

August 2021

Notice of Significant Variation

Pursuant to Section 51(1) of the Environment Protection Act 2019

Australia-ASEAN Power Link Project Proposal



Notice of Significant Variation Document ID 203014

Revision history

Revision	Date	Purpose	Prepared by	Reviewed by	Approved by
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Contents

1	Introduction	1
2	Details of variation	2
2.1.1	OHTL Utilities Corridor	5
2.1.2	Darwin Converter Site	5
2.1.3	Cable Transition Facilities	6
2.1.4	Subsea Cable System	6
2.1.5	Workforce	7
2.1.6	Schedule	7
3	Stakeholder engagement	11
4	Assessment of potentially significant impacts	12
4.1	Environmental values and sensitive receptors	14
4.1.1	Terrestrial environmental quality	14
4.1.2	Terrestrial ecosystems	15
4.1.3	Hydrological processes	17
4.1.4	Inland water environmental quality	19
4.1.5	Aquatic ecosystems	20
4.1.6	Marine environmental quality	20
4.1.7	Marine ecosystems	22
4.1.8	Air quality	25
4.1.9	Atmospheric processes	26
4.1.10	Community and economy	26
4.1.11	Culture and heritage	27
4.1.12	Human health	27
4.1.13	Matters of National Environmental Significance	28
4.2	Potential impacts and mitigation measures	28
5	Conclusion	38
6	References	38

Tables

Table 2-1. Comparison of original proposed action and varied action	3
Table 4-1. NT EPA Factors and Objectives identified in the NT EPA Statement of Reasons	13
Table 4-2. Land units and soil characteristics (Source: Easey et al. 2020)	14
Table 4-3. Background nutrient concentrations in marine waters (Source: Water Technology 2017)	21
Table 4-4. Conservation status of migratory birds within the Gunn Point area	24
Table 4-5. Summary of potential impacts and avoidance/mitigation measures for varied components	29

Figures

Figure 2-1. Map showing original location and varied location of infrastructure in the Darwin region	4
Figure 2-2. Map of Overhead Transmission Line (OHTL) in Utilities Corridor	8
Figure 2-3. Map of Darwin Converter Site and Cable Transition Facilities	9
Figure 2-4. Map of Subsea Cable System Route Options	10
Figure 4-1. Map of Chatto (2003) shorebird survey results for the Darwin and Bynoe Harbour region	25

1 Introduction

This document provides details of a proposed variation to Sun Cable’s Australia-ASEAN Power Link (AAPowerLink) proposal referred to the NT Environment Protection Authority (NT EPA) on 7 October 2020. The proposal is being assessed under the NT *Environment Protection Act 2019 (EP Act)* and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* under an accredited assessment process¹. Offshore project components within the NT Coastal Waters limit are subject to the *EP Act* and the Australia Exclusive Economic Zone (AEEZ) sets the extent of the *EPBC Act* assessment. Terms of Reference (TOR) for the assessment were issued by the NT EPA on 21 January 2021.

As detailed in the original Referral available on the NT EPA website ([available here](#)), 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 Powell Creek Solar Precinct). The electricity produced will be exported via a High-Voltage Direct Current (HVDC) Overhead Transmission Line (OHTL) to Darwin, and then on to Singapore via a Subsea Cable System. Proposal planning has progressed significantly since the original Referral was made to the NT EPA, including detailed modelling of generation and transmission system specifications as well as offtake market sounding. Through this process Sun Cable has identified a need to change the location of the Darwin facilities component of the proposal, as well as upgrade the system specifications. These changes trigger a ‘notice of significant variation’ pursuant to Section 51(1) of the *EP Act* and a variation request in accordance with Section 156A the *EPBC Act*.

Sun Cable proposes to relocate the Darwin facilities component of the proposal, including the Cable Transition Facilities, Darwin Converter Site, a segment of the Subsea Cable Corridor, and Overhead Transmission Lines, due to various constraints. Additionally, the proposed capacity rating of the solar farm and transmission system has been increased to reflect the latest solar module specifications and electricity demand forecasts, which in turn require additional cables and converter infrastructure.

The Darwin Converter Site and Cable Transition Facilities will be relocated from the current proposed location on Middle Arm Peninsula and Channel Island in Darwin Harbour, to Murrumujuk, 31km north-east of Darwin (Figure 2-1). This change is being made to avoid land use conflicts on Middle Arm Peninsula identified by the NT Department of Infrastructure Planning and Logistics (DIPL) Middle Arm Masterplan exercise. The changes will see the AAPowerLink infrastructure relocated to ultimately avoid inner Darwin Harbour, where the Subsea Cable System was proposed to be laid. The infrastructure is proposed to be located at Murrumujuk, following extensive consultation with a wide range of NT Government (NTG) agencies, and other key stakeholders. Importantly, the OHTL route was selected because it can be contained within a utilities corridor east of Darwin, identified by the NTG in its strategic planning policies.

The original dispatch capacity of the proposed AAPowerLink transmission system was identified as peak generation of approximately 10GW with 3.2 GW of electricity exported through the OHTL from the Solar Precinct. System modelling and review of forecast solar module technologies available from 2023 indicate the need for a revised peak generation capacity of approximately 17GW, subject to final modelling. The proposed transmission system rating is now approximately 6.4 GW for the OHTL and 5.4 GW for the Subsea Cable System. Generation and transmission capacity will be built in stages in response to market demand, with the OHTL, Voltage Source Converters (VSCs), batteries and Subsea Cable Systems able to be installed progressively and operated as two or more independent power systems dispatching power offshore.

The screening-level assessment of the proposed variation undertaken by EcOz Environmental Consultants indicates it is not expected to significantly alter the magnitude, extent or duration of environmental impacts associated with the proposal, for most environmental factors. The assessment did identify three additional NT listed threatened species (two plants and one frog species) that could potentially occur in the new footprint and therefore will require further survey to verify presence/absence. Details of these species are provided in the Terrestrial Ecosystems section of this document (Section 4.1.2) and the TOR have been amended to include further consideration of these species in the EIS. For all other environmental factors,

¹ An assessment conducted using the NT EPA assessment process that has been accredited by the Australian Government, making it possible to conduct a single assessment and avoid duplication.

the current TOR are considered to adequately capture the potentially significant impacts that require consideration in the EIS, without further amendment.

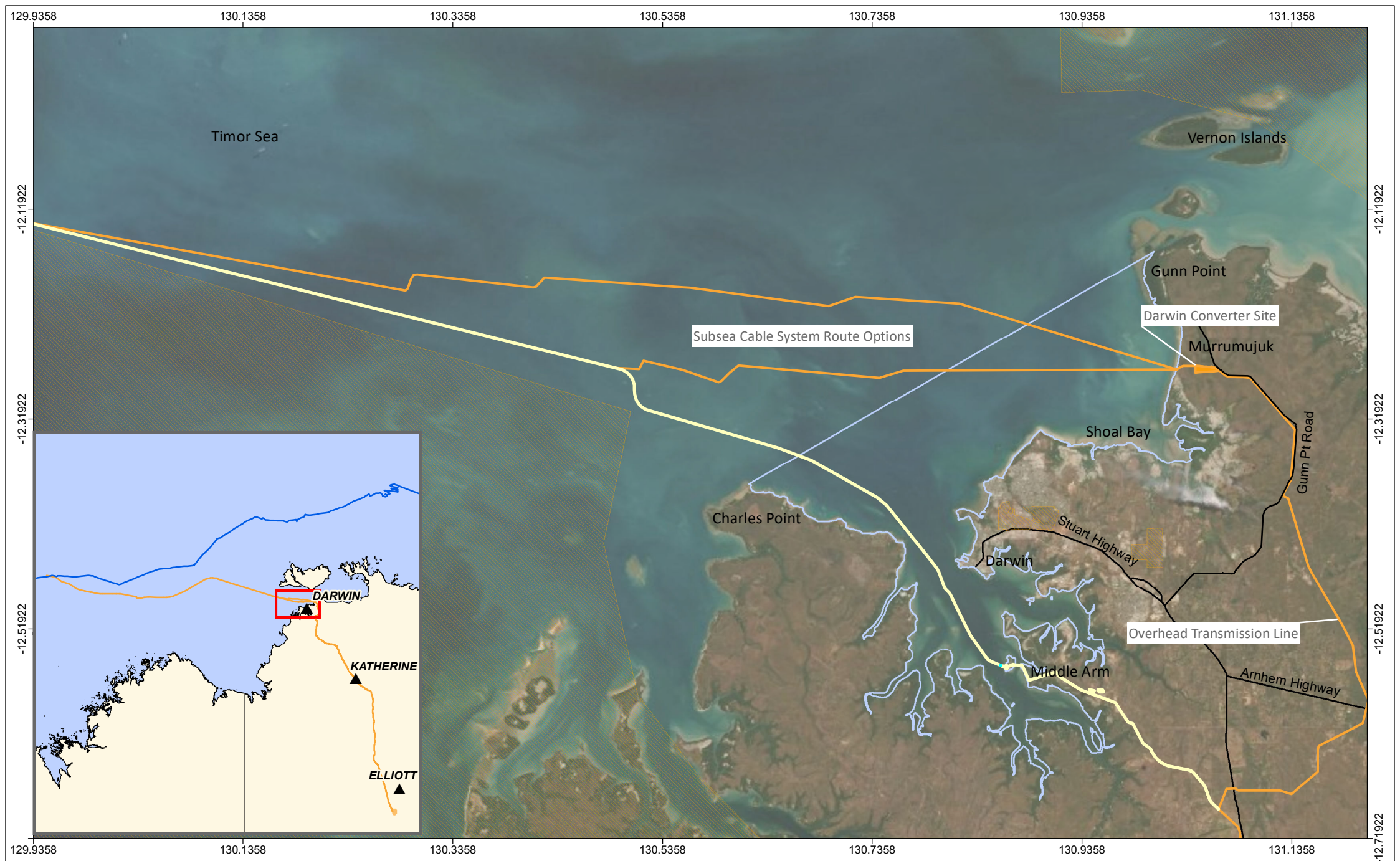
Sun Cable is determined to ensure that the revised Proposal delivers a net social and environmental benefit to the Northern Territory. The proposed infrastructure changes proactively avoid impacts within Darwin Harbour and Middle Arm through re-design and mitigate impacts to Gunn Point region through use of NTG allocated linear corridors and co-location of components with other similar facilities. Sun Cable aims to maximise opportunities for Indigenous and non-Indigenous Territorians throughout all project phases and is developing a Territory Benefits Plan to support this approach.

2 Details of variation

The variation relates primarily to proposal components in the Darwin region. All other components – namely the Powell Creek Solar Precinct and the southern 733 km of the OHTL within the Railway Corridor – remain consistent with the details provided in the original Referral, with the exception of capacity ratings. The proposed variation does not significantly alter the project components, or the methods associated with the construction and operation of the infrastructure. The dimensions of the OHTL remain consistent with the original referral, however, capacity has been increased, along with the overall length by 37km due to the locational change to Murrumujuk. The number of subsea cables proposed has increased from three to six, to accommodate the change in capacity ratings for the offshore system. The length and transmission capacity of the OHTL and Subsea Cable System have been amended because of this change and to accommodate updated electrical modelling. Table 2-1 and Figure 2-1 compare the original and varied location and footprint, and the proposed changes are further described in the sections below.

Table 2-1. Comparison of original proposed action and varied action

Proposal component	Original location/footprint	Varied location/footprint	Effect of change
Solar Precinct	Powell Creek Station	No change. The preferred site location will be identified in the EIS. Increase in generation capacity within existing footprint.	No change
Overhead Transmission Line	751km OHTL within Railway Corridor from Powell Creek Station to Darwin facilities site on Channel Island Road, Middle Arm Peninsula for up to 3.2GW of transfer capacity.	788km OHTL from Powell Creek Station to new Darwin facilities site at Murrumujuk. Final 66km deviates away from Railway Corridor, following a future utilities corridor identified by NTG to Murrumujuk. Up to 6.4 GW capacity.	Increased land clearing footprint (and associated potential impacts) due to additional 37km OHTL length. No material change in structure dimensions. No change to first 722km along Railway Corridor from Solar Precinct to Livingstone.
Darwin Converter Site	10ha site on Middle Arm Peninsula	124 ha site at Murrumujuk; development footprint of approximately 55ha.	Increase in size and number of VSCs to accommodate for peak electricity supply/demand modelling; however, avoids potential land use conflicts and impacts on Middle Arm Peninsula.
Underground Cable Corridor	~10km x 30m wide corridor along Channel Island Road to four optional sites	2.7km x 35m wide corridor from Darwin Converter Site at Murrumujuk to Land Sea Joint (LSJ) station at the southern end of Gunn Point Beach	Reduced land clearing footprint due to shorter cable length. Avoids mangroves and mudflats. No HDD crossings required.
Land Sea Joint Station	1ha site on southern shores of Middle Arm	1ha site at the southern end of Gunn Point Beach	Avoids impacts to mangroves. EIS will alternatively need to assess potential impacts to the beach and dune environment.
Shore Crossing Site	Horizontal directional drilling or temporary trench depending on local conditions and constraints	Temporary trench	No change
Subsea Cable System	731km Inshore section of route installed through Middle Arm Darwin Harbour. Three cables.	740km Inshore section of route installed through outer Shoal Bay and the coastal waters of Timor Sea, connecting into original route 45km offshore. No change to offshore section of route within the AEEZ. Six cables.	Cable length increased by approximately 9km. The methods of deployment / trench width per cable is consistent with the original referral. 6 cables spaced 50-200m apart with a total corridor width of 1.2km (inclusive of a 100m buffer). Avoids potential for future conflict with other land uses and cumulative impacts in Darwin Harbour.



- Legend**
- Original Sun Cable Infrastructure
 - Varied Sun Cable infrastructure
 - NT Roads
 - Australian Exclusive Economic Zone
 - Darwin Harbour boundary
 - Defence Training Area



Map showing original location and varied location of AAPowerLink infrastructure in the Darwin Region

Project: Australia-ASEAN Power Link		Reference #: Document 203032	Figure 2-1	Revision: A
Coordinate System: MGA 53	Datum: GDA2020	Date: 25/06/2021	SUN CABLE	
		Scale: 1:500,000		

Source: NTG - Roads, GA.gov - Defence areas. Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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2.1.1 OHTL Utilities Corridor

The new section of the OHTL corridor (referred to as the OHTL Utilities Corridor) extends from the Railway corridor exit point at Livingstone in a north-east direction to the Darwin Converter Site at Murrumujuk. The total length of the new section is approximately 66km. The route was selected based on the NTG's Litchfield Sub-Regional Land Use Plan (LSLUP) which identifies this land as a utilities corridor. The majority of this corridor is within Zone U (Utilities) except for between the railway corridor and the Stuart Highway where it traverses a section of Zone CN (Conservation) land and also proximate to Gunn Point Road where it traverses an area of Zone WM (Water Management) land. The location of the OHTL Utilities Corridor is shown in Figure 2-2. Sun Cable will utilise a portion of the corridor for transmission infrastructure, however, spatial requirements are such that it will not preclude the corridor from being used for other purposes.

Consistent with the original proposal, the OHTL infrastructure will occupy an easement of up to 60m wide, dependent upon site specific conditions. Anticipated construction methodology is consistent with the original Referral, although additional clearing will be required by virtue of the increased length.

2.1.2 Darwin Converter Site

The Darwin Converter Site is located on approximately 124ha of land at Murrumujuk in the Litchfield Council municipality (refer Figure 2-3). The subject site is formally identified as part of NT Portion 2626 and is Crown land with a Crown Lease in Perpetuity granted to the NT Land Corporation. The site is bounded by Murrumujuk Drive to the north and Gunn Point Road to the east, and land immediately to the south is within the Shoal Bay Coastal Reserve. The Project Sea Dragon aquaculture hatchery site is located immediately west on a 130ha site.

The subject site is within Zone FD (Future Development) of the Northern Territory Planning Scheme's (NTPS) Litchfield Sub-Regional Land Use Plan (LSLUP). Clause 4.27 of the NTPS states that the purpose of Zone FD is:

'Identify an area that is intended for future rezoning and development in accordance with the Strategic Framework. Development is limited to a level that will not prejudice future development or is compatible with planned future purposes.'

It is noted that proposed changes to the LSLUP were publicly exhibited early in 2021. Included in the proposed changes was a conceptual plan for the future Murrumujuk township. The Darwin Converter Site footprint does not prejudice the future residential aspirations of this concept plan. Importantly, the Zone FD status of the Darwin Converter Site remains unchanged. As such, the land use is considered to align with the strategic planning framework.

Within the site, approximately 55ha of land will be cleared and developed for the proposed facilities. The primary function of the Converter Site is to facilitate the conversion of the high voltage direct current (HVDC) power delivered by the OHTL to high voltage alternating current (HVAC), enabling isolation of onshore and offshore transmission, and to enable connection to the local electrical network in Darwin. Part of the power supply (600-1600MW) will be available for supply to the Northern Territory market. The majority of the power supply, approximately 4.4-5.4GW, will be converted back to HVDC for transmission offshore via the Subsea Cable Systems.

The Darwin Converter Site will comprise up to four Voltage Source Converters (VSC), a battery facility, substations and switchyards, an Operations and Maintenance Facility including staff offices and ablutions, site access, parking and laydown areas, and ancillary infrastructure. The increase in VSCs (from two in the original proposal, to four) is required to accommodate peak transmission requirements and future demand growth. The facilities will be located in a fenced compound with 24-hr lighting and surveillance. The facility will be connected to mains power and will source potable and firefighting water supply from an onsite bore or the nearby water pumping station.

2.1.3 Cable Transition Facilities

The Cable Transition Facilities include an Underground Cable Corridor, Land Sea Joint (LSJ) Station and Shore Crossing Site. The location of these facilities is shown in Figure 2-3.

2.1.3.1 Underground Cable Corridor

Power leaving the Darwin Converter Site enroute to Singapore, will be transferred by underground HVDC cables to the LSJ via an Underground Cable Corridor approximately 2.7km long and 35m wide. The proposed corridor will be subject to geotechnical testing and assessment of Acid Sulfate Soils (ASS) risk to confirm suitability of the soils and determine whether any specific treatments are required. The corridor will be partially cleared for construction purposes and reinstated with native grasses and cover species post construction.

2.1.3.2 Land Sea Joint Station

The LSJ Station will be a fenced 1ha site located approximately 300m inland from the beach near the junction of the access tracks to the adjacent Beach and Tree Point Conservation Reserve. The LSJ Station will house multiple LSJ Bays, one for each cable excavated to dimensions of approximately 20m (l) x 5m (w), to physically connect the onshore cables to the offshore cables. The LSJ Station site includes a construction area to accommodate excavators, generators, pumps, winches, surge arrestors, joint workshop, pipe storage, and ancillary infrastructure – including construction site offices, lighting, fuel storage and amenities.

2.1.3.3 Shore Crossing Site

The Shore Crossing Site is where the subsea cables will be winched from a barge located offshore to the LSJ Station. For each cable, an open trench will be dug from the LSJ Station across the shoreline out to the low water mark. The temporary trenches will be approximately 2m wide and 0.5-2m deep. The cable will be laid in the trench and then buried using the material excavated from the trench.

Post-construction, the land surface and seafloor will be reinstated and vegetation will be allowed to regrow. The disturbed corridor will then revert to an area with uninhibited public access consistent with current site conditions. Access to the area may be required for periodic faults, inspections or maintenance purposes.

2.1.4 Subsea Cable System

The Subsea Cable System will be laid from the LSJ Station through the coastal waters of outer Shoal Bay, the Timor Sea and into the Beagle Gulf heading westward toward the AEEZ. The proposed variation includes two route options under investigation from the shore crossing to a common point of convergence with the originally proposed Northern Route approximately 45km offshore. Both options will be subject to further engineering studies and marine survey with the preferred route identified in the EIS submission.

Both Subsea Cable System route options avoid known areas of recreational fishing value such as artificial reefs and wrecks. In broad terms, the first 22km of the routes traverses the coastal waters of outer Shoal Bay and the Darwin Harbour, remaining outside the Darwin Port boundary, before extending through the Timor Sea. The route options are approximately 7km offshore of Lee Point and 15km offshore of Charles Point. Once outside the boundaries of Darwin Harbour, the originally proposed Northern Route is adopted, which is generally consistent with the Referral. The routes are shown in Figure 2-1.

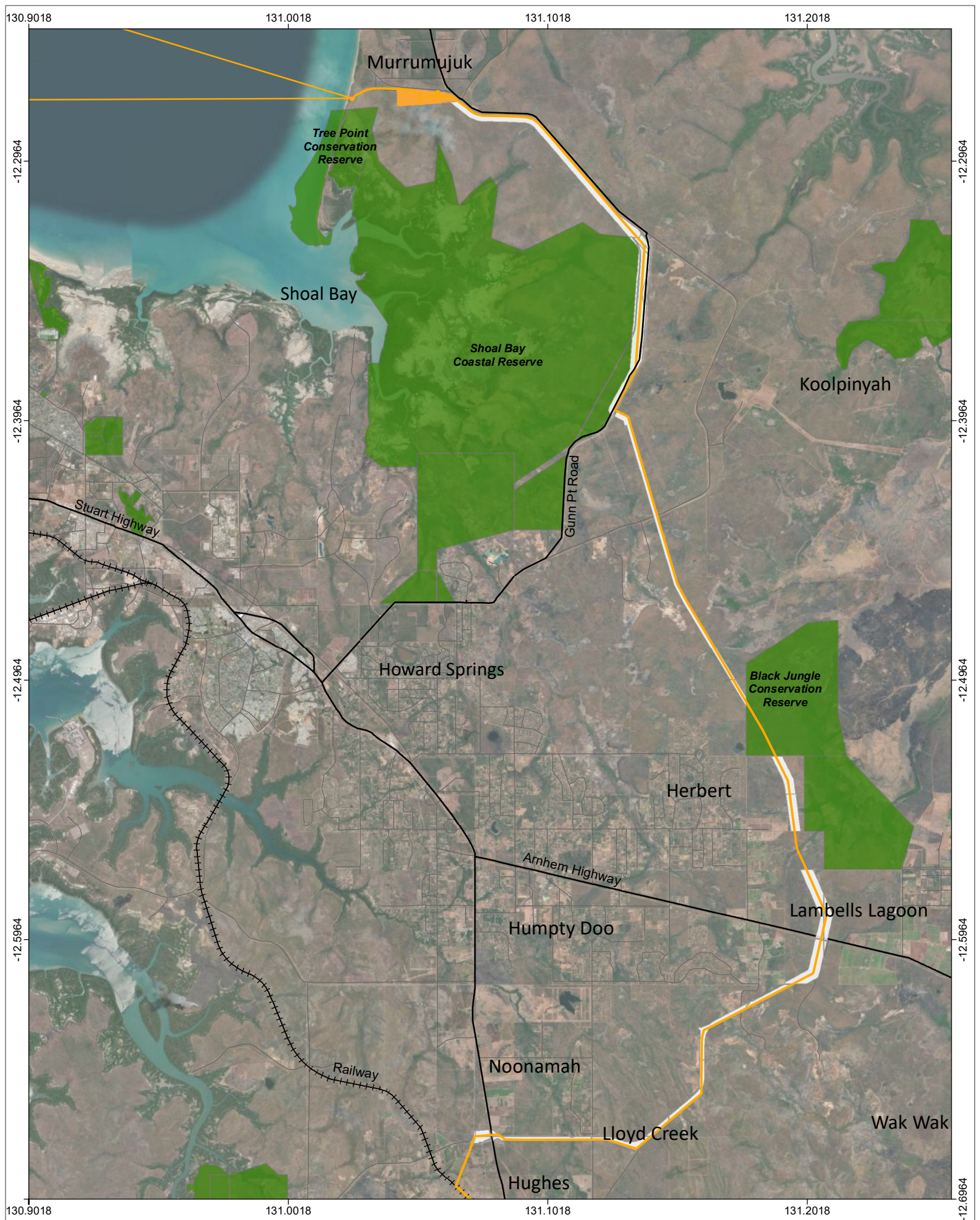
The system will comprise up to six cables to accommodate peak supply requirements and future growth in demand. Cables could be installed individually or in a bundled configuration. The spacing between the cables will be between 50-200m depending on specific sea floor features, with actual spacing requirements to be determined in detailed design. The cables will either be laid on the seafloor or trenched into the seabed generally to a depth between 0.3-1m (in certain circumstances it may be necessary to bury to 3m depth), or protected with armouring as required, subject to various hazards and sea floor conditions along the route. The method of laying cables remains consistent with the original Referral.

2.1.5 Workforce

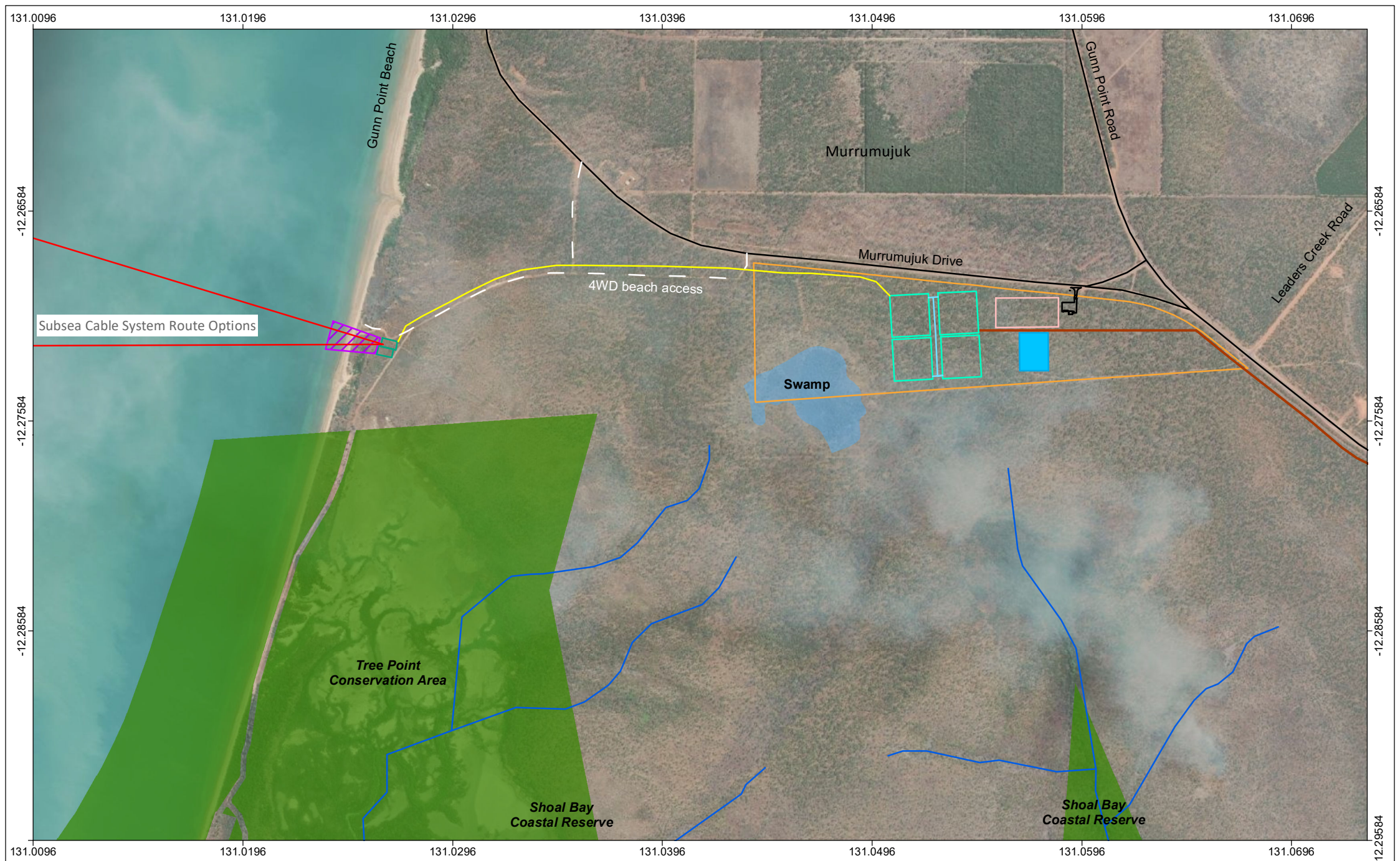
The variation does not change the workforce requirements in Darwin. An estimated construction workforce of 500 personnel will be required to construct the Darwin facilities. The workforce will be drawn from the Greater Darwin Region where available. Any external workers will be accommodated as close to site as possible and will be bussed to site to avoid traffic and parking congestion.

2.1.6 Schedule

The variation does not materially alter the proposed schedule. The onshore construction program will run for approximately 60 months and is scheduled to commence in the first quarter of 2024. The offshore construction program will run for 57 months and is scheduled to commence in the second quarter of 2024.



Legend Sun Cable infrastructure NT Park and Reserves Utilities corridor NT Rail		Roads Minor Road Major Road			Map of Overhead Transmission Line (OHTL) in Utilities Corridor		
Project: Australia-ASEAN Power Link					Reference #: Document 203032		
				Date: 25/06/2021 Figure 2-2 Revision: A			
Scale: 1:200,000 Datum: GDA2020				Coordinate System: MGA Zone 52 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 Community</small>							
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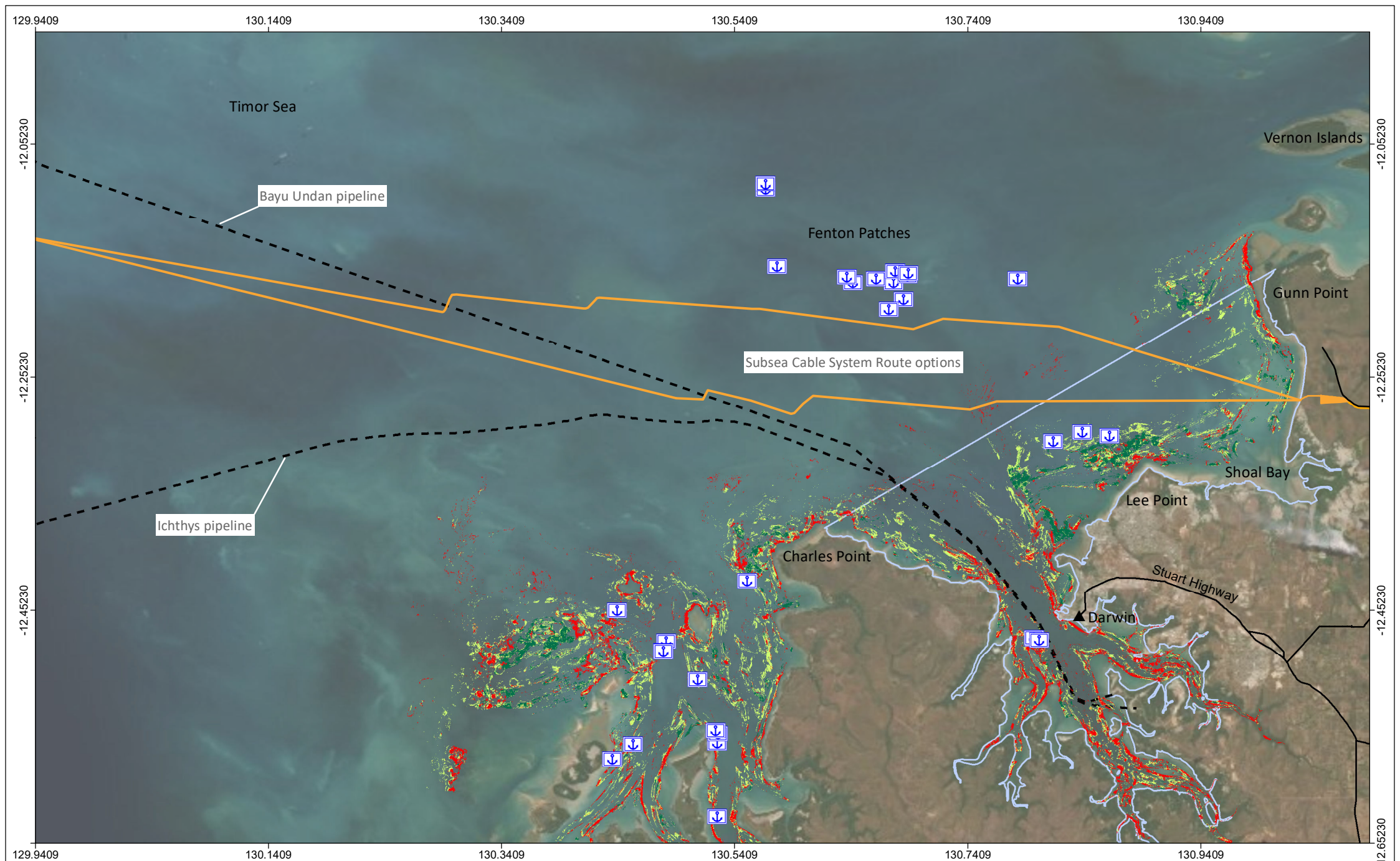
Legend		
— Subsea Cable System Route options	 Land Sea Joint Station	 Underground Cable Corridor
 OHTL Route	 Operations and Maintenance Facility	 Streams
 Darwin Converter Site	 Voltage Source Converter	 NT Parks and Reserves
 Shore Crossing	 Carpark and vehicle access	
 Battery Facility		



Map of Darwin Converter Station and Cable Transition Facilities

Project: Australia-ASEAN Power Link	Reference #: Document 203032	Figure 2-3	Revision: A
Coordinate System: MGA 53	Datum: GDA2020	Date: 25/06/2021	
		Scale: 1:25,000	A4

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
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Legend

- Sun Cable Infrastructure
- Petroleum Pipeline
- Darwin Harbour boundary
- Artificial reefs

Marine Communities (Probability >50%)

- Macroalgae
- Seagrass
- Hard coral

Source: NTG - Roads, Marine Communities, Artificial Reefs, WA Govt Data - Pipelines. Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Map of Subsea Cable System Route options

Project: **Australia-ASEAN Power Link** Reference #: Document 203032 Figure 2-4 Revision: A

Coordinate System: MGA 53 Datum: GDA2020 Date: 25/06/2021

Scale: 1:450,000 A4

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3 Stakeholder engagement

Sun Cable is undertaking a comprehensive and ongoing program of stakeholder engagement to inform planning and design of the AAPowerLink Proposal. The need for this variation to the Darwin facilities components of the proposal arose as a result of engaging with NTG agencies in relation to future land uses proposed for the Middle Arm Peninsula. Sun Cable has worked closely with NTG over the past twelve months to select and define the new location and footprints of the facilities. During this time, Sun Cable has also met with representatives of the Environmental Assessments Division (advisors to the NT EPA) and Commonwealth Department of Environment in relation to administrative arrangements for referring the variation and addressing the changes through the EIS process.

To support this notice of variation, Sun Cable undertook desktop research and consulted with key agencies and stakeholders to inform them of the proposed variation and seek their advice in relation to any significant issues or aspects to be considered and addressed during the EIS process.

Identified Stakeholders in the precinct include:

- Northern Territory Parks and Wildlife Commission
- Broader Community
- Conservation Land Corporation
- Landowners close to the OHTL Utilities Corridor
- Larrakia Traditional Owners
- Litchfield Council
- Residents within the Litchfield municipality
- Northern Territory Land Corporation
- NT Government Agencies
- Recreational users (fishing, camping)
- Seafarms Group Pty Ltd and other businesses in the region
- Tiwi Traditional Owners
- Wulna Traditional Owners

A broader consultation program specific to the variation will continue throughout the public exhibition period, including meetings and written correspondence to identified stakeholders to advise them of the variation and public exhibition period. Meetings will be held to support this process with identified stakeholders, and those that identify their interest.

Separately, Sun Cable is undertaking a strategic and community consultation program to support the EIS and the Social Impact Assessment. The EIS engagement strategy commenced in March 2021 and will continue throughout the EIS process.

It is important to note that consultation undertaken for this variation has focussed on identifying any required changes to the EIS TOR. The detailed consultation and contemplation of the TOR will be undertaken as part of the EIS engagement strategy referred to above.

4 Assessment of potentially significant impacts

The NT EPA, in its Statement of Reasons issued for the original proposal, considered that the Project has the potential to significantly impact environmental values associated with 12 environmental factors (refer Table 4-1). The environmental values and potential impacts associated with the new location and footprint have been subject to a screening level of assessment by EcOz. The assessment indicates that the variation is not likely to affect any additional factors but could alter the nature of potential impacts to the Terrestrial Ecosystems factor due to the different vegetation communities and habitats that occur in the new footprint.

Environmental values and receptors in the new footprint have been described and mapped using Government datasets, existing published information (referenced herein) and engagement with NT Government agencies (refer Section 4.1). The values present in the new footprint are – for the most part – less sensitive to development than the mangrove and marine environments of Middle Arm and inner Darwin Harbour (where the Darwin facilities and inshore section of the Subsea Cable System were to be originally located).

Assessment of the new footprint identified three additional NT-listed threatened species (two plants and one frog species) that could potentially occur and therefore will require further survey to verify presence/absence. Details of these species are provided in the Terrestrial Ecosystems section (Section 4.1.2).

There are some points along the new OHTL route that traverse closer to rural residences than the original OHTL route. The extent to which these areas could experience short-term nuisance noise and dust impacts during construction will be further considered in the EIS. The Darwin Converter Site and Shore Crossing Site (i.e. at Murrumujuk and the southern end of Gunn Point Beach) are areas that receive a high level of recreational use that could experience some temporary impact during the construction.

The sections below describe the environmental values and receptors that occur within and surrounding the new footprint and identify potential impacts that will require further assessment through the EIS process that is currently underway.

Table 4-1. NT EPA Factors and Objectives identified in the NT EPA Statement of Reasons

Land	<ul style="list-style-type: none"> • Terrestrial environmental quality – soil quality may be significantly impacted over a large area through: vegetation clearing; erosion; shading from solar panels; leaks of hazardous materials. • Terrestrial ecosystems – threatened species, and sensitive and significant vegetation, may be impacted by vegetation clearing and habitat disturbance. There is a high level of uncertainty regarding the significance of potential impacts due to lack of information.
Water	<ul style="list-style-type: none"> • Hydrological processes – the area of disturbance for the solar farm and numerous water crossings for the transmission line may result in impacts on surface hydrology, though the significance of potential impacts is uncertain. • Inland water environmental quality – the area of disturbance for the solar farm and numerous water crossings for the transmission line may result in impacts on surface water quality, though the significance of potential impacts is uncertain. • Aquatic ecosystems – the area of disturbance for the solar farm and numerous water crossings for the transmission line may result in impacts on aquatic ecosystems, though the significance of potential impacts is uncertain.
Sea	<ul style="list-style-type: none"> • Marine environmental quality – significant impacts to marine water quality may occur due to disturbance of the seabed during sub-sea cable installation. • Marine ecosystems – significant impacts to marine ecosystems may occur due to disturbance of habitat and threatened species during sub-sea cable installation and operation.
Air	<ul style="list-style-type: none"> • Air quality – there is the potential for significant impact to air quality through dust emissions at the solar farm precinct due to the large area of disturbance. • Atmospheric processes – while a renewable energy proposal may contribute to achieving greenhouse gas emission targets in the NT, this is yet to be demonstrated taking into account vegetation clearing.
People	<ul style="list-style-type: none"> • Community and economy – the proposed action has the potential to significantly impact communities, including Aboriginal communities, within its area of influence, both adversely and beneficially. • Culture and heritage – sacred sites and cultural and historical heritage may be impacted during construction of the proposed action. The significance of impacts is currently uncertain. • Human health – significant adverse impacts to human health from the proposed action are not anticipated but this must be demonstrated.

The NT EPA considered other environmental factors during its consideration of the referral, however, the impact on those factors was not considered to be significant.

4.1 Environmental values and sensitive receptors

The environmental characteristics and values associated with the varied components of the proposal footprint are described in the sections below.

4.1.1 Terrestrial environmental quality

The NT EPA's objective for Terrestrial Environmental Quality is to:

Protect the quality and integrity of land and soils so that environmental values are supported and maintained.

The land and soils present in the varied components of the proposal footprint are briefly summarised below from available land unit mapping (DENR 2010 and Easey et al. 2020).

4.1.1.1 OHTL Utilities Corridor

The OHTL Utilities Corridor traverses 18 land units that are found within the NT (DENR 2010). This area is predominantly comprised of lateritic plains, with some smaller areas of sandstone hills and plains at the southern end of the OHTL Corridor. Two floodplain areas are present within the deviation, one near Elizabeth River, and one within the Black Jungle conservation reserve. These floodplain areas have a moderate to high risk of erosion and poor drainage (DENR 2010).

Of the 18 land units traversed, those that contain one or more of the following characteristics need to be addressed:

- hydrosols
- slopes greater than 3%
- potential ASS

Land units that contain the above characteristics will be addressed during the construction process to minimise the likelihood of impacts to terrestrial environmental quality.

4.1.1.2 Darwin Converter Site

Land unit mapping prepared by Easey et al. (2020) indicates that the Darwin Converter Site is located on undulating upland plains with coarse unconsolidated sands and gravelly soils, associated within land unit 8. There is swamp (land unit 11) located in the south-western corner of the site, however, this area will not be developed. The land units are described in Table 4-2, and shown in Figure 2-3 (Easey et al. 2020).

There are no areas of ASS within the Darwin Converter Station footprint.

Table 4-2. Land units and soil characteristics (Source: Easey et al. 2020)

Land unit	Description	Dominant soil order	Soil depth	Slope range	Drainage	Runoff	Permeability
11 Swamps	Swamps, billabongs and closed depressions	Hydrosols	>1m	<1%	Very poorly drained	No runoff	Slow
8 Plains	Level to gently undulating upland plains	Kandosols	>1.5m	1-2%	Well drained	Very slow	Moderately permeable

Land unit	Description	Dominant soil order	Soil depth	Slope range	Drainage	Runoff	Permeability
7 Low rises	Low rises and gently inclined pediment slopes	Kandosols	0.25-0.5m	1-3%	Well drained	Slow to moderately rapid	Moderately permeable
6 Rises	Rises and short steep slopes	Rudosols	<0.25m	5-15%	Well drained	Moderately rapid - rapid	Moderately permeable

4.1.1.3 Cable Transition Facilities

The Underground Cable Corridor traverses land unit 8, and the LSJ Station is located in land unit 7, with a small section of land unit 6 in the north-western corner (Figure 2-3).

Land unit 6 (Rises) has the highest likelihood of erosion and topsoil migration due to its significant slope range of 5 to 15 %. Field investigations will ground-truth land unit boundaries. If the classification of land unit 6 is correct, management is likely to be required through the implementation of an ESCP.

There is some existing erosion at and adjacent to the LSJ Station caused by 4WD beach access tracks that lead onto Gunn Point beach at Murrumujuk. This locality is a frequented recreation area where 4WD'ing and camping has likely led to degradation of the beach dunes in some areas. Field surveys will be conducted to confirm any existing erosion or degradation of these areas.

The majority of the footprint is of sufficient distance from the coast to not contain ASS; however, the LSJ Station and Shore Crossing Site will pass through a section of high probability ASS just offshore of the beach (Lynch et al. 2012). Further assessment of ASS risk will be undertaken to inform management requirements.

4.1.2 Terrestrial ecosystems

The NT EPA's objective for Terrestrial Ecosystems is to:

Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The habitats present in the varied components of the proposal footprint are briefly summarised below from available desktop information. Field surveys of the footprint will be undertaken by ecologists later in 2021 to refine this information for the EIS.

4.1.2.1 OHTL Utilities Corridor

The OHTL Utilities Corridor footprint is predominantly a greenfield site identified by NTG. Existing desktop and spatial ecological datasets are available for parts of the corridor that run immediately adjacent to Shoal Bay Coastal Reserve and through the proposed Noonamah Ridge residential development site, which has been well surveyed (by EcOz). The main ecological survey gaps along the OHTL are the section between the Railway Corridor and the end of Alvery Rd (the Noonamah Ridge site boundary), and the section running north-east and then north from the Noonamah Ridge site to Black Jungle (Figure 2-2).

An analysis of desktop spatial datasets identifies the following ecological values that may be present within the utilities corridor that will be used for the OHTL:

- Rainforest and the associated threatened flora species – *Ptychosperma macarthurii* – are known to occur in Black Jungle Conservation Reserve. There are two very small areas of mapped rainforest within the corridor (but outside the reserve) which may support this species, noting that Department

of Environment Parks and Water Security (DEPWS) consider the distribution of this species as being well documented.

- Large areas of modelled habitat for *Typhonium praetermissum*, but only a few confirmed records. This species was not surveyed by DEPWS for the Mapping the Future survey, but it is noted that there is approximately 18,977 ha of high to moderately suitable habitat within that survey's study area.
- The corridor crosses numerous drainage lines, many of which have the potential to support *Stylidium ensatum* (which has been recorded near to the corridor at Gunn Point).
- There are a handful of modelled patches of sandsheet heath – a significant vegetation type that could support Howard River Toadlet (*Uperoleia daviesae*), *Utricularia dunstaniae*, *Cleome insolata* and/or *Typhonium taylori*. There are records of all these species proximate to the corridor, although because their habitat requirements are so specific, this does not mean they will be present within the corridor.

To determine whether or not threatened species and/or sensitive vegetation types occur within the footprint, a vegetation survey will be undertaken of the sections of the OHTL corridor that have not been previously surveyed (i.e. outside of the Gunn Point and Noonamah Ridge survey areas) and a habitat quality survey along the entire length of the corridor. The results of these surveys will be documented in the EIS.

4.1.2.2 Darwin Converter Site

The Darwin Converter Site is located within an area mapped as Eucalyptus community comprised of *Eucalyptus tetradonta*, *Eucalyptus miniata* and *Corymbia* species (Napier et al. 2020). There is a Melaleuca wetland/swamp within the western edge of the Darwin Converter Site, however, this area is not within the development footprint. A site visit by EcOz undertaken in July 2021, confirmed the presence of the above-mentioned vegetation types.

Flora investigations in the area were completed by the former Department of Environment and Natural Resources (DENR but now DEPWS) in 2018 and 2019 as part of the Mapping the Future Project and DEPWS has modelled areas with a high likelihood of the threatened plant species – *Stylidium ensatum*, *Cycas armstrongii* and *Typhonium praetermissum*. The modelling indicates that *Typhonium praetermissum* has a high likelihood of occurrence within the Cable Transition Facilities and areas of the Darwin Converter Site (Cruickshank 2020). There is a significant sub-population of this species recorded to the west of the main Darwin Converter Site – namely, on and adjacent to the Project Sea Dragon site.

Fauna investigations conducted for the *Mapping the Future Project* identified 88 native species within the Darwin Converter Site footprint, with five of these species being classed as Vulnerable or Endangered. The only terrestrial threatened species identified in surveys adjacent to the Darwin Converter Site was the Yellow-spotted Monitor (*Varanus panoptes*). Cruickshank (2020) mapped the Gunn Point area according to biodiversity risk classes (based on vegetation type, presence sensitive and/or significant vegetation communities, threatened species records, and habitat suitability). The Darwin Converter Site was classed as containing areas of moderate to high biodiversity values or areas requiring further investigation, with high biodiversity values within the landing site. This information will be verified during field surveys of the proposal area.

The Darwin Converter Site is located 2 km north-east of the Tree Point Conservation area, a large mangrove habitat and tidal creek that supports large numbers of shorebirds (NTPWC 2020). Parts of the Underground Cable Corridor, LSJ Station and Shore Crossing Site fall within the northern part of the Shoal Bay Site of Conservation Significance (SOCS). The SOCS is considered internationally significant because of the large migratory shorebird populations this area supports, and the threatened species within this region, including three plants, ten vertebrates and one invertebrate (Water Technology 2017). Other ecological values of the SOCS are the extensive tidal flats, as well as rainforest patches occurring on the margin of the tidal flats. These tidal flats are mostly located within the Tree Point Conservation Area and the Shoal Bay Coastal Reserve and are therefore well protected (Pavey 2009a).

It is noted that some sections of the SOCS are degraded due to heavy disturbance by recreational users, this is expected at the beach adjacent to the Darwin Converter Site as this is one of the major recreational areas in the region, with easy access from Darwin. The level of degradation within the proposal footprint will be verified during field surveys.

4.1.2.3 Cable Transition Facilities

The Cable Transition Facilities are located mainly within an area mapped as eucalyptus community comprised of *Eucalyptus tetradonta*, *Eucalyptus miniata* and *Corymbia* species (Napier et al. 2020). A site visit by EcOz undertaken in July 2021, confirmed the presence of the above-mentioned vegetation types in the Underground Cable Corridor and LSJ, and observed the presence of seasonally waterlogged/inundated coastal grassland and low sand dunes within the Shore Crossing Site.

The area classed as containing areas of moderate to high biodiversity values or areas requiring further investigation (Cruickshank 2020). There is a significant sub-population of *Typhonium praetermissum* recorded within the Underground Cable Corridor. The only terrestrial threatened fauna species identified in surveys adjacent to the Cable Transition Facilities was the Yellow-spotted monitor (*Varanus panoptes*). The presence/absence of threatened species will be confirmed by field surveys, the results of which will be reported in the EIS.

4.1.3 Hydrological processes

The NT EPA's objective for Hydrological Processes is to:

Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.

The surface water and groundwater systems present within the proposal area are summarised below from publicly available desktop and spatial datasets.

4.1.3.1 OHTL Utilities Corridor

Surface water

The OHTL Utilities Corridor crosses 28 watercourses, the vast majority of which are minor drainage lines of stream order 1. The route crosses the upper reaches of the Elizabeth River, which is stream order 3, and contains approximately 180m width of riparian vegetation. There are a smaller number of stream order level 2 crossings where riparian vegetation appears to be present (DENR 2019c). The OHTL will span watercourses where possible to minimise the direct impact.

Groundwater

The northern portion of the OHTL Utilities Corridor is located above the Howard Koolpinyah Dolostone aquifer, as discussed below in Section 4.1.3.2.

The OHTL Utilities Corridor is underlain by a number of other groundwater systems in the south of its route, including the Mount Partridge, Palmerston Dolostone, South Alligator and Burrell Creek formation systems (DENR 2018a). Interaction between the proposed action and groundwater will be negligible. Water required during construction will be trucked from existing groundwater bores under agreement with the landholder or from new bore/s installed by Sun Cable at the Darwin Converter Site.

4.1.3.2 Darwin Converter Site

Surface water

There are no watercourses or streams that intersect the Darwin Converter Site footprint. The closest streams are located south of the footprint and flow into the Tree Point Conservation Area (DENR 2019c). It is assumed

that surface water run-off from the development footprint travels via overland flow into these streams, or directly into Shoal Bay. During site visits it was observed by EcOz that there has been localised alteration and concentration of surface flows in localised areas caused by formal and informal access tracks.

Groundwater

The Darwin Converter Site is located above the Howard Koolpinyah Dolostone aquifer, which is a fractured rock aquifer. Fractured rock aquifers typically provide low to moderate yields and rely on wet season rainfall for recharge and do not have large storages (DEPWS 2021a).

Groundwater bores in the vicinity of the Darwin Converter Site have yields ranging from 0 - 20 L/s, with the majority of bores yielding 0 - 5L/s (DENR 2000). The groundwater level at the nearest groundwater monitoring bore, approximately 2 km north, has remained relatively constant since 2003 at around 7 - 8 m below ground level (DEPWS 2021b). This aquifer recharges through diffuse infiltration of rainfall in the south-western corner of the aquifer, which is a significant distance from the proposal area (DEPWS 2020b).

Water control districts and water allocation plans

The Darwin Converter Site is located within the Koolpinyah dolostone groundwater area in the Darwin Rural Water Control District. That water control district was gazetted on 2 June 1999 and was declared due to a high level of competition for water. As this area relies on wet season recharge to maintain groundwater levels, care must be taken to ensure this resource is used sustainably. The majority of water uses in the rural area are stock, domestic, horticultural or commercial users who are required to be licenced and their water use is metered (DEPWS n.d.).

The Howard groundwater system underlies a significant section of the Darwin rural area including the Darwin Converter Site and OHTL Utilities Corridor. A water allocation plan is currently being developed for this groundwater system and aims to ensure the sustainable use of this water resource (DENR 2019c).

A water supply to the site during both operations and construction is yet to be identified. Subject to identification of a sustainable source of suitable quality, a bore may be installed at the Darwin Converter Site using a licensed bore driller in accordance with permitting requirements under the *Water Act*.

4.1.3.3 Cable Transition Facilities

The underground HVDC and LSJ station footprints do not intersect any surface water courses. The Shore Crossing Site encompasses a low-lying area in the hind dunes that is seasonally waterlogged during the wet season months.

The groundwater system underling these components is the same as for the Darwin Converter Site described above.

4.1.4 Inland water environmental quality

The NT EPA's objective for Inland Water Environmental Quality is to:

Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses and the welfare and amenity of people are maintained.

Information available in relation to the existing quality of surface water and groundwater is summarised below.

4.1.4.1 OHTL Utilities Corridor

Surface water

The watercourses crossed by the corridor are described above. There is no publicly available information on surface water quality in the region, however, given the largely greenfield nature of the corridor, it is expected that water quality will be within natural variation and is unlikely to be contaminated by existing land uses. There is potential for some areas of localised turbidity to occur downstream of existing areas of disturbance associated with access roads/tracks and extractives operations.

Groundwater

Groundwater quality in the Darwin Rural Groundwater area was assessed in 2011 for households using bore water (Gough and Maeda 2012). This assessment sampled water from over 1,100 households in the Darwin Rural area, with 19 containing arsenic levels above the guidelines. Testing also showed the presence of nickel, lead and copper, aluminium, iron and zinc. There was, however, no link between geology and these results, with metals due to the presence of bores, tanks and other metal infrastructure (Gough and Maeda 2012). Development of OHTL Utilities Corridor will require water (for construction) to be trucked from existing groundwater bores under agreement with the landholder as required.

4.1.4.2 Darwin Converter Site

Surface water

As no watercourses or streams are present, surface water quality will not be impacted by this component of the proposal.

Groundwater

Water chemistry analysis of the aquifer beneath the Darwin Converter Site reported in Cruickshank, (2020) indicated that the proposal site is located in an area of moderate risk of salinity issues, with salinity levels ranging between EC 450 and 2000 $\mu\text{s}/\text{cm}$. Water quality testing will be undertaken as part of investigations to identified a sustainable source of suitable quality water to supply the Darwin Converter Site during construction and operations.

4.1.4.3 Cable Transition Facilities

No watercourses or streams intersect with the Cable Transition Facilities; therefore, surface water quality will not be impacted by this component of the proposal.

The groundwater system beneath the Cable Transitions Facilities is the same as described for the Darwin Converter Site above.

4.1.5 Aquatic ecosystems

The NT EPA's objective for Aquatic Ecosystems is to

Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The sections below describe the aquatic habitats present in the varied components of the proposal footprint.

4.1.5.1 OHTL Utilities Corridor

As indicated above, a total of 28 watercourses will be crossed by the OHTL Utilities Corridor. All of these, except for the lowest order streams and drainage lines, are likely to support aquatic ecosystems of varying richness and diversity; much of which has not been studied or quantified. There are no records of threatened aquatic fauna within the proximity of the OHTL Utilities Corridor.

The OHTL Utilities Corridor passes through the Black Jungle Conservation Reserve which is part of the Adelaide River Conservation Reserves. The Adelaide River coastal floodplain is a Site of Conservation Significance (SOCS), with its environmental values including habitat for species such as the Freshwater Sawfish (*Pristis microdon*), Speartooth Shark (*Glyphis* sp.) and the Northern River Shark (*Glyphis* sp.). As the Black Jungle Conservation Reserve is in the upper reaches of the SOCS, the presence of these species is very unlikely (Pavey 2009b).

4.1.5.2 Darwin Converter Site

As depicted in Figure 2-3 there is an area of Melaleuca swamp located in the south-western corner of the Darwin Converter Station. This area will be examined during site investigations, and any aquatic ecosystem values considered in the EIS.

4.1.5.3 Cable Transition Facilities

There are no aquatic ecosystems present within the Cable Transition Facilities footprint.

4.1.6 Marine environmental quality

The NT EPA's objective for Marine Environmental Quality is to:

Protect the quality and productivity of water, sediment and biota so that environmental values are maintained.

The sections below describe current knowledge about the water, sediment and biota present in the Shoal Bay region where the Subsea Cable System will be installed. It's important to note, that the Subsea Cable system does not encroach on the inner creek network of what is commonly referred to as Shoal Bay.

4.1.6.1 Oceanographic conditions

The Shoal Bay region is a shallow embankment with a number of sandbars that stretch across the coastal fringe and at the entrance to tidal creeks. This area receives the majority of its nutrients and sediment from the catchment of the Howard River, mainly during the wet season. A few smaller creeks also flow into the bay. The only industrial source of wastewater is from the Leanyer-Sanderson Wastewater Treatment Plant which discharges in Shoal Bay via Buffalo Creek (DENR 2019b).

4.1.6.2 Tides and currents

Tides within the Gunn Point region are large, with a spring tide range of approximately 8 m. The tidal patterns at Gunn Point and the wider Darwin Harbour are consistent, with a relatively consistent range of water levels. The maximum recorded water level within Darwin Harbour is approximately 3.6m Australian Height Datum (AHD), with the minimum recorded water level at Gunn Point reaching -4.0m AHD in 2016-2017 (Seafarms

2018). These extremes in water level are rare, with the mean high water level being 2.6m AHD and the mean low water level being -2.6m AHD (Seafarms 2018). These large tides expose significant tidal flats adjacent to the proposal area.

The closest current data is available from two Australian Institute of Marine Science (AIMS) buoys located in the Beagle Gulf between Darwin and the Tiwi Islands. Currents recorded at both buoys are highly directional. The currents recorded at the location closest to Darwin Harbour typically move from the north-west to the south-east, while those further out move east to west. Current speeds are highest at the water’s surface, and peak at over 1 m/s (Seafarms 2018).

4.1.6.3 Seabed and bathymetry

A hydrographic survey was completed as part of the Notice of Intent for Project Sea Dragon in 2017. These surveys investigated the offshore areas adjacent to the proposal area and consisted of single beam soundings running along the shoreline. Information from this survey was combined with 5m topographical Lidar DEM from GeoScience Australia and Darwin Harbour bathymetric survey completed by NTG (Seafarms 2018).

Cross-sections of the offshore bathymetry running from the shoreline out indicate the consistent nature and slope of the bathymetry in this location. The cross sections run to approximately 6km from the shoreline to offshore. From the mean high water (3m AHD) to mean low water line (-3m AHD) the slope is rapid at approximately 1:50 before tapering off after the low water line to a slope of 1:700. This slope nature is consistent across all three cross-sections (Seafarms 2018).

The site-specific conditions that occur within the Subsea Cable Corridor options will be further assessed by geophysical and geotechnical surveys to identify any constraints to development.

4.1.6.4 Water quality

The 2019 Darwin Harbour report card outlines the water quality for the Shoal Bay region in Zone 7 of the report, which received a grade of A. This indicates that the current water quality is excellent and complies with all of the Darwin Harbour water quality objectives for nutrients, water clarity (turbidity), dissolved oxygen and algae. The Shoal Bay region has received a grade of A or B since 2012, indicating good water quality in the area, which is likely linked to the limited population and industry that feeds into this zone (DEPWS 2020a).

Investigations conducted by Seafarms measured nutrients, water temperature and salinity offshore from Gunn Point from November 2016 to July 2017 (Water Technology 2017). Background concentrations at the monitoring locations nearest to the proposal area were all below the Darwin Harbour Water Quality Objectives (WQO’s). Based on the location, the WQO’s for outer estuary were adopted. The background nutrient concentrations and WQO’s are outlined in Table 4-3.

Table 4-3. Background nutrient concentrations in marine waters (Source: Water Technology 2017)

Parameter	Median Background Concentration (µg/L)	Darwin Harbour WQO (µg/L)
Total Nitrogen (N)	160	440
Total Phosphorous	8	20
Chlorophyll a	0.5	1

4.1.6.5 Other uses

Commercial fishing tours, recreational fishing, boating and other watercraft use are common within the Shoal Bay region, as is camping and recreation along Gunn Point beach. This is outlined further in Section 4.1.10. Consultation will be undertaken as part of the EIS engagement strategy.

4.1.7 Marine ecosystems

The NT EPA's objective for Marine Ecosystems is to:

Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.

The sections below describe current knowledge about the marine habitats present in the Shoal Bay region and coastal waters of the Timor Sea where the Subsea Cable System will be installed. It also captures the shoreline of the adjacent beaches more broadly.

4.1.7.1 Marine communities

There are between five and twelve different benthic habitat types that have been identified in the Gunn Point region by a number of habitat mapping programs (Palmer and Smit 2020). These habitats are mangroves; seagrass; areas dominated by algal, soft or hard coral; sponge or other filter feeder communities; bare rock; and sediment substrates. Based on the available spatial mapping data, the proposal footprint has the potential to intersect areas of seagrass, macro algae, filter feeders, soft corals and hard corals (Palmer and Smit 2020).

There is a significant stretch of seagrass that follows the shoreline along the southern end of Murrumujuk beach, and is located approximately 800 m from the shore directly west of the proposal area (Palmer and Smit 2020). The placement of the subsea cables will likely result in the direct loss of some of this seagrass habitat, with burying of the cables causing further sedimentation for the surrounding seagrass community. The seagrass species within Shoal Bay are characterised as having rapid-colonising growth. This indicates that any impacted seagrass will be able to quickly re-establish in the disturbed area (Siwabessy et al. 2019).

The Darwin-Bynoe habitat mapping and the Mapping the Futures report also indicated the presence of small patches of hard coral and macro algae, and large areas of filter feeders that intersect with the proposal footprint (Siwabessy et al. 2019; Palmer and Smit 2020). There is a line of hard coral approximately 4.5 km offshore from the proposal area, which would be intersected by either subsea cable options (Figure 2-4).

The proposal does not impact on any mangrove areas.

The benthic habitat types present in the proposal footprint will be verified during geophysical surveys. If seagrasses and/or corals are present, the EIS will assess the significance of impacts to these habitats and the marine fauna that utilise them.

4.1.7.2 Marine fauna

The Shoal Bay area and the Gunn Point peninsula contain a range of marine fauna species that are significant on a local, national and international level. These species and their significance are outlined in this section.

Marine fauna of conservation significance under the *Territory Parks and Wildlife Conservation Act* and the *EPBC Act* are expected to be present within the waters of the Shoal Bay area. These species are the same as those identified for the Middle Arm location. These species are all highly mobile and only visit the Shoal Bay occasionally.

Cetaceans

There are six species of cetaceans that have been recorded around the Gunn Point peninsula (Palmer and Smit 2020):

- Dugong - *Dugong dugon*
- Blue Whale - *Balaenoptera musculus*
- Humpback Whale - *Megaptera novaeangliae*

- Australian Snubfin Dolphin - *Orcaella heinsohni*
- Australian Humpback Dolphin - *Sousa sahalensis*
- Bottlenose Dolphin - *Tursiops aduncus* & *Tursiops truncatus*

Dolphins

The three species of dolphin found in the Shoal Bay region are all listed as migratory cetacean species under the *EPBC Act*, and as Data Deficient or of Least Concern under the *TPWC Act* (Palmer and Smit 2020).

Abundance estimates from helicopter surveys indicate that Bottlenose Dolphins are more abundant within coastal areas as opposed to estuaries, while the Australian Snubfin and Australian Humpback Dolphins are distributed in both areas. Population trends for these species from 2011 to 2018 indicate that Australian Humpback Dolphin populations are decreasing significantly, Bottlenose Dolphin populations remain stable, and Australian Snubfin Dolphin populations have increased significantly (DENR 2019a).

The Gunn Point region and Shoal Bay area is expected to be within the ranging and foraging areas for dolphin populations inhabiting Darwin Harbour; however, movement dynamics are poorly understood.

Dugong

Under the *EPBC Act*, the Dugong (*Dugong dugon*) is listed as a migratory and marine species, and under the *Territory Parks and Wildlife Conservation Act* it is listed as Near Threatened.

Dugongs live in northern Australia's sheltered, coastal waters and their diet consists entirely of seagrass (DOE 2021a). Dugongs are usually found in coastal areas such as shallow protected bays and mangrove channels and in the lee of large inshore islands where seagrass grows (Heinsohn, Marsh & Anderson 1979). However, they have also been recorded further offshore in areas where the continental shelf is wide, shallow (up to 37 m deep), and protected (Lee Long, Mellors & Coles 1993; Marsh et al. 2002).

There is seagrass habitat present within the proposal footprint, which is part of the patchy seagrass communities within Shoal Bay and dugongs have been recorded in the area (Palmer and Smit 2020).

Whales

The Humpback Whale (*Megaptera novaeangliae*) and the Blue Whale (*Balaenoptera musculus*) have been recorded in the Gunn Point region. The Blue Whale is listed as Endangered under the *EPBC Act* while the Humpback Whale is listed as Vulnerable (Palmer and Smit 2020). It is estimated that less than 40 Humpback Whales are recorded annually within NT waters, with the Blue Whale being an occasional vagrant (Palmer and Smit 2020). On this basis, it is possible that either species could occasionally traverse the areas where the Subsea Cable System will be installed, but the area is not considered important habitat.

Turtles

Four marine turtles have been recorded within the Gunn Point region, with all species being listed as threatened, migratory and marine under the *EPBC Act*. These species are the Green Turtle (*Chelonia mydas*), Flatback Turtle (*Natator depressus*), Hawksbill Turtle (*Eretmochelys imbricate*) and Loggerhead Turtle (*Caretta caretta*). There is insufficient information on turtle distribution to determine the key foraging, inter-nesting and nursery areas within Shoal Bay and Gunn Point. It is, however, known that the majority of the Gunn Point peninsula is unsuitable for nesting due to the large intertidal areas with mangroves (Palmer and Smit 2020). Chatto and Baker (2008) recorded low numbers of turtle tracks on the beach adjacent to the proposal area; there are no nesting records for this area.

Estuarine Crocodile

The Estuarine or Saltwater Crocodile (*Crocodylus porosus*) is listed as a marine and migratory species under the *EPBC Act*, and has been protected in the NT since 1971 (DOE 2021b).

The Estuarine Crocodile can be found in both fresh and salt water of the Northern Australian coast, rivers, estuaries, swamps, lakes and marshes. Within the NT, the species can be found along the entire coast, and in many of the rivers in the Top End up to approximately 150 km inland (DOE 2021b). The Darwin Harbour Crocodile Management Area, which covers Shoal Bay and Gunn Point, removes approximately 275 crocodiles from the area annually (Palmer and Smit 2020).

Crocodiles could occur in the higher order rivers and creeks traversed by the OHTL corridor. The offshore components are located in areas where Estuarine Crocodiles occur, however, the species is highly mobile, and more commonly inhabit rivers as opposed to the ocean.

Fish

Four fish species in the Gunn Point region are listed under the *EPBC Act* – the Northern River Shark (*Glyhis garricki*), Dwarf Sawfish (*Pristis clavata*), Tidepool Pipefish (*Micrognathus* sp.) and the Pacific Shortbody Pipefish (*Choeroichthys* sp.) (Palmer and Smit 2020).

Under the *EPBC Act* the Northern River Shark is listed as endangered, the Dwarf Sawfish is vulnerable, and the pipefish species are both listed as marine species.

The likelihood of these species within the proposal footprint and the wider Shoal Bay is low as their preferred habitat is not present.

4.1.7.3 Migratory Birds

There are 26 species of migratory shorebirds, 13 resident shorebirds and 16 seabird species that have been recorded within the Gunn Point area. This information was collected from past aerial and ground surveys, national volunteer-based programs and targeted scientific studies. Eight of these species are listed as Vulnerable, Endangered or Critically Endangered under the *TPWC Act* and/or the *EPBC Act* – see Table 4-4 (Palmer and Smit 2020).

Table 4-4. Conservation status of migratory birds within the Gunn Point area

Common Name	Scientific Name	TPWC Act	EPBC Act
Bar-tailed Godwit (western Alaskan)	<i>Limosa lapponica baueri</i>	Vulnerable	Vulnerable
Bar-tailed Godwit (northern Siberian)	<i>Limosa lapponica menzbieri</i>	Critically Endangered	Critically Endangered
Curlew Sandpiper	<i>Chlidonias hybrida</i>	Vulnerable	Critically Endangered
Far Eastern Curlew	<i>Numenius madagascariensis</i>	Vulnerable	Critically Endangered
Great Knot	<i>Calidris tenuirostris</i>	Vulnerable	Critically Endangered
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Vulnerable	Vulnerable
Lesser Sand Plover	<i>Charadrius mongolus</i>	Vulnerable	Endangered
Red Knot	<i>Calidris canutus</i>	Vulnerable	Endangered

Aerial surveys and site visits conducted by Chatto (2003) undertook a comprehensive survey of shorebirds across the NT coastline. The proposal area is within survey block 4 (see Figure 4-1). 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. Within the Gunn Point peninsula, the most records were for the southern Shoal Bay (including southern Gunn Point beach). Based on available mapping, the density of records for both Middle Arm and Murrumujuk appear similar. However, Palmer and Smit (2020) point out that further studies are required to understand shorebird abundance (season, duration and frequency) and habitat use for feeding and roosting.

The area surrounding the proposal has high recreation use 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 investigation for Project Sea Dragon found few shorebirds using the intertidal zone along the adjacent beach, potentially due to a lower abundance of invertebrates due to coarse sandy substrates, and high levels of disturbance by vehicles, people and pets along the beach (Seafarms 2018).

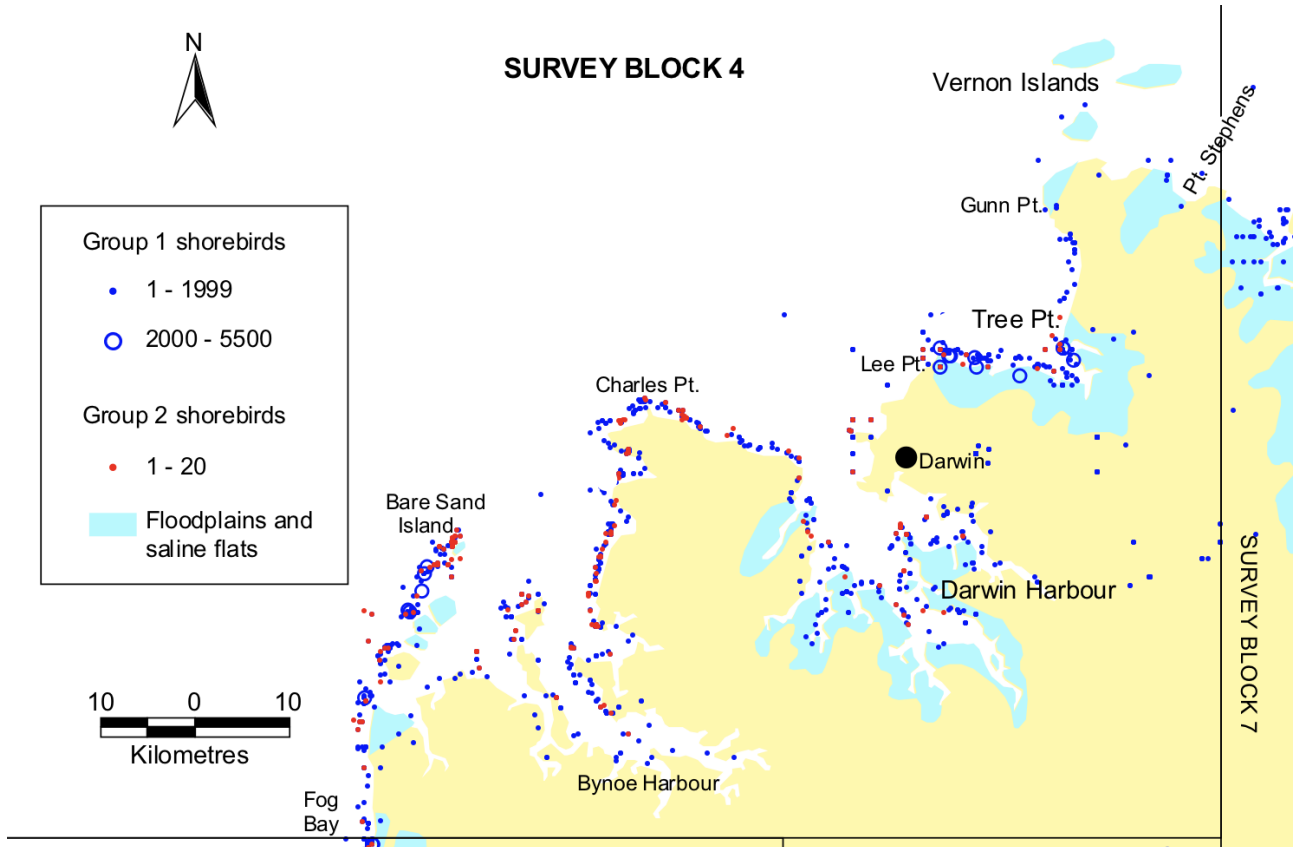


Figure 4-1. Map of Chatto (2003) shorebird survey results for the Darwin and Bynoe Harbour region

4.1.8 Air quality

The NT EPA’s objective for Air Quality is to:

Protect air quality and minimise emissions and their impact so that environmental values are maintained.

The nearest air monitoring station to the site is located in Darwin. There are limited long term air quality data available in the NT, with particulate monitoring being conducted in Darwin since 2004 (NT EPA 2020).

Air quality monitoring found that the primary air pollutants in the Darwin region are particulates from smoke from vegetation burn offs during the dry season, with Carbon Monoxide (CO), Nitrogen Oxides (NO_x, NO and NO₂) and Sulfur Dioxide at very low levels compared to other cities in Australia. Ozone (O₃) occurs in moderate levels in the Top End, mainly due to natural processes (NT EPA 2020).

Results indicate a significant difference in air quality between the wet and dry seasons in the Top End, with particulate matter criteria being exceeded on a number of days each dry season. This is also associated with dry season burn offs.

The nearest residential receptors that have the potential to be impacted by air quality (primarily dust emissions during construction) are located 200-300m from OHTL corridor through Livingstone and 600m

from the corridor through Noonamah, approximately 5km from Darwin Converter Site, and recreational campers on Gunn Point Beach are also within a few hundred meters of the LSJ Station and shore crossing.

Air quality modelling will be prepared to assess potential impacts to sensitive receptors associated with dust emissions during construction. The results of this modelling will be provided as part of the EIS.

4.1.9 Atmospheric processes

The NT EPA's objective for Atmospheric Processes is to:

Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.

Sun Cable is committed to minimising greenhouse gas (GHG) emissions and has engaged a specialist consultancy to prepare emissions calculations and undertake a whole-of-proposal Lifecycle Carbon Assessment. The variation will involve additional vegetation clearing along the approximately 66 km OHTL Utilities corridor which is a predominantly greenfield area. This has the potential to increase the GHG emissions of the project.

Opportunities to minimise carbon emissions will be explored through the proposal planning and design phase, considering all aspects of the proposal from materials selection and procurement, through to logistics and travel. Sun Cable will quantify scope 1 and 2 emissions in the EIS and provide a Draft GHG Abatement Plan.

4.1.10 Community and economy

The NT EPA's objective for Community and Economy is to:

Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.

The sections below provided details of the communities, current land uses and potential future land uses along the OHTL Utilities Corridor and around Murrumujuk.

Sun Cable will be undertaking detailed consultation with stakeholders of the Murrumujuk precinct as part of the Social Impact Assessment (SIA) study being undertaken for the EIS. This will ensure that cultural, social and economic context for Murrumujuk is incorporated into the proposal planning and design.

4.1.10.1 OHTL Utilities Corridor

The OHTL Utilities Corridor passes through or is adjacent to a number of Darwin's rural areas – including Noonamah, Wak Wak, Lambells Lagoon, Herbert and Koolpinyah. The nearest residential areas are 200-300m from the OHTL corridor with respect to Livingstone and 600m with respect to Noonamah. The route also travels through the Black Jungle/Lambells Lagoon Conservation Reserve and the Shoal Bay Coastal Reserve (NTPWC 2020).

4.1.10.2 Darwin Converter Site

The Darwin Converter Site is located at Murrumujuk, which is identified 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 subject site, is owned by the NT Land Corporation and zoned for the future development.

The nearest residential area, Tree Point Community, is approximately 5km from Darwin Converter Site. The Durduga Tree Point Aboriginal Association Incorporated, or Tree Point Community, holds an approximately 250ha portion of freehold land 5km south of the proposal area. The Tree Point Community is made up of approximately 10 dwellings.

The Mapping the Future Project identified the Gunn Point region as an area of high development potential due to its proximity to Darwin, its status as a Priority Development Zone under the Economic Development Framework (Cruikshank 2020) and the availability of Crown land. The Gunn Point peninsula is identified as having land suitable for development as a rural centre – with rural lots, tourism and horticulture. The future town of Murrumujuk is proposed to be located immediately north of the Darwin Converter Site. According to Cruikshank (2020), the Darwin Converter Site is mainly located in a class 2 development potential area, with some areas of class 3².

The Darwin Converter Site is also located adjacent to Seafarms proposed Project Sea Dragon aquaculture facility.

4.1.10.3 Cable Transition Facilities

The Cable Transition Facilities will terminate at the LSJ station site immediately to the south of the current beach access point. The area is a popular fishing, camping and leisure area due to its close proximity to Darwin. The recently surfaced Gunn Point Road has made this area much more accessible and therefore busier, with a number of beach access points along Murrumujuk Drive. Recreational campers frequent Gunn Point Beach for informal camping, within a few hundred meters of the LSJ Station and Shore Crossing Site.

The Tree Point Conservation Reserve and the Shoal Bay Coastal Reserve are located immediately south of the proposal area and both hold high recreational and environmental values.

4.1.11 Culture and heritage

The NT EPA's objective for Culture and Heritage is to:

Protect sacred sites, culture and heritage.

Current knowledge of the cultural and heritage values present within the proposal footprint is summarised below, noting that formal surveys are yet to be undertaken.

4.1.11.1 Aboriginal heritage

The Gunn Point peninsula is located within Larrakia Land and is currently used by the Larrakia, Tiwi and Wulna Indigenous groups for hunting and ceremonial purposes. Preliminary discussions with Larrakia representative organisations acknowledged the significance and shared interests over this area.

An application for an Authority Certificate has been lodged with the Aboriginal Areas Protection Authority (AAPA) for the revised proposal. In addition to this, an Abstract of Records has been procured from AAPA to inform the planning process. Consultation with AAPA and Northern Land Council is ongoing.

A heritage and archaeological assessment will be undertaken in accordance with the *Heritage Act* and conducted with Traditional Owner engagement to ensure cultural and heritage values are identified and managed accordingly.

4.1.11.2 Non-indigenous heritage

The NT Heritage Register shows no known heritage items within the proposal footprint.

4.1.12 Human health

The NT EPA's objective for Human Health is to:

Protect the health of the Northern territory population.

The current EIS TOR require assessment of potential impacts associated with biting insects and Electro Magnetic Fields (EMF). These impacts are not predicted to be significant for any component of the proposal

² Class 3 is the least recommended area to develop and class 1 being the most recommended.

footprint; however, information will be provided in the EIS to address the issues raised by stakeholders and the community.

The nearest residential areas to the OHTL Utilities Corridor are 200-300m from the OHTL corridor through Livingstone and 600m from the corridor for Noonamah. The nearest residential area to the Darwin Converter Site is 5km away.

Recreational users camp on Gunn Point Beach within a few hundred meters of the LSJ Station and Cable crossing. Consultation and research will be undertaken to further map this use, and it will be considered in the design of the project.

4.1.13 Matters of National Environmental Significance

Matters of National Environment Significance (MNES) that are protected under part 3 of the *EPBC Act* relevant to the proposal are:

1. Listed threatened species and communities
2. Listed marine and/or migratory species
3. Commonwealth marine environment, for the proposal component that extends from the edge of territorial waters (3 nautical miles) to the edge of the exclusive economic zone (EEZ).

A Protected Matters Search covering the new proposal footprint identified the following additional listed threatened and migratory shorebird species that will require consideration in the EIS:

- Far Eastern Curlew *Numenius madagascariensis*
- Lesser Sand Plover *Charadrius mongolus*
- Bar-tailed Godwit *Limosa lapponica*
- Red Knot *Calidris canutus*
- Great Knot *Calidris tenuirostris*
- Greater Sand Plover *Charadrius leschenaultii*
- Curlew Sandpiper *Calidris ferruginea*.

The EIS TOR have been amended to include assessment of the likely occurrence of listed threatened and migratory shorebird species associated with Gunn Point Beach where the Shore Crossing Site is located.

The Commonwealth Department of Environment will be informed of the variation to the proposal.

4.2 Potential impacts and mitigation measures

Table 4-5 summarises the potential impacts and mitigation measures associated with the variation for each of the 12 environmental factors under assessment.

Table 4-5. Summary of potential impacts and avoidance/mitigation measures for varied components

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Relevant Policy & Guidelines
<p>Terrestrial Environmental Quality</p> <p>Protect the quality and integrity of <u>land and soils</u> so that environmental values are supported and maintained</p>	<p>OHTL Utilities Corridor</p> <p>Majority of the corridor is undulating plains with slopes >2%. Some sections of increased slope, seasonally inundated land, and watercourse crossings, where there is increase erosion risk. No current land uses of existing sources of contamination.</p> <p>Darwin Converter Site</p> <p>Site is situated on undulating upland plains with coarse unconsolidated sands and gravelly soils with slopes 1-2%. No current land uses of existing sources of contamination.</p> <p>Cable Transition Facilities</p> <p>Underground HVDC cable route traverses undulating upland plains with coarse unconsolidated sands and gravelly soils with slopes 1-2%. Low likelihood of ASS.</p> <p>LSJ Station is a small footprint located on gently inclined slopes 1- 3%. Moving towards the coast, within the shore crossing footprint, there is a steeper incline and evidence of existing erosion.</p> <p>Acid Sulfate Soils (ASS) potential identified in shore crossing footprint to be further assessed.</p>	<p>Direct disturbance of landforms and soils from land clearing and earthworks during construction.</p> <p>Erosion and offsite movement of sediments.</p> <p>The OHTL Utilities Corridor footprint is wider and crosses a number of drainages, which increases erosion mitigation requirements.</p> <p>Disturbance of ASS. The varied footprint poses a significantly lower likelihood of ASS.</p> <p>Leaks of hazardous materials from construction plant and equipment, batteries, transformers or other infrastructure.</p>	<p>Progressive land clearing within defined footprint.</p> <p>Installation of erosion and sediment controls in accordance with an Erosion and Sediment Control Plan (ESCP) prepared by a Certified Professional.</p> <p>Undertake ASS assessment and implement management controls if ASS will be disturbed during construction.</p> <p>Hazardous materials stored and handled in accordance with Australian Standards and regulatory requirements.</p> <p>Stormwater drainage system at Darwin Converter Site will be designed to manage runoff in a controlled manner.</p>	<p><i>NT Land Clearing Guidelines (DENR 2019)</i></p> <p><i>Best Practice Erosion and Sediment Control Guidelines (International Erosion Control Assoc.)</i></p> <p><i>National acid sulfate soils sampling and identification methods manual (Sullivan et al. 2018)</i></p> <p><i>Australian Dangerous Goods Code</i></p> <p><i>Australian Standard 1940 Storage and Handling of Flammable and Combustible Liquids</i></p> <p><i>Waste Management and Pollution Control Act</i></p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
<p>Terrestrial ecosystems Protect <u>terrestrial habitats</u> to maintain environmental values including biodiversity, ecological integrity and ecological functioning.</p>	<p>OHTL Utilities Corridor Presence/absence of the following values to be confirmed by site surveys: Small sections of rainforest, which could support the threatened palm <i>Ptychosperma macarthurii</i> Large areas of modelled habitat for the threatened plant <i>Typhonium praetermissum</i>, but only a few confirmed records. Numerous drainage lines, many of which have the potential to support the threatened plant <i>Stylidium ensatum</i>. Modelled patches of sandsheet heath – a significant vegetation type that could support Howard River Toadlet, <i>Utricularia dunstaniae</i>, <i>Cleome insolata</i> and/or <i>Typhonium taylori</i>.</p> <p>Darwin Converter Site Area mapped as <i>Eucalyptus tetradonta</i>, <i>Eucalyptus miniata</i> and <i>Corymbia spp.</i> woodland. Modelled habitat for the threatened plant <i>Typhonium praetermissum</i>. Presence/absence to be confirmed through site surveys in January 2022.</p> <p>Cable Transition Facilities Significant sub-population of threatened plant <i>Typhonium praetermissum</i> recorded in underground HVDC cable corridor footprint</p>	<p>Direct loss of flora/ecological communities from vegetation clearing. The Darwin Converter Site footprint is larger but does not directly impact any significant or sensitive communities. Habitat fragmentation caused by clearing the OHTL and underground cable corridors. Habitat degradation by erosion, dust, weeds/pathogens, disturbance of ASS. Introduction or increase of weed species due to construction, operation or maintenance activities. The OHTL Utilities Corridor footprint has a lower likelihood of weed species occurrence, which increases the importance of weed mitigation measures to prevent weed introduction to the area. Loss of threatened flora species through land clearing within development footprint. The varied proposal footprint traverses a number of areas where threatened plant species have either been recorded or areas mapped as potentially suitable. Further surveying is required to confirm presence/absence and potential for impacts to populations. Direct impacts to fauna as a result of collision with vehicles, equipment and OHTL.</p>	<p>OHTL instead of underground, reduces disturbance footprint to localised areas for tower construction. OHTL towers will be strategically placed (up to 400m apart) to avoid or minimise impacts to sensitive habitats such as watercourses. Cable Transition Facilities and shore crossing avoids impacts to significant habitats. There are no mangroves in the varied footprint. Surveys will be undertaken to verify the presence/absence of threatened species in the development footprint and assess potential for impacts to populations. Mitigation measures and offsets for threatened species will be developed in consultation with NT and Cwth agencies if required. Weed surveys and mapping will be undertaken prior to commencement of works. Weed hygiene measures, monitoring and follow-up control will be implemented during construction and operations. OHTL corridor will be reinstated post-construction with only a 12 m wide access required in long-term.</p>	<p><i>NT Land Clearing Guidelines (DENR 2019)</i> <i>EPBC Significant Impact Guidelines 1.1 MNES Guidelines for Assessment of Impacts on Terrestrial Biodiversity (NT EPA, 2013)</i> <i>Weed Management Act Weed management plan – Gamba Grass 2020-2030 (DEPWS, 2020)</i> <i>NT Weed Data Collection Manual (DLRM 2015)</i> <i>NT Biodiversity Offsets Policy (under-development)</i> <i>EPBC Act Offsets Policy</i></p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
<p>Hydrological processes</p> <p>Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.</p>	<p>OHTL Utilities Corridor</p> <p>Corridor crosses Elizabeth River.</p> <p>Several minor streams within the Black Jungle Conservation Reserve.</p> <p>Various minor (stream order 1) watercourses traversed by corridor.</p> <p>Darwin Converter Site</p> <p>No watercourses present in development footprint. A seasonal swamp is located within the site boundary but will not be directly impacted.</p> <p>Groundwater aquifer is part of the Howard Koolpinyah dolostone groundwater area in the Darwin Rural Water Control District</p> <p>Groundwater bores have yields ranging from 0 - 20 L/s, with the majority of bores yielding 0 - 5L/s (DENR 2000).</p> <p>The groundwater level around 7 - 8 m below ground level (DEPWS 2021b).</p> <p>Cable Transition Facilities</p> <p>No watercourses present in development footprint. Surface flows drain towards Shoal Bay.</p>	<p>The development is not predicted to impact surface water flow regimes.</p> <p>Extraction of groundwater at Darwin Converter Site could contribute to pressure on the aquifer, which is currently over-allocated. However, the volumes of water required for the development are small compared to other land uses in the region.</p> <p>Variation to proposal is not expected to increase or alter impacts to hydrological processes compared to the original proposal.</p>	<p>Access track along OHTL corridor will have floodway or culvert crossings designed to maintain pre-development flows.</p> <p>Vegetation and soil stockpiles will not be placed in watercourses or other locations where they could impede flows.</p> <p>Stormwater drainage system at Darwin Converter Site will be designed to manage runoff in a controlled manner.</p> <p>Groundwater investigation will be undertaken to inform identification of a sustainable water supply at the Darwin Converter Site.</p> <p>Surface water and groundwater extraction will only be permitted under a licence issued under the <i>Water Act</i>.</p>	<p><i>NT Land Clearing Guidelines (DENR 2019) Water Act</i></p>
<p>Inland water environmental quality</p> <p>Protect the quality of groundwater and surface water so that environmental values including ecological health,</p>	<p>Refer above for summary of surface water and groundwater resources.</p> <p>Water quality in the surface water courses and groundwater system is expected to be good. There are no known sources of contamination that would impact water quality.</p>	<p>Increased turbidity in watercourses downstream of the OHTL corridor due to erosion caused by land clearing and disturbance.</p> <p>Run-off from untreated ASS enters Shoal Bay.</p> <p>Spills or leaks of hazardous materials enter watercourses or groundwater.</p>	<p>OHTL towers will be strategically placed (up to 400m apart) to avoid or minimise impacts to sensitive habitats such as watercourses.</p> <p>Installation of erosion and sediment controls in accordance with an Erosion and Sediment</p>	<p><i>Australia and New Zealand Environment Conservation Council (ANZECC) Guidelines for Fresh and Marine Water Quality (2000)</i></p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
<p>land uses and the welfare and amenity of people are maintained.</p>		<p>Variation to proposal is not expected to increase or alter impacts to water quality compared to the original proposal.</p>	<p>Control Plan (ESCP) prepared by a Certified Professional.</p> <p>Undertake ASS assessment and implement management controls if ASS will be disturbed during construction.</p> <p>Hazardous materials stored and handled in accordance with Australian Standards and regulatory requirements.</p> <p>Monitoring program implemented to detect leaks/spills and downstream water quality impacts.</p> <p>Emergency Response Plan in place to respond to spills/leaks to prevent pollution of the environment.</p>	<p><i>Water Quality Objectives for the Darwin Harbour Region</i></p>
<p>Aquatic ecosystems Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning</p>	<p>OHTL Utilities Corridor OHTL corridor traverses the upper reaches of the Elizabeth River and the Black Jungle Conservation Reserve, where aquatic habitats are present downstream. There are no aquatic habitats within the corridor.</p> <p>Darwin Converter Site No aquatic habitats within or downstream of footprint.</p> <p>Cable Transition Facilities No aquatic habitats within or downstream of footprint.</p>	<p>Indirect disturbance of aquatic ecosystems during construction of OHTL towers, where in proximity to waterways/wetlands – e.g. sedimentation, erosion, uncontrolled run-off, spills of hazardous materials.</p> <p>Variation to proposal is not expected to increase or alter impacts to aquatic habitats compared to the original proposal.</p>	<p>Above measures for avoiding and mitigating impacts to water quality will also protect aquatic habitats.</p>	<p>As above</p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
<p>Marine environmental quality</p> <p>Maintain the quality and productivity of water, sediment and biota so that environmental values are protected.</p>	<p>Subsea Cable System</p> <p>Corridor traverses coastal waters of Timor Sea and Outer Darwin Harbour. The Darwin Harbour Report Card 2019 reports ‘Excellent’ water quality in this area. Sediment quality is expected to be good as there are no existing sources of contamination.</p>	<p>Direct disturbance of sediments and biota within Subsea Cable Corridor during cable laying and burial.</p> <p>Trenching and cable laying/burial will temporarily mobilise sediments into the water column, creating temporary elevated turbidity within a zone around the activities.</p> <p>Disturbance of ASS during trenching of the shore crossing could cause water quality impacts.</p> <p>Variation to proposal is not expected to alter the extent of the zone of impact, or to influence to water quality. Shoal Bay; however, has less sensitivity to cumulative impacts than the original location in Darwin Harbour.</p>	<p>Geophysical and geotechnical surveys will be undertaken to select an acceptable cable corridor.</p> <p>Modelling of the scale and extent of impacts to water quality will be undertaken to determine zone of impact and influence.</p> <p>Mitigation measures will be implemented if sensitive receptors identified in zone of impact or influence that could be significantly impacted by short-term elevated turbidity.</p> <p>Undertake ASS assessment and implement management controls if ASS will be disturbed during construction.</p>	<p><i>Water Quality Objectives for the Darwin Harbour Region</i></p>
<p>Marine ecosystems</p> <p>Protect marine flora and fauna so that biological diversity and ecological integrity are maintained</p>	<p>Subsea Cable System</p> <p>Benthic habitat mapping (Palmer and Smit 2020) indicates the following habitats may be present in the Subsea Cable System corridor: seagrass, macro algae, filter feeders, soft corals and hard corals.</p> <p>Significant stretch of seagrass located approximately 800 m from shore within Subsea cable System footprint.</p> <p>Various cetaceans have been recorded in Shoal Bay.</p> <p>Marine turtles have been recorded in the waters; however, there are no nesting</p>	<p>Direct loss of seagrass habitat (and therefore Dugong habitat) in footprint during cable laying and burial.</p> <p>Indirect temporary impact to seagrass due to elevated turbidity and sedimentation.</p> <p>The seagrass species within Shoal Bay are characterised as having rapid-colonising growth and therefore are expected to recolonise the disturbed areas.</p> <p>Loss of disturbance of coral communities if corridor intersects these habitats.</p>	<p>Above measures for avoiding and mitigating impacts to marine water quality will also protect marine ecosystems.</p>	<p><i>Water Quality Objectives for the Darwin Harbour Region</i></p> <p><i>EPBC Significant Impact Guidelines 1.1 MNES</i></p> <p><i>EPBC Act Policy Statement 3.21 - Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species</i></p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
	<p>records for Gunn Point Beach near the LSJ station and shore crossing.</p> <p>Aerial surveys and sites visits conducted by Chatto (2003) concluded that although there are shorebird occurrences along Murrumujuk Beach, they were not of regional significance. Further studies are required to understand shorebird abundance (season, duration and frequency) and habitat use for feeding and roosting.</p>	<p>Temporary avoidance of the area by marine fauna due to vessel movements and noise.</p> <p>There are no significant noise sources that would cause harm to marine fauna.</p> <p>Temporary disturbance of shorebird roosting and feeding activity.</p> <p>Variation to proposal is not expected to alter or increase impacts to marine ecosystems. Shoal Bay has less sensitivity to cumulative impacts than the original location in Darwin Harbour.</p>		<p><i>NT Biodiversity Offsets Policy (under-development)</i></p> <p><i>EPBC Act Offsets Policy</i></p>
<p>Air quality</p> <p>Protect air quality and minimise emissions and their impact so that environmental values are maintained.</p>	<p>Primary air pollutants in the Darwin region are particulates from smoke from vegetation burn offs during the dry season, with Carbon Monoxide (CO), Nitrogen Oxides (NOX, NO and NO2) and Sulfur Dioxide at very low levels compared to other cities in Australia.</p> <p>Nearest residential receptors are located: 200-300m from OHTL corridor through Livingstone and 600m from corridor through Noonamah</p> <p>5 km from Darwin Converter Site.</p> <p>Recreational campers on Gunn Point Beach are also sensitive receptors within a few hundred meters of the LSJ Station and shore crossing.</p>	<p>Dust emissions from land clearing and disturbance during the dry season.</p> <p>Diesel and particulate emissions from construction vehicles, plant and equipment.</p> <p>Variation to proposal is not expected to increase impacts to air quality compared to the original proposal.</p>	<p>Air quality modelling will be undertaken to define a zone of influence and identify sensitive receptors within this zone.</p> <p>Where modelling indicates potential impacts to sensitive receptors:</p> <p>Engage with stakeholders to advise works timing and duration.</p> <p>Implement dust controls as required to ensure impacts remain within tolerable limits.</p>	<p><i>Ambient Air Quality NEPM 1997 and Air Toxins, National Environment Protection Measure (NEPM) 2004, 1996</i></p>
<p>Atmospheric processes</p> <p>Minimise greenhouse gas</p>	<p>NT GHG emissions are comparatively low compared to other Australian jurisdictions due to sparse population and low level of industrial development.</p>	<p>Land clearing and emissions from construction vehicles, plant and equipment.</p>	<p>Sun Cable is committed to minimising GHG emissions and has engaged a company to prepare emissions calculations</p>	<p><i>National Greenhouse Energy Reporting Framework</i></p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
<p>emissions so as to contribute to the NT Government’s aspirational target of achieving net zero greenhouse gas emissions by 2050.</p>		<p>Improvement in renewable energy supply to the NT.</p> <p>AAPowerLink has potential to offset significant amounts of GHG emissions in both Australia and Singapore.</p> <p>Variation to proposal will result in a minor increase to the project footprint and therefore land clearing emissions.</p>	<p>and undertake a whole of project Lifecycle Carbon Assessment (LCA).</p> <p>Opportunities to minimise carbon emissions will be explored through the project planning and design phase, considering all aspects of the proposal from materials selection and procurement, through to logistics and travel.</p> <p>Sun Cable will quantify scope 1 and 2 emissions in the EIS and provide a Draft GHG Abatement Plan.</p>	<p><i>Draft NT Large and Expanding Emitters Policy 2020</i></p> <p><i>NT Offsets Framework (under development)</i></p> <p><i>EPBC Act Offsets Policy</i></p>
<p>Communities and economy</p> <p>Enhance communities and the economy and foster resilience to a changing climate, for the welfare, amenity and benefit of current and future generations of Territorians</p>	<p>Darwin based workforce 500 personnel during construction</p> <p>OHTL Utilities Corridor The Utilities Corridor route is located in a future utilities corridor identified on the Litchfield Regional Land Use Plan. Nearest residential receptors are located 200-300 m from the OHTL corridor through Livingstone and 600 m through Noonamah.</p> <p>Darwin Converter Site Crown Land with no formal land use. Seafarms prawn aquaculture facility proposed on land adjacent to site. Nearest residents are the Tree Point Community located 5 km south.</p> <p>Cable Transition Facilities</p>	<p>Temporary reduction in residential and recreational amenity from construction noise, dust, traffic and construction workforce presence.</p> <p>Visual impact of construction activity and project infrastructure.</p> <p>Perceived impacts on access and recreational use of Gunn Point beach for camping and walking on the beach, especially during construction.</p> <p>Potential pressures during construction on short-term accommodation and housing in the Greater Darwin Region</p> <p>Potential impacts on rural values and lifestyle from land clearing.</p> <p>Economic benefits from local procurement and jobs, and increased availability of renewable energy as a power supply.</p>	<p>A Social Impact Assessment will be undertaken, and a Social Impact Management Plan developed to minimise impacts and maximise project benefits.</p> <p>Indigenous Engagement Plan and a Territory Benefits Plan (TBP) to maximise benefits for the local community and industry.</p> <p>A Traffic Study will be undertaken to assess the impact of project related traffic on the local road network and associated safety and other mitigation measures.</p> <p>Public access to Gunn Point Beach will be maintained throughout the construction and operational phases of the project to ensure</p>	<p><i>Guidelines for the preparation of an economic and social impact assessment (NT EPA 2013)</i></p> <p><i>IAP2 Quality Assurance Standard for Community and Stakeholder Engagement</i></p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
	<p>Recreational users of Gunn Point Beach use the area within a few hundred meters of the LSJ Station and shore crossing.</p>	<p>Compared to the original proposal, there is increased potential for impacts to rural values (on Darwin’s outskirts), amenity and land-based recreational activities, mainly during the construction phase.</p>	<p>ongoing recreational use can occur.</p> <p>Security and signage will be in place during construction and operations.</p> <p>Engagement with stakeholders to inform of construction schedule and activities and to provide a contact for issues/complaints.</p>	
<p>Culture and heritage Protect sacred sites, culture and heritage.</p>	<p>Darwin Converter Site and Cable Transition Facilities are on Larrakia Land currently used by the Larrakia, Tiwi and Wulna Indigenous groups for hunting and ceremonial purposes.</p> <p>Sacred sites and archaeological heritage sites could occur. Further surveys required to confirm presence/absence and mitigation requirements.</p> <p>No NT Heritage sites occur.</p>	<p>Impacts to Indigenous land use.</p> <p>Disturbance of sacred sites</p> <p>Disturbance or loss of cultural heritage materials</p> <p>The OHTL Utilities Corridor away from the railway corridor increases the potential for impacts to previously unrecorded heritage sites compared to the original proposal.</p>	<p>Engagement with representatives of the Indigenous community through project planning and design.</p> <p>Cultural heritage surveys will be undertaken across the project footprint by qualified archaeologists with cultural monitors assisting to identify Aboriginal cultural values.</p> <p>AAPA Authority Certificate in place prior to commencement of works.</p>	<p><i>Heritage Act</i> <i>Aboriginal Sacred Sites Act</i></p>
<p>Human health Protect the health of the Northern Territory population.</p>	<p>Nearest residents are located: 200-300 m from OHTL corridor through Livingstone and 600 m from corridor through Noonamah</p> <p>Nearest residential area is 5 km from Darwin Converter Site.</p> <p>Recreational campers on Gunn Point Beach are also sensitive receptors within a few hundred meters of the LSJ Station and shore crossing.</p>	<p>Electromagnetic fields (EMF) hazard has been identified as an issue of concern in the EIS TOR. The risk to the workforce is low and there is no risk to the community. However, as this has been identified by stakeholders, it will be addressed in the EIS.</p> <p>Other potential impacts to human health identified in the EIS TOR relate to biting insects, ticks and mites. These issues are</p>	<p>Engagement with stakeholders to inform of construction schedule and activities and to provide a contact for issues/complaints.</p> <p>Noise and dust controls during construction.</p> <p>Darwin Converter Site drainage design to minimise creation of biting insect habitat.</p>	<p><i>International Commission on Non-Ionizing Radiation Protection (ICNIRP) Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)</i></p> <p><i>Construction practice near tidal areas in the</i></p>

NT EPA factor and objective	Presence/absence of environmental values (Summarised from Section 4.1)	Potential impacts and benefits	Avoidance and Mitigation	Policy/Guidelines
		<p>not expected to be exacerbated by the project.</p> <p>Variation to proposal is not expected to increase impacts human health compared to the original proposal.</p>	<p>Workforce education and Personal Protective Equipment.</p> <p>Security around facilities to exclude public access.</p>	<p><i>Northern Territory - Guidelines to prevent mosquito breeding (Medical Entomology, 2009a).</i></p> <p><i>Guidelines for preventing biting insect problems for urban residential developments or subdivisions in the Top End of the Northern Territory (Medical Entomology, 2009b).</i></p>

5 Conclusion

The variation to the components of the AAPowerLink Proposal in the Darwin region is being referred to the NT EPA under Section 51 of the *EP Act* and the Commonwealth Environment Minister will also be notified by a variation request in accordance with Section 156A the *EPBC Act*. The variation is not likely to affect any additional environmental factors or MNES but could alter the nature of potential impacts to the Terrestrial Ecosystems factor due to the different vegetation communities and habitats that occur in the new footprint.

Technical studies and assessment of the varied proposal footprint are underway and the EIS will incorporate assessment of environmental impacts associated with these components. The original EIS TOR for the Terrestrial Ecosystems factor have been amended to include further consideration of the additional threatened species that could occur in the new footprint. For all other environmental factors, the current TOR are considered to adequately capture the potentially significant impacts that require consideration in the EIS, without further amendment.

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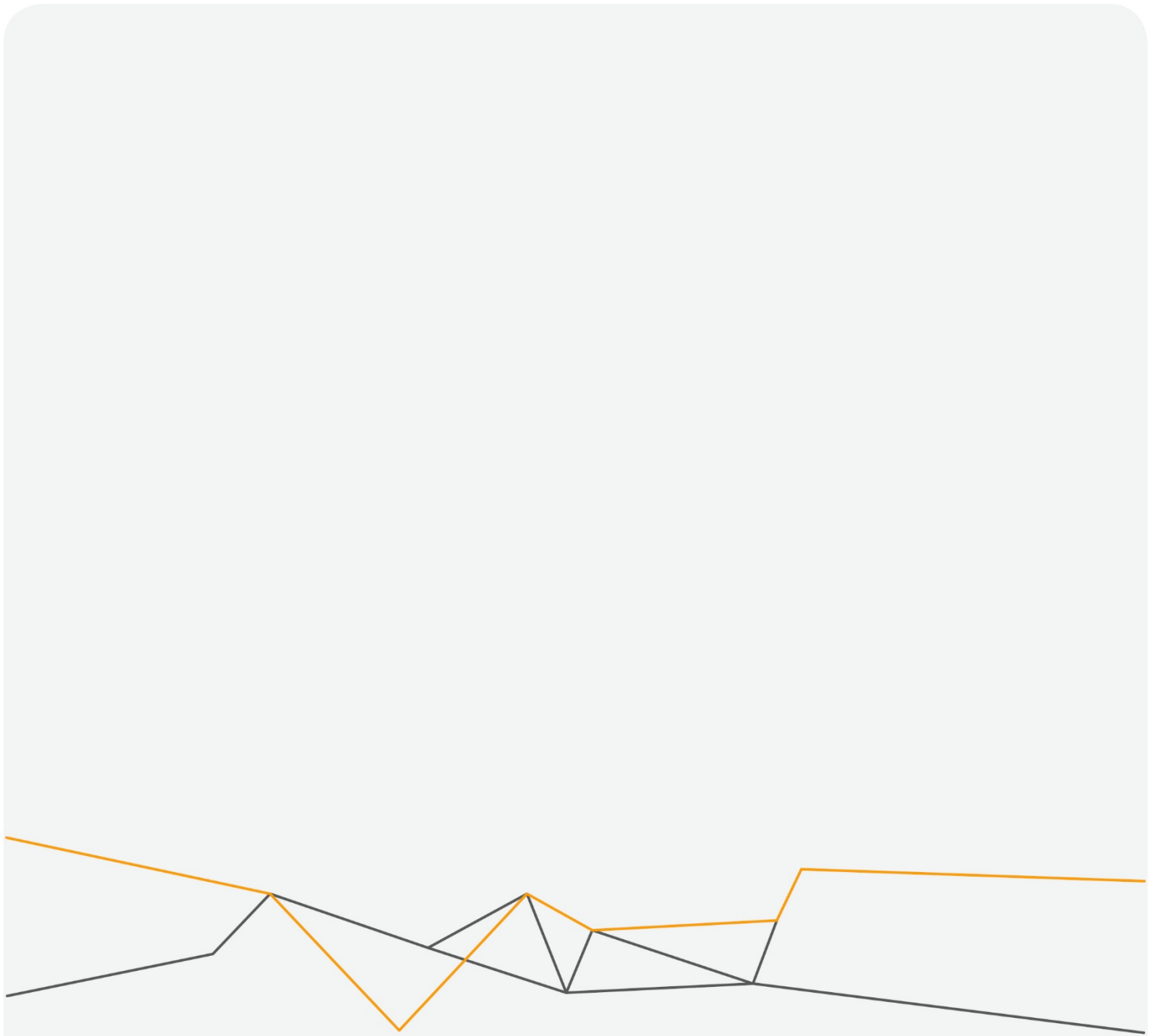
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