taller forests characteristic of higher rainfall coastal and sub-coastal areas (Debus 1998), but there are some isolated records of wandering birds from central Australia (Woinarski 2006).

The Pale Field-rat (*Rattus tunneyi*) historically occurred in a wide range of habitats, but now primarily in dense vegetation along creeks (Aplin et al. 2008). Previously widespread and patchily abundant, particularly

in the north-west of the Top End, the Pale Field-rat appears to have declined in lower rainfall areas (Woinarski 2000).

Two species of water monitors – Mertens' (*Varanus mertensi*) and Mitchell's (*Varanus mitchelli*) – occur in the Top End along the edges of freshwater watercourses, swamps and lagoons, and are seldom seen far from water (Christian 2004, Shine 1986). Mertens' Water Monitors occur across far northern Australia – from the western Cape York Peninsula to the Kimberley (Christian 2004). The species is widespread in the NT, occupying all of the Top End river systems (Ward et al. 2006). Mitchell's Water Monitors are not as widespread, occurring in the Top End and Kimberley (Schultz and Doody 2004). In the NT, the species is recorded in most catchments flowing into the Timor Sea, Arafura Sea and the Gulf of Carpentaria (Ward 2012).

Three threatened species of fish – the Northern River Shark (*Glyphis garricki*), Speartooth Shark (*Glyphis glyphis*) and Freshwater Sawfish (*Pristis pristis*) – have been recorded in the inland reaches of the Adelaide River but are unlikely to be present in any of the other rivers intersected by the OHTL railway corridor, apart from the Elizabeth River. The two shark species have not been recorded as far inland as where the OHTL railway corridor intersects the Adelaide River. Of the four *Pristis* species reported to occur in Australia, the Freshwater Sawfish is the one most often associated with freshwater, and has been recorded several hundred kilometres upstream (Thorburn et al. 2003). All these species have been recorded in other jurisdictions across northern Australia.

Greater Bilby

A helicopter survey for the presences of Greater Bilby within the OHTL railway corridor was undertaken by EcOz in late 2020. The survey method is presented in the Terrestrial Ecology Report for the Solar Precinct.

The entire section of OHTL that occurred in potentially-suitable Greater Bilby habitat was surveyed by aerial transects (totalling approximately 150 km) – see Figure 2-12. The majority of the corridor had good visibility and the three observers were able to complete a thorough check of the survey area. Putative Greater Bilby signs were detected at fifty-eight sites along the OHTL from the helicopter. These were concentrated in the northern part of the OHTL survey area and were all located within the Redsan land system, which is known to support areas of suitable habitat for Greater Bilby. As discussed in the methodology section, due to access issues, the OHTL aerial survey did not include ground inspections to confirm sign identity – therefore positive identification of Greater Bilby signs could not be achieved.

The summary results are as follows:

- **Eleven sites had signs that are potentially Greater Bilby**. These sites were all located within patches of thick shrubby vegetation (mainly Lancewood or Turpentine) which made aerial identifications difficult and landings not possible given available time frames. In most circumstances, the sign observed was a large burrow as well as diggings in the area. It is possible that large varanid lizards are responsible for the sign; ground verification is required to confirm identity.
- **Nineteen sites were noted to contain signs that were unlikely to be Greater Bilby**. Observers considered signs were more likely from either *Varanus gouldii* or *V. panoptes*.
- **Twenty-eight sites were clearly not Greater Bilby**, as hover inspections unequivocally determined signs to be from another species, or other land feature (i.e. burnt tree stump hole).

The northern part of the OHTL survey area is considered to support areas of suitable habitat for Greater Bilby, and there has been numerous recent (and historic) records of the species on the western side of the railway corridor on Murranji Station. Although no signs within the OHTL corridor were confirmed as Greater Bilby, it is still considered likely that the species will occasionally occur within this part of the OHTL corridor due to present of suitable habitat and close proximity to current colony.

The middle section of the OHTL survey area crosses the Atlas Ms14 Land System which is considered to be unsuitable habitat for Greater Bilby. Observers did not record any potential signs of Greater Bilby in this land

system during the survey. This area does not support habitat typically utilised by Greater Bilby (i.e. no *Triodia* species or relevant Acacia shrubs). It is a flat loamy to loamy clay plain that supports scattered Bloodwood (*Corymbia opaca*), Silver Box (*Eucalyptus pruinosa*), Dogwood (*Acacia sericophylla*) and Yellow Hakea (*Hakea arborescens*), over mixed tussock grasses (*Aristida, Astrebla spp., Eriachne spp*., *Chrysopogon fallax*) and a relatively high cover of Tickweed (*Cleome viscosa*). It is also noted that this area is exposed to a higher grazing pressure (i.e. close to a bore and a dominance of palatable tussock grasses). Furthermore, existing records in the region are predominantly limited to the sandplain land systems (including Redsan and Altas B32). As such, it is unlikely that Greater Bilby uses habitat in Atlas Ms14 land system; however, the species may be occasionally observed in the area due to close proximity to populations in adjacent sandplain land types.

The southern section of the OHTL survey area also crosses the Redsan land system, but no potential or confirmed Greater Bilby signs were detected. Five sites with putative signs were observed. Hover inspections clearly indicated those signs were from *Varanus spp*. at four sites, and unlikely to be Greater Bilby at the fifth.

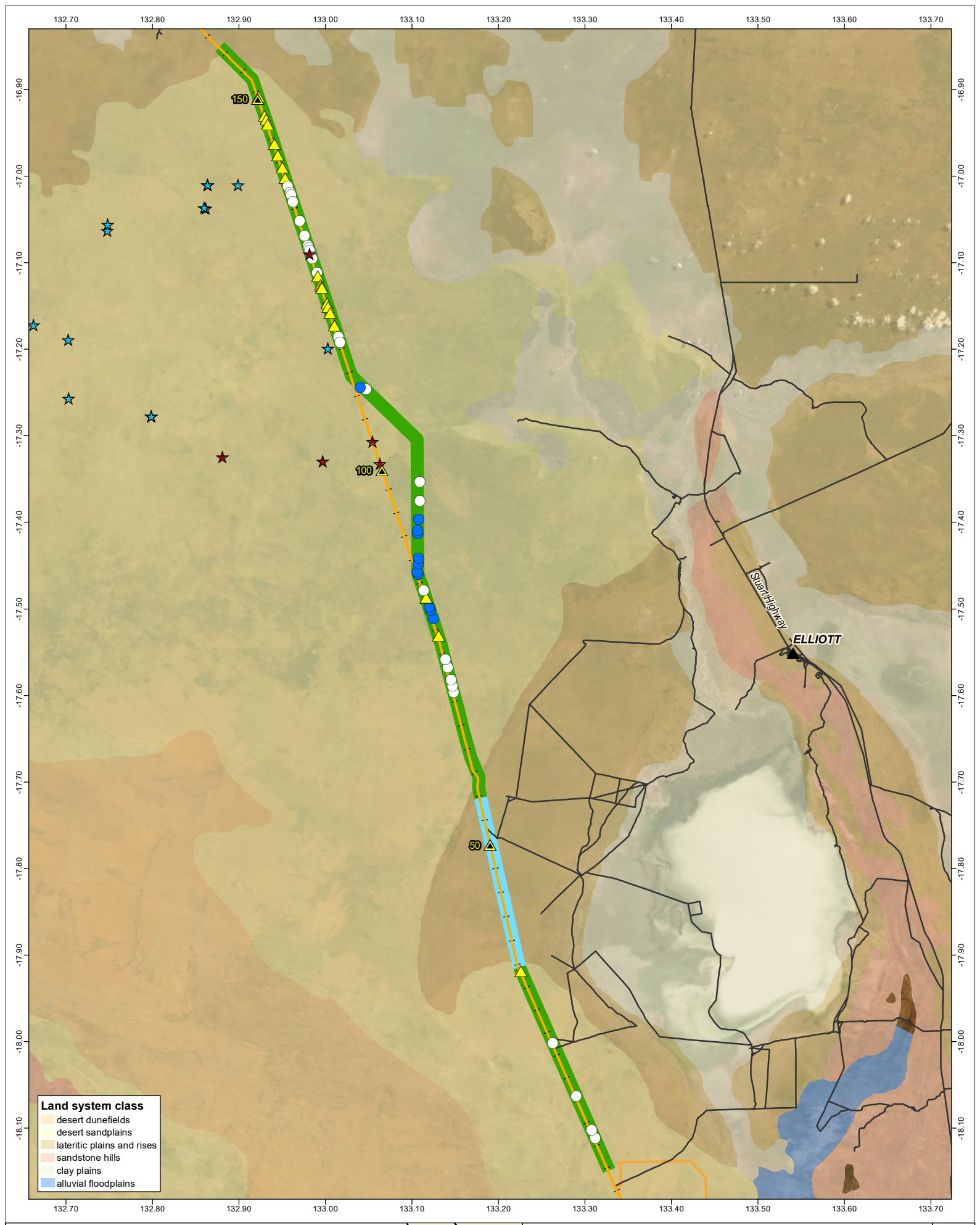
Typhonium praetermissum

Typhonium praetermissum is a small perennial herb with above ground parts present during the annual wet season, usually between December and April. This species occurs in open woodland and favours relatively unshaded areas in red brown clay and shallow gravelly soils. Plants are typically found in small, relatively open (unshaded) patches of gravel or gravelly sandy substrate supporting less than 20% vegetation ground cover, and located on the edge of lateritic plateau areas (NTH 2021).

The species is endemic to the greater Darwin region, extending from the Gunn Point area, south to Lake Bennett and west to Cox Peninsula.

The NT Government has developed a habitat model for *Typhonium praetermissum* for the Greater Darwin region (Cuff and Green 2019). Figure 2-13 shows there is one patch modelled as high likelihood habitat for *Typhonium praetermissum* that is relevant to the OHTL corridor footprint – in Acacia Hills between Leonino Rd and Townend Rd (KP 708.5 and KP 724), noting that disturbance associated with construction of the railway may mean the species is not present.

The species is also modelled as occurring within the OHTL utilities corridor, as discussed in Section 3.3.2.



Legend

- Town
- AAPowerLink infrastructure
- Railway
- Roads

Habitat suitability

- Suitable habitat
- Marginal to not suitable habitat

Greater Bilby OHTL results

- Site - not Bilby
- Site - potential Bilby
- Site - unlikely Bilby

Existing Greater Bilby records

- NT Fauna Atlas
- Murranji survey (DEPWS 2020)

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

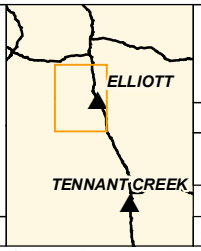


Figure 2-12: Map of Greater Bilby results relevant to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 20 Kilometres

Scale: 1:600,000

Coordinate System: GDA2020 | A4

Reference: M-Files Document ID 204951

Date: 08/11/2021 | Revision: A

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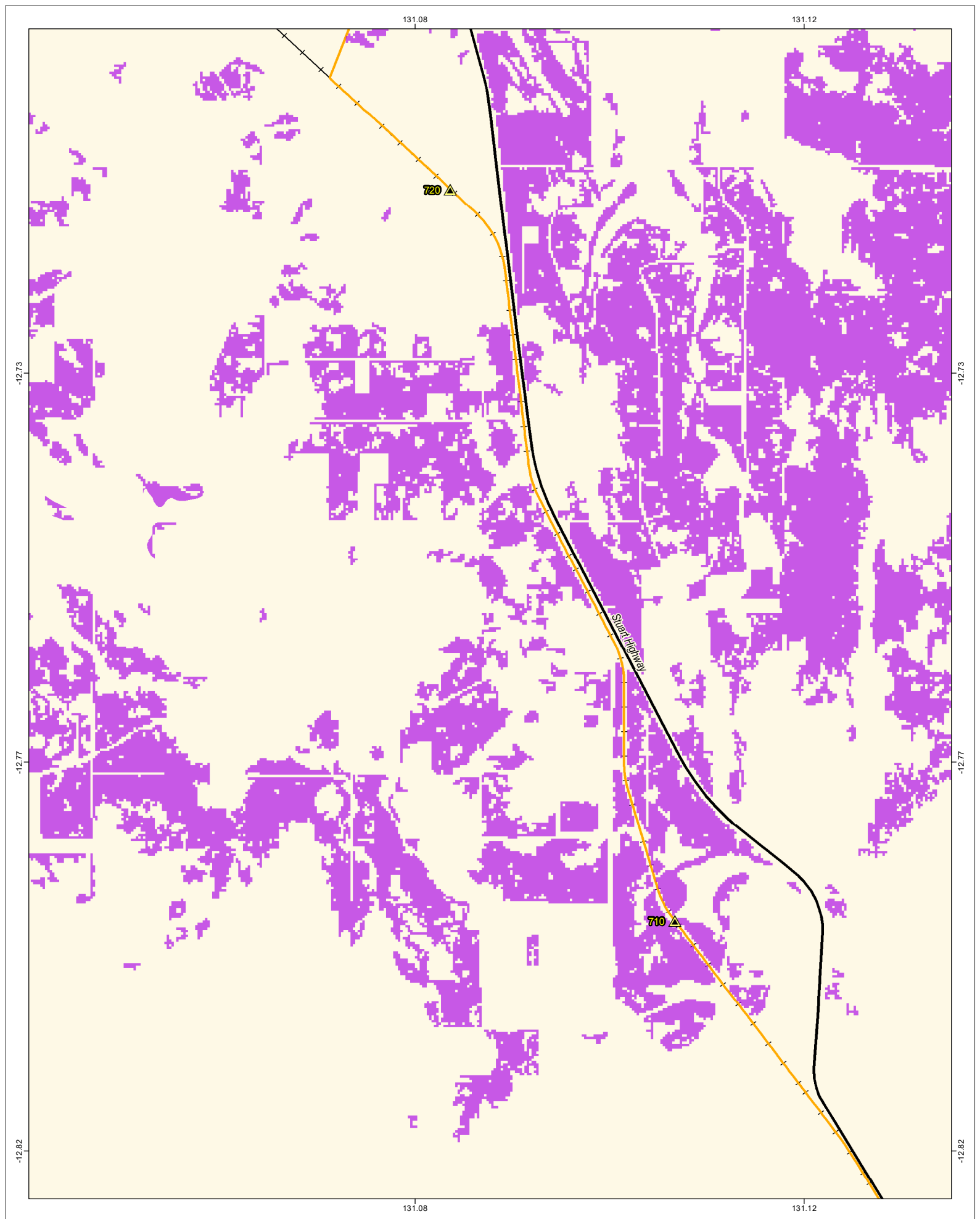


Legend

- OHTL Route
- Railways

Roads

- Principal road
- Secondary road
- OHTL Kilometre Point
- *Typhonium praetermissum* high likelihood habitat

Source: Sun Cable, Geoscience Australia, NR Maps

Fig 2-13: Map of modelled *Typhonium praeterimissum* relevant to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 1.5 Kilometres

Scale: 1:60,000

Coordinate System: GDA2020 | A4

Reference: M-Files Document ID 204951

Date: 03/11/2021 | Revision: A

N

SUN CABLE

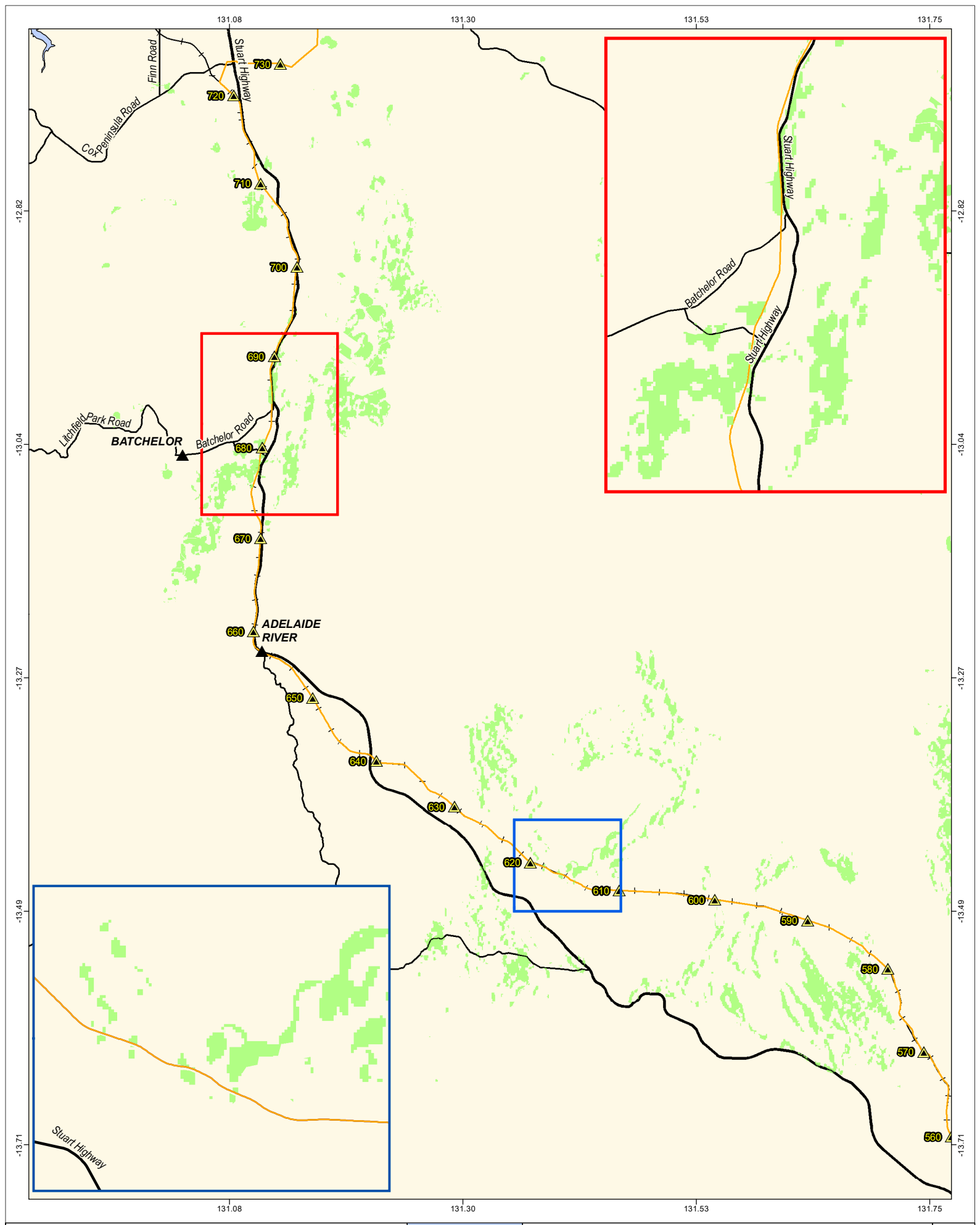
Helicteres macrothrix

Helicteres macrothrix is a multi-stemmed subshrub that is endemic to the Northern Territory. The species is associated with *Eucalyptus tectifica*, *E. miniata* and/or *E. tetrodonta* woodland on clayey soils derived from siltstone or sandier soils derived from the granite-like rock syenite. *Helicteres macrothrix* has been recorded from three populations – near Mt Bundey, near Batchelor and in the Lake Bennett area.

The NT Government has mapped the extent of occurrence of *Helicteres macrothrix* based on known recorded locations (DLRM 2016). Potential habitat for the species has been modelled from historical land resource information that includes existing land unit, vegetation and geological mapping. There are areas of high likelihood habitat modelled within the OHTL railway corridor in patches from Pine Creek to Acacia Hills – see Figure 2-14 – noting that disturbance associated with construction of the railway may mean the species is not present. The OHTL railway corridor crosses just over 10 km of habitat – most of which is between Darwin River Dam and Adelaide River – see Table 2-9. There has been little survey effort for this species in the south of its projected distribution, and the only records from that region happen to be near to the OHTL railway corridor just south of where it crosses Crater Lake Rd near the Batchelor turn-off.

Table 2-9. Locations of high likelihood modelled habitat of *Helicteres macrothrix* within the OHTL railway corridor

KP range	Location	Length (m)
691 – 695	Between Darwin River Dam & Lake Bennett	2,500
685 – 689	Between Lake Bennett & Bachelor turn-off	2,300
676 – 681	Between Coomalie Creek & Adelaide River	3,400
615 – 620	Between Adelaide River & Brocks Creek	1,400
599 – 600	Around Grove Hill	180
583 – 584	Between Grove Hill & Pine Creek	150
578 – 579		190



Legend

- OHTL Route
- Railway

Roads

- Principal road
- Secondary road
- OHTL Kilometre Point
- *Helicteres macrothrix* high likelihood habitat

Source: Sun Cable, Geoscience Australia, NR Maps

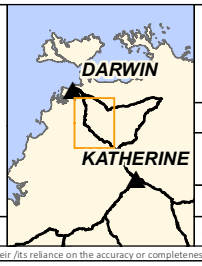


Figure 2-14: Map of modelled *Heliceteres macrothrix* relevant to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 10 Kilometres

Scale: 1:500,000

Coordinate System: GDA2020

A4

Reference: M-Files Document ID 204951

Date: 03/11/2021

Revision: A

N

SUN CABLE

Stylidium ensatum

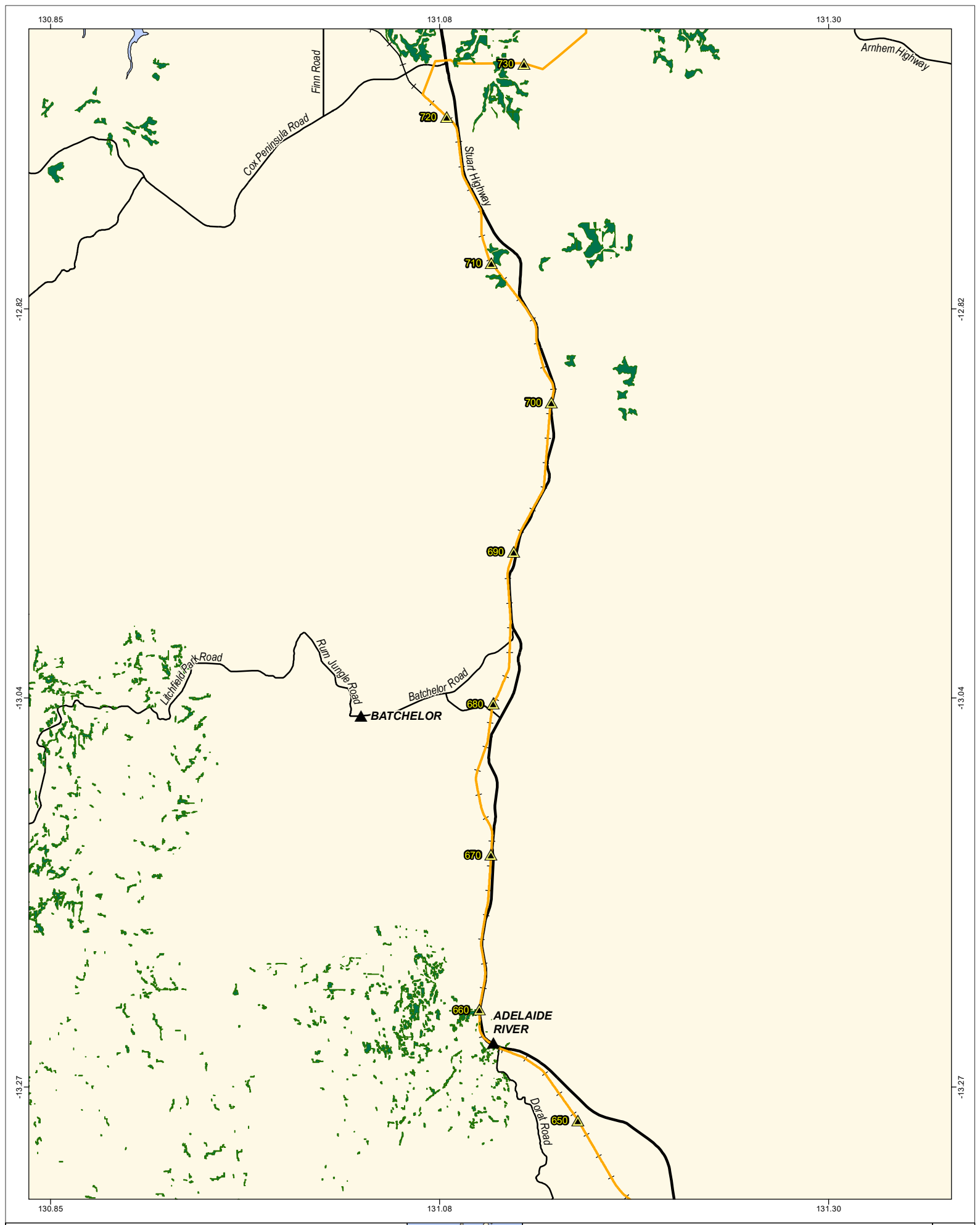
The trigger plant, *Stylidium ensatum*, is endemic to the NT and inhabits margins of drainage areas in damp heavy clay or peaty soil (Cowie and Westaway 2012), although it may prefer sandier or loamy soils (Ian Cowie, NT Herbarium, pers. comm. 2017). Suitable areas for *Stylidium ensatum* tend to be adjacent to Lophostemon swamps, where surface moisture is maintained into the early to mid-dry season (Nick Cuff, NT Herbarium, pers. comm., 2017). The preferred habitat for *Stylidium ensatum* generally supports *Melaleuca viridiflora*, *Eucalyptus alba* and *Lophostemon lactifluus*, but also perennial grasses such as *Eriachne burkittii*, *Pandanus spiralis*, *Osbeckia australiana* and scattered *Banksia dentata* (Donna Lewis, NT Herbarium, pers. comm. 2020).

The NT Government has mapped the extent of occurrence of *Stylidium ensatum* based on known recorded locations close to Darwin and a site at Hayes Creek (NTG 2016). Potential habitat for the species has been modelled from historical land resources that includes existing land unit and vegetation mapping, and defines areas of low and moderate-high likelihood habitat.

There are areas of high likelihood habitat modelled within the OHTL railway corridor in small patches near Acacia Hills and around Adelaide River township – see Table 2-10 and Figure 2-15 – noting that disturbance associated with construction of the railway may mean the species is not present.

Table 2-10. Locations of high likelihood modelled habitat of *Stylidium ensatum* within the OHTL railway corridor

KP range	Location	Length (m)
708 – 711	Acacia Hills	1,150
659 – 660	North of Adelaide River	60



Legend

- OHTL Route
- Railway

Roads

- Principal road
- Secondary road
- OHTL Kilometre Point
- *Stylidium ensatum* high likelihood habitat

Source: Sun Cable, Geoscience Australia, NR Maps

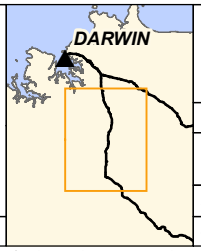


Figure 2-15: Map of modelled *Stylidium ensatum* relevant to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 10 Kilometres

Scale: 1:300,000

Coordinate System: GDA2020 | A4

Reference: M-Files Document ID 204951

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SUN CABLE

Bats

The Bare-rumped Sheathtail Bat (*Saccolaimus saccolaimus (nudicluniatus)*) has only been detected at 11 locations, all in coastal and adjacent areas. 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, specimens have been collected from Pandanus woodland fringing the sedgelands of the South Alligator River, and Eucalyptus tall open forests (Friend and Braithwaite 1986; Churchill 2008) with more recent records from Howard Springs (Milne et al. 2009). Most records occur within near-coastal habitats with one recent exception (Jasper Gorge) 150 km inland (Woinarski et al. 2014). The species forages above the canopy and roosts in groups ranging from 10 to 100 individuals in large trees (*Eucalyptus miniata, E. tetrodonta* and *Melaleuca leucadendra*) that have deep hollow pipes, where the hollow is at least 18 cm in diameter and the entrance to the hollow is at least 6 m from the ground (Milne pers. comm.; Churchill 2008).

The Northern Leaf-nosed Bat (*Hipposideros stenotis*) has only been recorded in few locations across a wide distribution – from Kimberley, WA to the Mt Isa region of north-western Qld (Woinarski et al. 2014). There is a concentration of records around the Pine Creek – including of roosts in old mine adits. The species prefers rocky outcrops and is an obligate cave rooster. Most roosting caves are small, shallow overhangs or splits in sandstone cliffs (Churchill 2008). Foraging habitat is broad and includes monsoon vine thickets, woodlands and open grasslands (Milne 2012).

The Ghost Bat (*Macroderma gigas*) has also been recorded in concentration around the Pine Creek region. The species has a broad distribution – ranging from the arid Pilbara to tropical savanna woodlands and north Queensland rainforests (TSSC 2016) – and generalist foraging requirements, but only 14 breeding sites are known (Worthington Wilmer 2012). Permanent roost sites are generally deep natural caves or disused mines; most breeding sites are caves with multiple entrances (TSSC 2016). One of these is the Kohoonir Adit colony – the largest known maternity site for Ghost Bat – located just south of Pine Creek, and approximately 400 m to the west of the OHTL railway corridor. Ghost Bats move between a number of caves seasonally or as dictated by weather conditions, and require a range of cave sites (Hutson et al. 2001).

Gouldian Finch

The critical components of suitable habitat for the Gouldian Finch (*Erythrura gouldiae*) vary seasonally. In the dry season, the critical components are hollow-bearing Eucalyptus trees (especially *E. tintinnans*, *E. brevifolia* and *E. leucophloia*) (Higgins et al. 2006; O'Malley 2006; Tidemann 1996; Tidemann et al. 1999) with an understorey of the favoured annual grass (*Sorghum* spp., *Schizachyrium* spp.) and a nearby (within 4 km) source of surface water. Gouldian Finches feed on five grass species as the seeds of these species become seasonally available (Lewis 2007), and birds will move from area to area as the seeds from each species become available (Dostine and Franklin 2002; Dostine et al. 2001).

The breeding season extends from February to April, with a longer season (January to August) in years of extended wet season rainfall (Blakers et al. 1984; Woinarski and Tidemann 1991; Tidemann and Woinarski 1994; Tidemann et al. 1999). Individuals or groups appear to first select patches of habitat with high densities of potential nesting sites, and breeding pairs then select specific nest sites based on a suite of preferred hollow morphometric attributes (Brazill-Boast et al. 2010).

In the non-breeding season birds can disperse widely (Garnett et al. 2011), greatly increasing the possible range of this species. Gouldian Finches can occur in flocks of hundreds but are usually observed in much smaller numbers.

The Gouldian Finch was formerly widespread across the northern savannas from the Kimberley to eastern Queensland including Cape York (O'Malley 2006). It has disappeared from most of its previous Queensland distribution, and is now only recorded occasionally and in small numbers from a few sites around the Atherton Tableland and Gregory Range, and in far western Queensland (Barrett et al. 2003; Holmes 1995, 1998). A number of breeding populations are known from the Kimberley. In the Northern Territory, most

known breeding populations occur in the Top End with some isolated records in the Barkly Tableland and in coastal areas of the Gulf of Carpentaria. Some sources believe that Gouldian Finch populations may have recently stabilised, and perhaps begun to increase and spread (Garnett et al. 2011).

A well-studied site intersected by the OHTL railway corridor is the Yinberrie Hills area north of Katherine. Dostine et al. (2001) notes that:

> *A breeding population of Gouldian Finches has occupied this site since at least the early 1980s (Bamford 1982); the persistent use of this site by relatively large numbers of Gouldian finches, while neighbouring sites remain unused or sparsely used, suggests selection for characteristics that are not common in the broader landscape, but poorly understood.*

The Yinberrie Hills is the largest known breeding population of the Gouldian Finch in the Northern Territory. According to Dostine et al. (2001), that population undertake regular seasonal shifts from breeding areas in hill woodland in the dry season, to adjacent lowlands throughout much of the wet season, in response to seasonal changes in food availability.

Using the 1:100,000 spatial dataset entitled *Vegetation of the Daly River Catchment* (Cuff 2011), an analysis was undertaken of the available foraging and roosting habitat within the OHTL railway corridor. As shown in Figure 2-16, the OHTL railway corridor intersects with multiple patches of breeding and foraging habitat for Gouldian Finches in the Yinberrie Hills region – totalling 3.1 km of breeding habitat and 1.7 km of foraging habitat. There are also many records near to the OHTL railway corridor in the Yinberrie Hills SOCS.

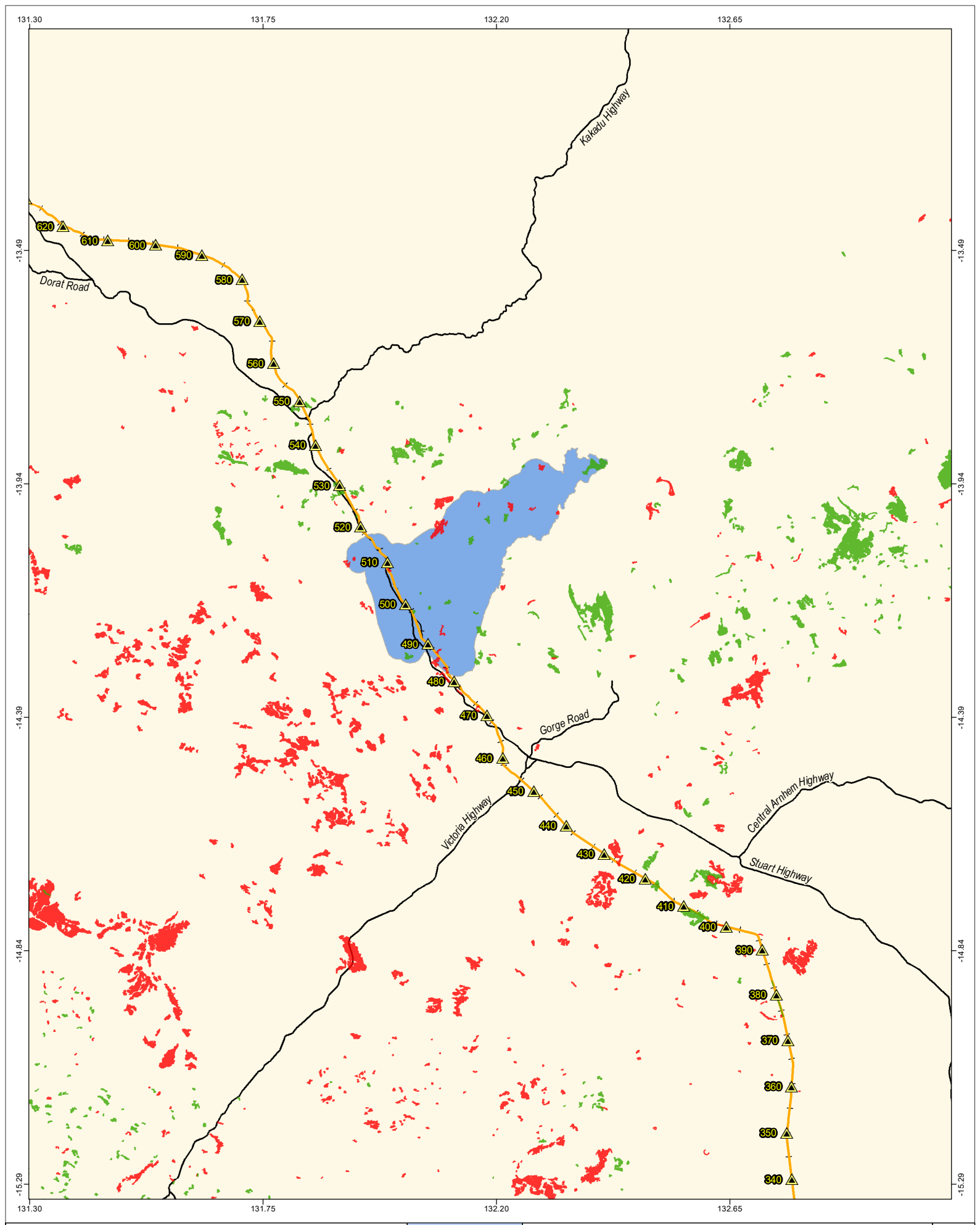
2.4 Migratory species

Australia is a signatory to three bilateral migratory bird agreements with Japan, China and the Republic of Korea. These agreements provide a basis for cooperation on activities for the conservation of migratory birds that move between each country. Species listed on the annexes to these agreements are a Matter of National Environmental Significance under the *EPBC Act* as listed migratory species.

The Protected Matters Search Tool report and the EIS Terms of Reference identify fauna species listed as 'migratory' under *EPBC Act* that may be present within the OHTL railway corridor footprint.

When assessing if a project will significantly impact upon a migratory species, the key considerations under the *EPBC Significant Impact Guidelines 1.1* (DEWHA 2013) are whether an important habitat for a migratory species or an ecologically-significant proportion of a population of a migratory species is involved.

The migratory species relevant to this component of the proposal have very different habitats and ecologies. However, they are all similar in that the OHTL railway 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
- Major Drainage
- Railways
- OHTL Kilometre Point
- Gouldian Finch breeding habitat
- Gouldian Finch foraging habitat

Sites of Conservation Significance

- Yinberrie Hills

Source: Sun Cable, Geoscience Australia, NR Maps

Figure 2-16: Map of key Gouldian Finch habitat relevant to the OHTL railway corridor

Project: Australia-Asia PowerLink

0 10 20 30 Kilometres

Scale: 1:1,000,000

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