

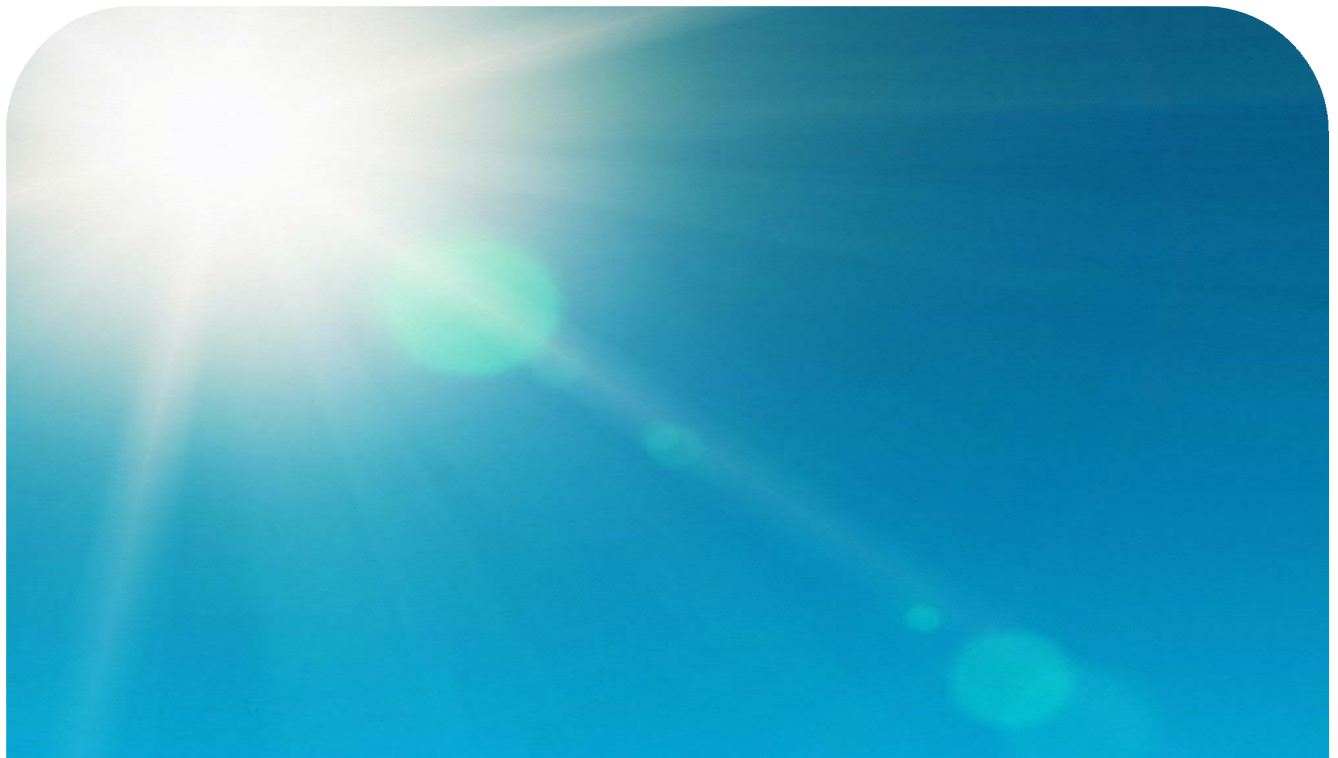


Chapter 2 – Project Refinement

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Approved Rev	Approver Position	Signature	Date
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2 Project Refinement

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2 Project Refinement

2.1 Overview

The Project comprises the following six key components:

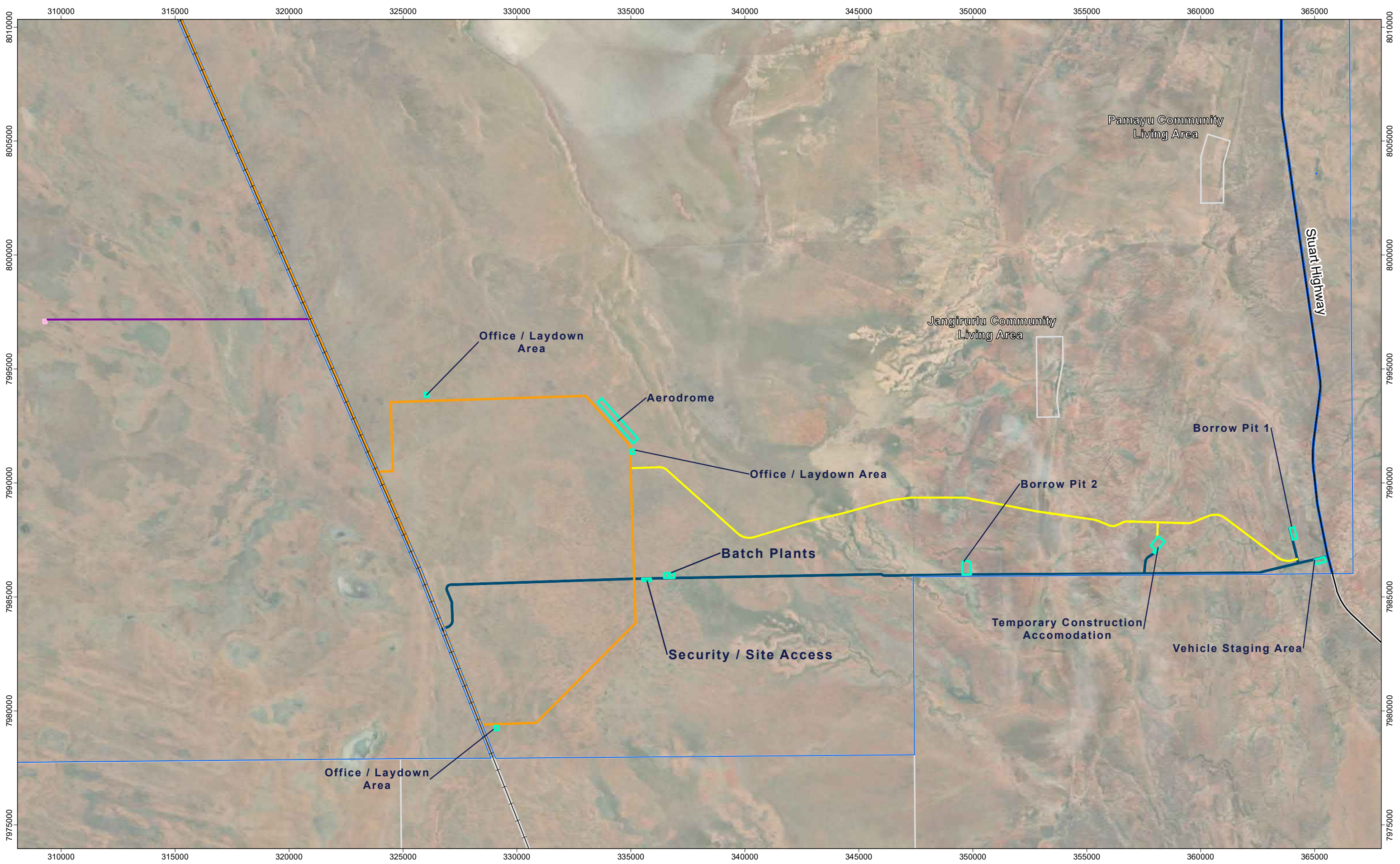
- Powell Creek Solar Precinct in the Barkly Region of the NT where electricity will be generated, stored, and transmitted
- OHTL to transmit electricity from the Solar Precinct to Darwin
- Darwin Converter Site (DCS) including Voltage Source Converters (VSCs), energy storage and network connection to supply electricity to the Darwin region
- Cable Transition Facilities at Murrumujuk and Gunn Point Beach to transition power cables between land and sea
- Subsea Cable System extending from the Cable Transition Facilities to Singapore
- Singapore Converter Station to receive electricity and supply the Singapore electrical network.

The Solar Precinct will have a peak generation capacity of approximately 17-20 GW, subject to final modelling. The proposed transmission system rating is approximately 6.4 Gigawatts (GW) for the OHTL and 4 GW for the Subsea Cable System. AAPowerLink is forecasted to be operational in the NT in 2028, and in Singapore by 2030. The Project design life is 70 years.

This chapter provides an overview of Project refinements since the submission of the Draft EIS. Project refinements are discussed in detail including activities associated with the construction, operation and decommissioning of the infrastructure.

The Direction to prepare a SEIS received from the NT EPA specifically sought more information on the following key Project components: Solar Precinct Ancillary Infrastructure (AI); OHTL Corridor; Electrode Areas; and Subsea Cable System. Additional information has been provided to enable a more detailed understanding of potential impacts associated with the Project (updated impact assessments are presented in other SEIS chapters, identified in Table 2-1).

Key Project components areas are shown in Figure 2-1 to Figure 2-4. A tabulated comparison of Project refinements is presented in Table 2-1. Figures depicting the OHTL Corridor from Powell Creek to Murrumujuk are provided in Appendix 2.2 to this chapter.



Legend

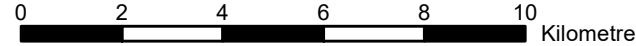
OHTL Corridor	Cadastre	Solar Precinct
Gravel Access Track	Powell Creek Station	Ancillary Infrastructure
Main Access Track	HVDC Electrode Line Corridor	Powell Creek Electrode
Existing railway line		



Figure 2-1: Powell Creek Ancillary Infrastructure

Project: Australia-Asia PowerLink	Reference #: AAPL_GNR_CTA_GEN_MAP_0284	Figure: 1 of 1	Revision: B
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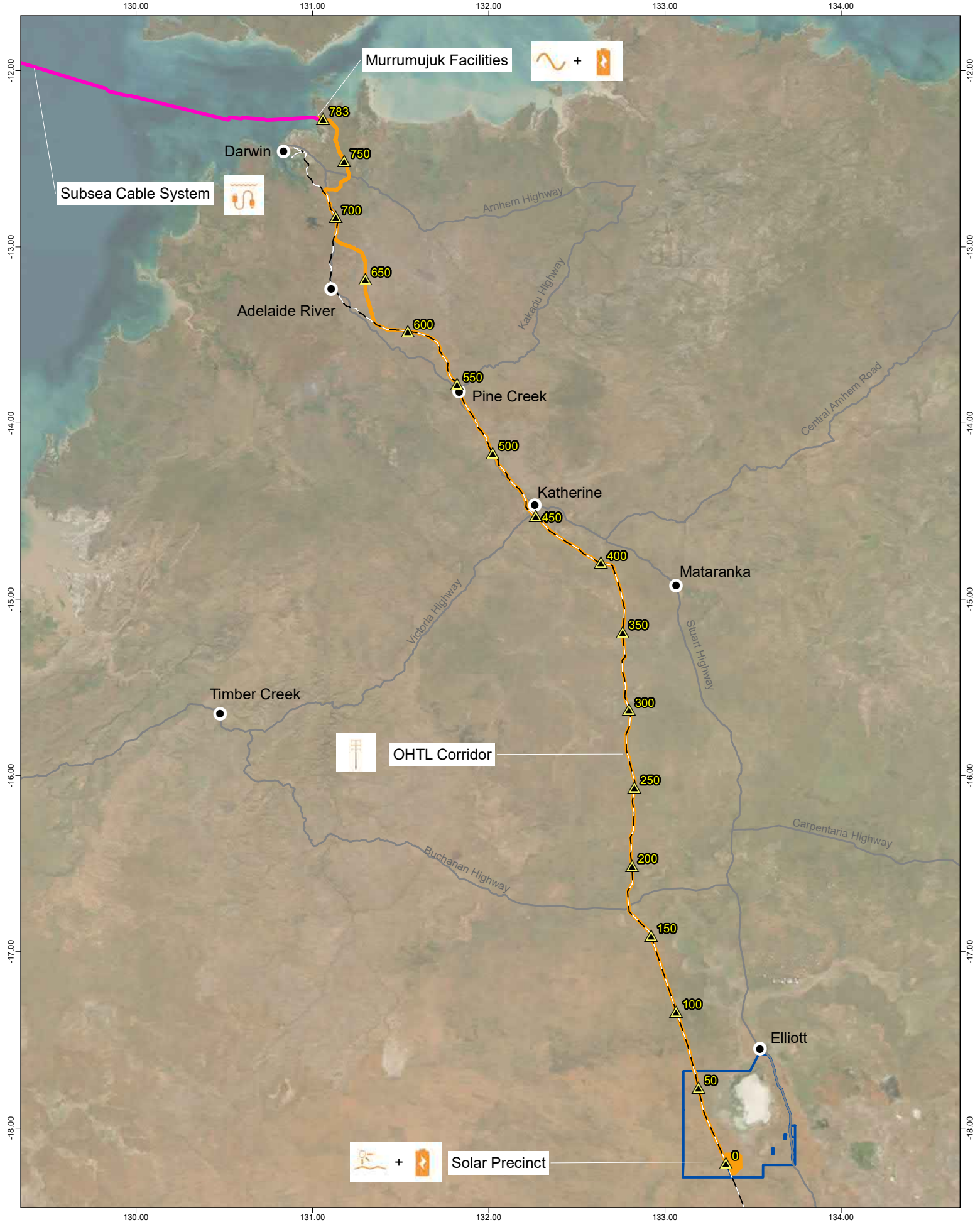
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Legend

- Highway
- Existing railway line
- Kilometre points
- Subsea Cable System
- AAPowerLink Infrastructure
- Powell Creek Station

Source: NTG data - Parks and reserves. Australian Government data - Railway, roads, coastal waters and marine parks



Figure 2-2: Overhead Transmission Line Corridor (OHTL)

Project: **Australia-Asia PowerLink**

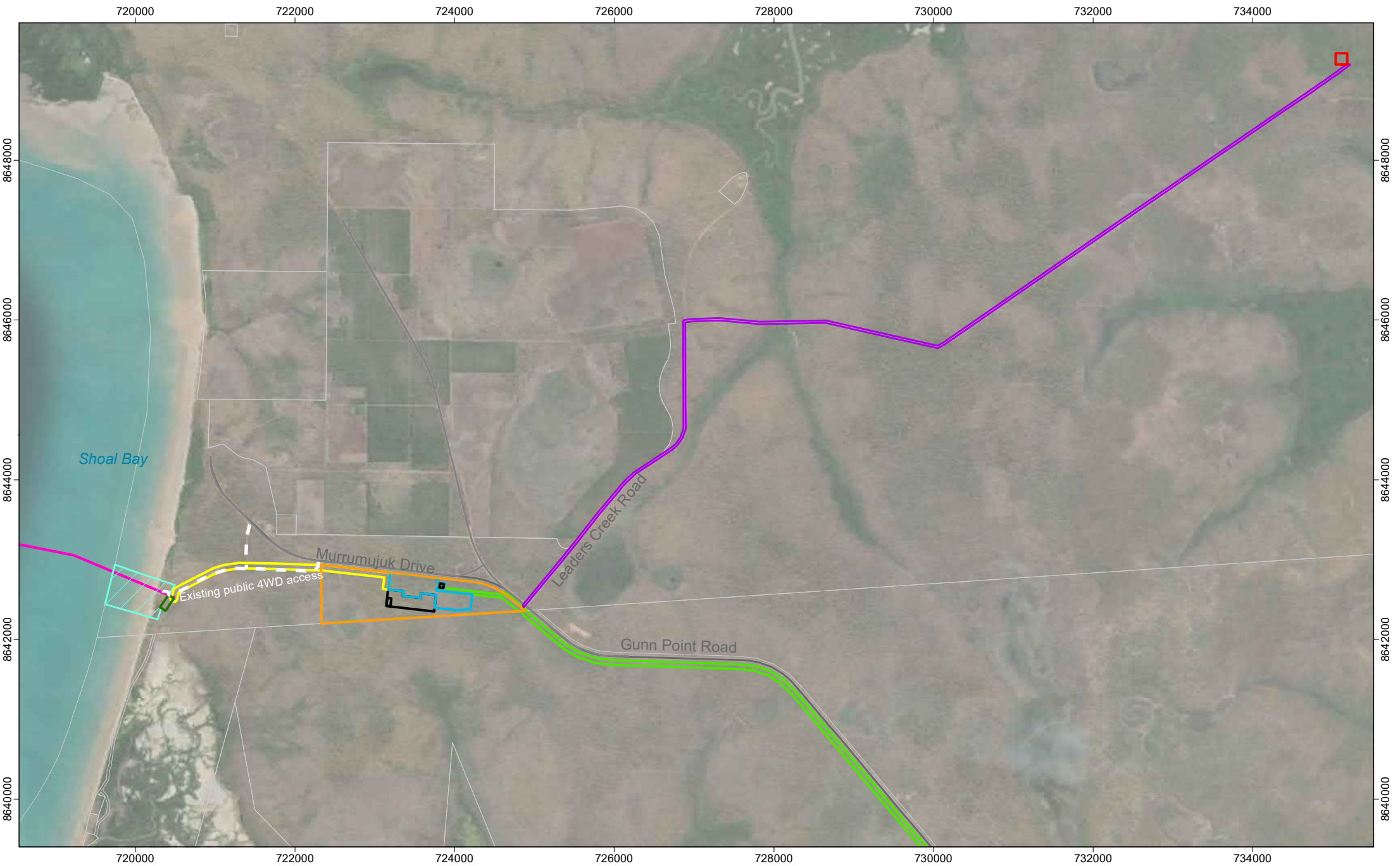
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Date: 06/11/2022 | Figure: 1 of 1 | Revision: B

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Coordinate System: - | A4

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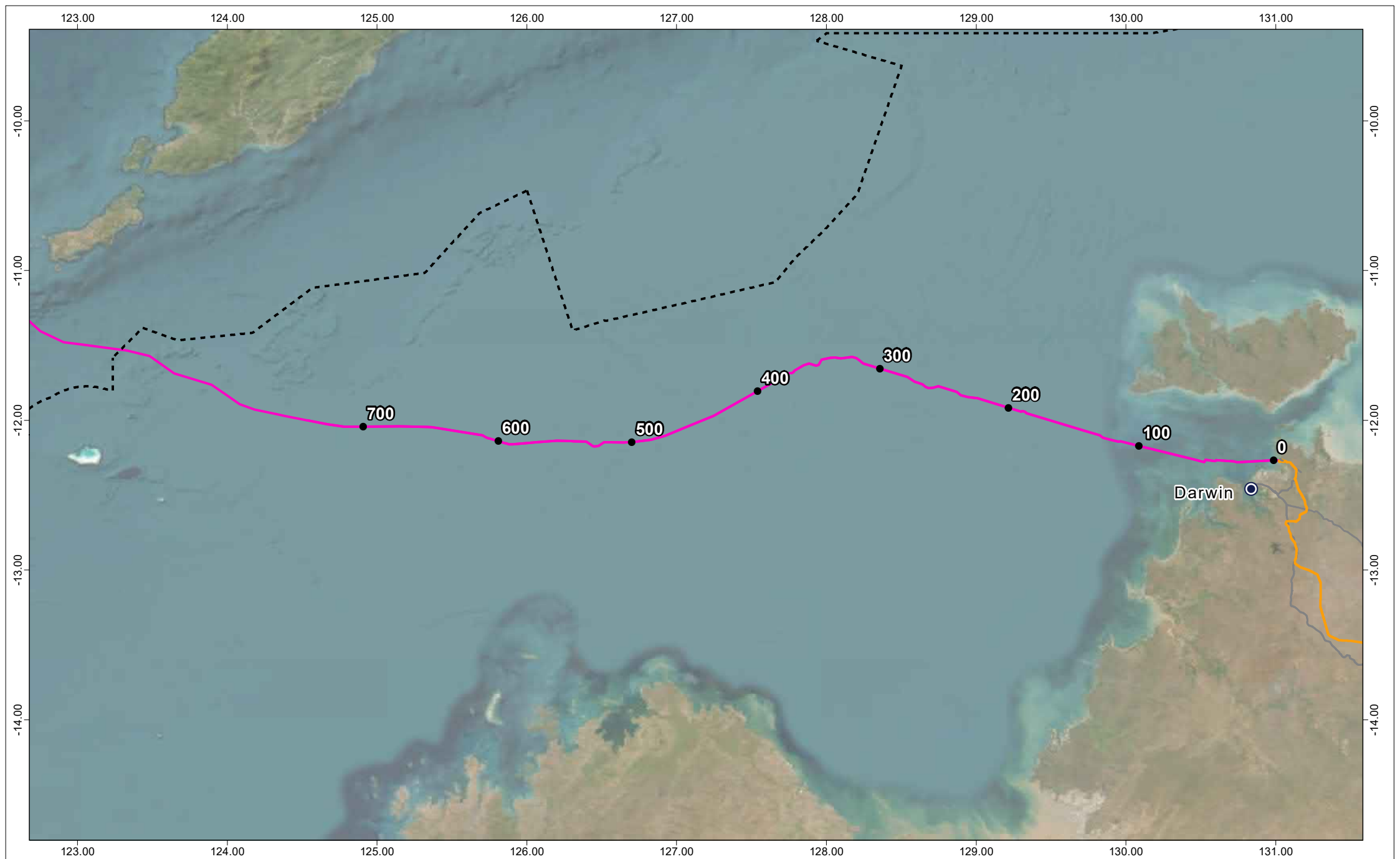
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Subsea Cable System	Darwin Converter Site Electrode	Future use area
Cadastre	HVDC Electrode Line Corridor	OHTL Corridor
Shore Crossing Site	Darwin Converter Site	Underground Cable Corridor
Land Sea Joint Station	Converter Site, VSC's, Switchyard, BESS Construction	



Figure 2-3: Darwin Converter Site and Cable Transition Facilities

Project: Australia-Asia PowerLink		Reference #: AAPL_GNR_CTA_GEN_MAP_0295	Figure: 1 of 1	Revision: A
Coordinate System: MGA 52	Datum: GDA2020	Date: 02/11/2022		
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Legend

- Kilometre Points
- Commonwealth Marine Area
- Subsea Cable System
- Land based AAPowerLink Infrastructure

Source: NTG data - Cadastre and roads. Imagery: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Figure 2-4: Subsea Cable System

Project: Australia-Asia PowerLink		Reference #: AAPL_GNR_CTA_GEN_MAP_0077	Figure: 1 of 1	Revision: D
Coordinate System: GDA 2020	Datum: GDA 2020	Date: 16/11/2022		
		Scale: 1:3,500,000		



Table 2-1: Summary of Changes to the Project Description

Project component	Draft EIS	Supplement to the Draft EIS	Rationale	Environmental Factors assessed in SEIS
Powell Creek Solar Precinct and Ancillary Infrastructure Section 2.2	AI is located within the Solar Precinct footprint (12,000 ha) except for the Aerodrome and associated infrastructure as well as two Access Roads (244.5 ha). Estimated water demand: <ul style="list-style-type: none"> Construction: approximately 1,500 ML/year Operations: approximately 10 ML/year. 	AI (total of 134 ha at peak construction) will be located outside the 12,000 ha Solar Precinct area. The majority (124 ha) is temporary infrastructure required for construction only, and 10 ha is permanent infrastructure. Minor amendments to the alignment of Access Roads and off shoot roads to AI locations included. Estimated water demand: <ul style="list-style-type: none"> Construction: up to approximately 1,860 ML/year (for a total of 8,040 ML over 4 to 4.5 years) Operations: approximately 11.4 ML/year (increase of 1.4 ML/year for a total of 798ML). 	Space constraints have necessitated this change. A review of solar panel technology indicates full area of the Solar Precinct may be required for panel installation and associated electrical infrastructure. AI required to move outside the Solar Precinct boundary during the construction period. Access Road alignment amendments have been optimized to avoid sensitive areas and landscape features. Increase in water demand estimates driven by improved understanding of Project requirements during construction/operational phases	Chapter 4: TEQ Chapter 5: Terrestrial Ecosystems Chapter 6: Hydrology Chapter 7: Aquatic Ecosystems Chapter 10: Amenity Chapter 12: Land Use and Transport Chapter 13: Culture and Heritage Chapter 14: Human Health Chapter 15: MNES Additional Appendices that inform assessment: Appendix 2.1: Environmental Design Criteria and Standards Appendix 4.1: Constraints Planning and Field Development Procedure Appendix 5.1: Supplementary Ecology Report Part 1 Appendix 5.2: Supplementary Ecology Report – Part 2 Appendix 5.3: Weed Management Plan Appendix 6.1: Groundwater Assessment
OHTL Corridor	OHTL Corridor deviation options at Katherine, Pine Creek, and Adelaide River. OHTL easement width of 60m.	OHTL Corridor alternatives assessment undertaken with preferred option identified for each alternative. The preferred OHTL	Ongoing route refinement, environmental and technical interaction studies and constraints mapping has	Chapter 4: TEQ Chapter 5: Terrestrial Ecosystems Chapter 6: Hydrology

Project component	Draft EIS	Supplement to the Draft EIS	Rationale	Environmental Factors assessed in SEIS
Section 2.3.2	<p>Cleared pad area of 12 m x 6 m around each pole structure during the operational phase.</p> <p>Micro-siting approach proposed to address uncertainties in site conditions and demonstrate commitment to mitigating impacts once detailed design available.</p> <p>The Draft EIS noted that the height of vegetation within the corridor would be based on the potential for interference with the conductors.</p>	<p>route footprint is now referred to in this SEIS as the OHTL Corridor.</p> <p>Variable corridor (easement) widths between 30-60 m have been identified in certain sections (see Appendix 2.2 for detailed OHTL mapping).</p> <p>Cleared Structure Pad Area of 16 m x 16 m under each structure for foundations will be retained during the operational phase.</p> <p>Micro-siting approach to structure placement has been developed into a more comprehensive Constraints Planning and Field Development Procedure (see Appendix 4.1).</p> <p>Vegetation management to maintain low vegetation cover (below approximately 6 m in height) within an approximate 38 m wide corridor (or appropriate to OHTL sizing) will support optimal electrical safety clearances during the operational phase (see Appendix 5.4).</p>	<p>informed the preferred and more optimal OHTL Corridor footprint.</p> <p>The increase in structure pad area retained during the operational phase is related to the potential increase in the height of OHTL structures.</p>	<p>Chapter 7: Aquatic Ecosystems Chapter 10: Amenity Chapter 12: Land Use and Transport Chapter 13: Culture and Heritage Chapter 14: Human Health Chapter 15: MNES</p> <p>Additional Appendices that inform assessment: Appendix 2.1: Environmental Design Criteria and Standards Appendix 2.2: OHTL Project Mapping. Appendix 4.1: Constraints Planning and Field Development Procedure Appendix 5.1: Supplementary Ecology Report Part 1 Appendix 5.2: Supplementary Ecology Report – Part 2 Appendix 5.3: Weed Management Plan Appendix 5.4: OHTL Vegetation Management Framework Appendix 5.5: Memorandum – Riparian Vegetation Assessment</p>
<p>OHTL structures</p> <p>Section 2.3.4</p>	<p>Steel monopole structures between 44 – 56 m tall inclusive of Metallic Earth Return (MER). Steel lattice structures of similar dimensions contemplated where tensioning</p>	<p>OHTL structures (inclusive of steel monopoles and steel lattice structures) up to 60 m tall.</p> <p>Approximately 2,785 structures.</p>	<p>Increased understanding of topography, route features and system design indicates structures heights up to 60 m may be required to achieve optimal spans.</p>	<p>Chapter 10: Amenity</p> <p>Additional Appendices that inform assessment: Appendix 2.1: Environmental Design Criteria and Standards</p>

Project component	Draft EIS	Supplement to the Draft EIS	Rationale	Environmental Factors assessed in SEIS
	<p>is required to account for directional changes. Approximately 2,500 structures.</p>		<p>Curvature of the revised OHTL Corridor requires an increase in number of structures. MER retained for optionality despite preference for Electrodes. Span distance remains at 200 m to 450 m, as described in the Draft EIS.</p>	<p>Appendix 4.1: Constraints Planning and Field Development Procedure Appendix 5.1: Supplementary Ecology Report Part 1 Appendix 5.2: Supplementary Ecology Report – Part 2 Appendix 5.3: Weed Management Plan Appendix 5.4: OHTL Vegetation Management Framework Appendix 5.5: Memorandum – Riparian Vegetation Assessment Appendix 10.1: Landscape and Visual Impact Assessment (VIA)</p>
<p>OHTL fibre optic cable 2.3</p>	<p>Trenched fibre optic cable within temporary disturbance footprint to a depth of approximately 1.2 m for the entire OHTL Corridor. Alternative option to string fibre optic cable on OHTL structures.</p>	<p>Trenching of fibre optic cable along the OHTL Corridor is no longer proposed. Fibre optic cable to be strung on OHTL structures, if required.</p>	<p>Optionality retained for fibre optic cable strung along OHTL structures for increased transmission system control, subject to detailed design.</p>	<p>Nil.</p>
<p>Electrodes Section 2.3.7</p>	<p>The Project may install up to two Electrodes connected to the VSC via an overhead connection line (spatial requirements not provided). Extensive areas of interest identified for the electrode locations approximately 8 km away from the VSCs at both the Powell Creek Solar Precinct and the DCS. Each site will have a footprint of</p>	<p>A preferred 2 ha site has been identified within both original areas of interest. The HVDC Electrode Line requires a corridor of approximately 30 m wide. An estimated 10 m wide disturbance footprint will be required to construct the HVDC Electrode Line. The height of these structures is approximately 12 m. The DCS HVDC Electrode Line Corridor will prioritise an alignment adjacent to the existing road to minimise disturbance. An Access Track will be situated inside the</p>	<p>Based on further engineering and environmental studies, approximate locations for each Electrode and HVDC Electrode Line have been refined.</p>	<p>Chapter 4: TEQ Chapter 5: Terrestrial Ecosystem Chapter 6: Hydrology Chapter 7: Aquatic Ecosystems Chapter 12: Land Use and Transport Chapter 13: Culture and Heritage Chapter 14: Human Health Chapter 15: MNES</p>

Project component	Draft EIS	Supplement to the Draft EIS	Rationale	Environmental Factors assessed in SEIS
	<p>approximately 2 ha each selected within the areas of interest.</p>	<p>Powell Creek HVDC Electrode Line Corridor where the existing pastoral Access Track does not suffice, subject to the application of the Constraints Planning and Field Development Procedure (Appendix 4.1).</p>		<p>Additional Appendices that inform assessment: Appendix 2.1: Environmental Design Criteria and Standards Appendix 4.1: Constraints Planning and Field Development Procedure Appendix 5.1: Supplementary Ecology Report Part 1 Appendix 5.2: Supplementary Ecology Report – Part 2 Appendix 5.3: Weed Management Plan Appendix 12.1: Land Based Electrode Technical Report</p>
<p>Cable Transition Facilities – Underground Cable Corridor Section 2.5</p>	<p>Total Underground Cable Corridor width approximately 70 m based on two cable systems. Lateral spacing between underground cables in the Underground Cable Corridor approximately 2 m apart, with indicative total trench width of 9.5 m.</p>	<p>Total Underground Cable Corridor width has been reduced to approximately 63 m for two cable systems. Lateral spacing between underground cables in the Underground Cable Corridor will increase to approximately 4 m apart, within an approximate trench width of 13.5 m.</p>	<p>Refined understanding of construction and operational requirements has increased trench width but reduced total corridor width.</p>	<p>Draft EIS assessment deemed sufficient for this non-material project refinement.</p>
<p>Subsea Cable System – Route Section 2.6</p>	<p>Two route options (A and B) under consideration.</p>	<p>Further investigations have identified route B (southern route) as the preferred Subsea Cable System alignment. Minor re-alignment of route B has occurred based on further marine and engineering studies.</p>	<p>Route B realignment allows for increased spacing of bends where the cable system will cross existing infrastructure (pipelines). A marine survey was completed from Gunn Point beach along Route B for ~60 km to where Route B adjoins the original cable system route.</p>	<p>Chapter 8: Marine Environmental Quality Chapter 9: Marine Ecosystems Chapter 15: MNES Additional Appendices that inform assessment:</p>

Project component	Draft EIS	Supplement to the Draft EIS	Rationale	Environmental Factors assessed in SEIS
				Appendix 8.1: Marine Cable Burial Risk Assessment (Confidential) Appendix 8.2: Guardian Geomatics Interim Report (Confidential) Appendix 8.3: Sediment SAPIR Appendix 9.1: Memorandum – Benthic Video Footage Analysis
Subsea Cable System – Sediment removal during construction / operations. Section 2.6	Presweeping is described in the Draft EIS and notes the potential use of a Mass Flow Excavator (MFE) or cutter-suction dredger. The potential for spoil disposal at sea of sandwaves (marine sediment) removed during cable installation activities was identified however no additional information provided to enable assessment. Information on maintenance activities during Operations phase not provided at the time of the Draft EIS.	For the construction phase, marine sediment disposal at sea will be required. During the operational phase, minor sediment removal may be required to be undertaken to rectify faults in the cable. However, the quantities of sediment and methods of sediment removal and placement which would be required during operations are unlikely to trigger consideration of the NAGD or the Guidelines for the Environmental Assessment of Marine Dredging in the NT (NT EPA, 2013). Four potential spoil disposal grounds have been identified for the disposal of approximately 260,000 m3 of marine sediment material	Marine geotechnical / geophysical side-scan sonar studies carried out since the Draft EIS have confirmed the need to remove areas with elevated sandwaves to enable safe installation of the cable to a design depth of 0 to 3m below seabed. Additional information on the locations and volumes of marine sediment being removed and disposed during construction is now available for assessment. The material has been characterized as non-deleterious and appropriate for disposal.	Chapter 8: Marine Environmental Quality Chapter 9: Marine Ecosystems Chapter 15: MNES Additional Appendices that inform assessment: Appendix 8.1: Marine Cable Burial Risk Assessment (Confidential) Appendix 8.2: Guardian Geomatics Interim Report (Confidential) Appendix 8.3: Sediment SAPIR Appendix 9.1: Memorandum – Benthic Video Footage Analysis
Subsea Cable System – Fibre optic cable Section 2.6	Not provided.	Fibre optic cable will be bundled within each cable within Australian waters (no visual or additional physical impact).	Inclusion of fibre optic cable will improve nearshore fault detection and monitoring of subsea cable system performance and fault detection	Draft EIS assessment deemed sufficient for this non-material Project refinement.

Based on the above Project refinements, the areas of disturbance for the Project have been adjusted. These are described below in Table 2-2.

Table 2-2: Adjusted Areas of Disturbance due to Project Refinements

Project Component	Description	Draft EIS Disturbance Footprint	Supplement to the EIS Disturbance Footprint
Powell Creek Solar Precinct and AI, Section 2.2	Solar Arrays, Battery Energy Storage Systems (BESS), Electrical Infrastructure and AI including Access Tracks, Temporary Construction Accommodation, including the Pioneer Camp, Intermodal Logistics Facility, Internal Roads, Construction Waste Disposal area.	12,269 ² ha	12,403 ² ha
OHTL, Powell Creek to Murrumujuk	OHTL Corridor Length	787 km	783 km
	OHTL Structures	2,500	2,785
	OHTL Corridor (described in the Draft EIS as 'OHTL easement')	4,728 ha	4,494 ha
	OHTL Construction Corridor (temporary)	1,734 ha ^{1,2}	1,723 ² ha
	OHTL Construction Pads for OHTL structures (temporary) (minus the Construction Corridor overlap area*)	950 ha ² (minus 550 ha overlap area ³)	977 ha ² (minus 630 ha overlap area ³)
	Temporary construction areas and OHTL mobile camps re-instated post construction	6 ha ²	6 ha ²
	OHTL Operations footprint - includes Access Track and Structure Pad Areas (permanent) – within footprint already disturbed during construction.	497 ha	541 ha
	OHTL Corridor Reinstatement	No figure provided	533 ha
	OHTL Operations Vegetation Management Activities	No figure provided	2 436 ha
	Electrodes footprint	No figure provided	24 ha ² (inclusive of 2 ha Electrode and 10 ha HVDC Electrode Line Corridor per Electrode) *
DCS, Murrumujuk	Up to 4 x VSCs, batteries, AC substation, site offices, parking and laydowns, warehousing, and AI	55 ha ²	60 ha ²
Cable Transition Facilities, Murrumujuk	Underground Cable Corridor (temporary) for up to six cables plus bundled fibre optic cable connection from DCS to Land Sea Joint Station	19 ha ²	18.5 ² ha
	Land Sea Joint Station (temporary)	1.5 ha ²	1.5 ² ha

Project Component	Description	Draft EIS Disturbance Footprint	Supplement to the EIS Disturbance Footprint
	Shore Crossing Site (temporary)	No figure provided	25 ha ²
Total area cleared for construction		15,035 ha	15,238 ha

1. In the Draft EIS, this value was incorrectly reported as the total disturbance within the OHTL Corridor. This value has been corrected for the SEIS and all disturbance areas have been updated to include temporary construction areas and mobile camps which will be re-instated post construction.
2. Values included in the calculation of areas to be cleared for initial construction. This calculation does not include consideration of area to be reinstated after construction.
3. This value indicates area where the Construction Corridor crosses the Construction Pads as depicted in Figure 2-5.

2.2 Powell Creek Ancillary Infrastructure

Ancillary Infrastructure (AI) is required to facilitate the construction and operation of the Project at the Powell Creek Solar Precinct Figure 2-1. AI is listed in the Draft EIS and described as being located within the Solar Precinct boundaries. Ongoing investigations into the engineering requirements have resulted in the need for increased optionality for locating temporary and permanent AI outside the Solar Precinct boundary. Additional footprints are required (Table 2-3); temporary infrastructure will be required for the construction period only; permanent infrastructure will be required for the operation of the Project.

The following AI will be temporary and located outside of the main Powell Creek Solar Precinct footprint:

- Construction Offices and Laydown Areas (multiple)
- Temporary Construction Accommodation
- Construction support areas (batch plants, security/site access, vehicle staging area, equipment, and material laydown areas)
- Two Borrow pits.

The following AI is associated with the operational life of the Project and categorised as permanent (70 years). It will be located outside the main Powell Creek Solar Precinct footprint:

- Access Tracks
- Aerodrome
- Landfill/Waste Management Area (conceptually proposed within borrow pit footprints)
- Water Bores, storage, and supply infrastructure.

Table 2-3: AI Footprint outside the Solar Precinct Boundary

Ancillary Infrastructure	Footprint (Approximate)
Temporary (124ha)	
Construction Office/Laydown Area	10 ha
Temporary Construction Accommodation (including utilities)	45 ha
Construction Support Areas (Batch Plant, Security/Site Access, Vehicle Staging Area)	24 ha
Borrow Pits (2)	30 ha
Multiple equipment and material laydown areas	15 ha
Permanent (10 ha)	
Landfill or waste management areas	30 ha (Borrow pits to be re-purposed once material is exhausted)
Water bores and water storage areas	5 ha
Additional Access Tracks to AI	5 ha
Approximate Total	134 ha

2.2.1 Location and Footprint

Indicative temporary AI locations are shown in Figure 2-1. Engineering design optimisation is ongoing and will identify the most efficient arrangement of solar arrays within the Solar Precinct. Land within the Solar Precinct is prioritised for solar generation and critical electrical infrastructure for the following reasons:

- Preferred solar generation technology mix between fixed arrays and Single Access Trackers (SATs) remains subject to final design. Retaining flexibility for site layout options to accommodate the preferred technology mix is required.
- The optimal solar arrangement will always be a linear and geometric arrangement.
- Limited design flexibility of site layout options and potentially solar generation capacity while balancing the need for proximate temporary AI, particularly the Temporary Construction Accommodation facility.
- A key factor in construction workforce attraction, wellbeing, and retention for major projects in remote area, is the location and quality of the accommodation provided. Re-locating the Temporary Construction Accommodation external to the Solar Precinct where it is physically separated from the main construction front and support areas allows workers to mentally 'switch off' after shift. The preferred location is also elevated on the Ashburton Ranges and provides an improved amenity, and more ventilated, cooler location.
- Safe, efficient, and controlled construction access to the Solar Precinct is paramount. Vehicle staging and security access points are positioned to ensure that only authorised personnel can access the Solar Precinct and associated AI locations. The main vehicle staging area adjacent the Stuart Highway will also serve as a biosecurity and weed hygiene check point to mitigate the potential impacts from external factors.

Indicative permanent AI locations external to the Solar Precinct are discussed below.

2.2.2 Site Selection

The indicative locations shown in Figure 2-6 are the result of initial constraints mapping and a site selection workshop. During this workshop, mapping layers which clearly delineated areas to be avoided during placement of the infrastructure were reviewed. Constraints mapping layers included land access, identified areas of cultural heritage significance, ecology, geology, and flooding potential. The Project team also completed ground truthing of the area to confirm the findings of the desktop review and workshop, which included confirming the useability and access to the locations selected. The indicative AI locations were refined in consultation with TOs and Custodians through the NLC.

As engineering and design progresses, further refinements of these locations may occur. Any refinement will consider: TOs', Custodians', and landowners' requirements; environmental and social areas of significance; geotechnical investigations and engineering design, including detailed flood modelling. A Constraints Planning and Field Development Procedure (Appendix 4.1), sacred site clearances and ongoing engagement with TOs and Custodians as well as landowners, will be completed with the aim of firstly avoiding placement of infrastructure in locations which may cause impacts to identified values. Where the principle of avoidance is not possible, the Project will identify management options to mitigate potential adverse impacts.

2.2.3 Key Components

2.2.3.1 Access Roads

The Draft EIS Section 2.4.3.2 described installing two separate Access Roads from the Stuart Highway to provide all-weather access to the Solar Precinct during construction and operations.

Two access roads are required as they will be constructed and used for different phases of the Project. The initial access road will be gravel, approximately 34 km long, and will make use of existing station tracks and previously disturbed areas where possible. This access will facilitate early works including the construction of the Main Access Road and establishment of the Temporary Construction Accommodation. It will also provide the initial track to access the Solar Precinct work fronts for delivery of construction materials. This will continue to be used during the construction phase as it will help prevent damage to the permanent road due to heavy vehicle movement.

The Main Access Road will be approximately 44 km long (10 km in within the Solar Precinct), bituminised and designed with consideration of drainage lines that intersect the alignment following the relevant Austroads Guide to Road Design standards. Design elements which may be incorporated include installation of culverts at certain locations to allow for natural flows along drainage lines to continue.

Should the Gravel Access Road no longer be required to support Project activities or for use by pastoralists or TOs, it will be rehabilitated. The level of rehabilitation required for the Gravel Access Road will be confirmed through discussions with relevant stakeholders.

The proposed access road locations have been refined to avoid sensitive areas and landscape features, and off-shoot internal tracks to access AI locations have been added. These changes were made in consultation with Project stakeholders and through internal workshops with the project team. Final alignments are subject to ongoing consultation with project stakeholders and consideration of the Constraints Planning and Field Development Procedure (Appendix 4.1).

2.2.3.2 Aerodrome

Multiple Aerodrome options, including making use of existing facilities in the NT have been reviewed and considered. The preferred location was identified in consultation with project stakeholders and was informed by environmental factors including ecology; hydrology; and cultural heritage. Baseline data was reviewed during site selection workshops with the project team. A Glint and Glare Study was also undertaken to review the potential impact from solar arrays on the safe operation of the Aerodrome (v0.1 105901-01). The potential impact from glint and glare was considered negligible and the preferred Aerodrome location was subsequently retained.

Bulk storage tanks which are required for aviation fuel and any other hazardous materials, will be stored, and handled in compliance with Australia Standard 1940 – The Storage and Handling of Flammable and Combustible Liquids. The hazardous materials storage area for the Aerodrome will be located within the Aerodrome’s footprint. Design of the storage area will include appropriate separation distances, use of tanks that incorporate an impermeable bund (which can hold up to 110% of the tank storage volume), and having a spill prevention, emergency response and management process in place.

The final location of the Aerodrome will be subject to the Constraints Planning and Field Development Procedure (Appendix 4.1).

2.2.3.3 Concrete Batching and Water Supply

Two indicative locations are proposed for Batch Plants adjacent to the eastern boundary of the Solar Precinct. The approximate footprint of each Batch Plant is 5 ha. The estimated volume of concrete required for production is approximately 202,000 m³ and forecast water demand is approximately 51 ML total during the construction period (included in water consumption estimate above in Table 2-1).

2.2.3.4 Waste

The Project is developing an overall Waste Management Strategy for both construction and operational waste with the objective of reducing waste throughout the project life. In instances where waste generation is unavoidable, the priority is transportation of waste materials to off-site licensed facilities, subject to further studies on the capacity of these existing facilities. Where this is not possible, the Project proposes to use on-site landfill(s), to be located in previously disturbed Borrow Pit areas. Table 2-4 is an initial waste inventory, with indicative volumes of waste types which would be generated over a four-year construction period.

Table 2-4: Indicative Waste Inventory

Waste Type	Description	Waste Classification and indicative disposal	Indicative Total Volume over 4 years
General Construction waste	Scrap metal from wiring off-cuts, packing straps, steel off-cuts, aluminium off-cuts.	General Solid (inert and non-putrescible). Reclaimed and recycled as scrap metal.	12,000 Metric T
	Broken pallets and timber from packaging and pallets delivered, broken formwork.	General Solid (inert and non-putrescible). Disposed to landfill.	

Waste Type	Description	Waste Classification and indicative disposal	Indicative Total Volume over 4 years
	Plastic and cardboard from wrapping and packaging.	General Solid (inert and non-putrescible). Reclaimed and recycled where possible. Disposed to landfill if not recyclable.	
	Asphalt and bitumen waste.	General Solid waste (inert and non-putrescible). Disposed to landfill.	
	Concrete washout waste.	General Solid (inert and non-putrescible). Disposed to landfill.	
Workshop waste	Generated by the maintenance of equipment including air and oil filters, worn components and rags.	Listed (prescribed) waste. Collection and disposal by a license provider.	72 Metric T
	Oil, grease, fuel, chemicals, and other hydrocarbon contaminated fluids.	Listed (prescribed) waste. Collection and disposal by a license provider.	336 kL
	Lead Batteries.	Listed (prescribed) waste. Collection and disposal by a license provider.	5 Metric T
	Tyres.	Listed (prescribed) waste. Collection and disposal by a license provider.	12 Metric T
	Paint, solvents, and spray cans.	Listed (prescribed) waste Collection and disposal by a license provider.	5 Metric T
Domestic waste	Generated by workers, offices, and Temporary Construction Accommodation.	General solid (inert and non-putrescible). Disposed to landfill.	24 Metric T
Sanitary Waste	Collected from wastewater systems across the project	Treated on site	2 Metric T
Wastewater Treatment Plant sludge	This is the residual sludge waste from the treatment of effluent from all facilities at the Solar Precinct.	Listed (prescribed) waste. Sludge pressed to minimise volume then removed for disposal at a licensed facility.	192 kL

Waste Type	Description	Waste Classification and indicative disposal	Indicative Total Volume over 4 years
Clinical waste	This is waste generated at onsite paramedics	Listed (prescribed) waste. Collection and disposal by a license provider.	2 Metric T
Regulated waste	This includes contaminated soils and listed waste which may be generated and not previously described.	Listed (prescribed) waste. Collection and disposal by a license provider.	48 Metric T

Borrow Pits

Two indicative Borrow Pit locations are proposed approximately 15 ha each external to the Solar Precinct (see Figure 2-5). Borrow Pit footprints will be re-purposed as landfill sites once material is exhausted and if an alternative waste management solution has not been identified. Extraction volume is estimated to be approximately 1.5 Mm³ of crushed rock per Borrow Pit.

Landfill

Two landfill sites are proposed within the disturbed footprints of each 15 ha Borrow Pit footprint. Re-purposing the Borrow Pits once material is exhausted will reduce overall disturbance required for construction activities. Landfill material is anticipated to be predominantly inert, comprised of non-putrescible general waste generated during construction, including timber, steel, cardboard, and scrap metal, which are not able to be reused or recycled.

E-Waste Stream

E-waste, as discussed in this section, relates to the waste generated from the solar farm and covers damaged or non-functioning panels which cannot be repaired, over the life of the project. The approach to the management of e-waste is under development in conjunction with the overall waste management strategy for construction and operations. An outline of the hierarchy of options is provided below:

- Avoidance of waste generation: Reduce cell/module degradation and maximise life span during the solar array design process. The solar industry is currently advancing technology to reduce module degradation rates (indicatively up to 0.15% per annum). Design changes which reduce stress on the solar modules will likely further reduce system wide degradation. Some technology scans modules in the assembly process. Any sub-optimal components are returned to the Original Equipment Manufacturer (OEM) before they are installed.
- Engineering and design: Improvements in technology and manufacturing process may support an economic decision regarding whether the asset should even be replaced during its operational life. In other words, the cost of replacement outweighs the uplift in yield gained from installing new technology.
- Re-use of solar arrays deemed sub-optimal for utility scale generation: As degradation rates are negligible, modules will have decades of operational capacity remaining suitable for a range of applications including micro-grid applications for small scale projects or domestic use.
- Recycling: As of 2021, Australia has six main companies who recycle solar panels and products. Many of the elements in a solar panel can be recycled. While challenging to forecast,

the recycling industry is anticipated to continue growing in the medium term and throughout the life of the Project.

The Project is committed to diverting e-waste from landfill and will further investigate options for disposal of solar panels throughout the life span of the Solar Precinct.

2.3 OHTL Corridor

2.3.1 Location

The Draft EIS proposed approximately 788 km of OHTL from Powell Creek to Murrumujuk within the existing railway corridor. At Livingstone, the OHTL enters the proposed NTG utilities corridor and extends for approximately 66 km to the DCS at Murrumujuk.

Three primary areas of constraint were identified in the Railway Corridor at Katherine, Pine Creek, and Adelaide River. The spatial constraints and/or physical obstructions within the railway corridor at each location are such that the OHTL Corridor is required to exit the railway corridor, deviate proximate to each location, then re-enter the railway corridor and continue north. The Draft EIS identified indicative areas of interest as potentially suitable OHTL Corridor options at each location, subject to further detailed investigations. These are described in the following sections, using Kilometre Points (KP) to identify the locations.

In the SEIS, an OHTL Corridor for the entire length of the OHTL is presented. A preferred route for the OHTL Corridor has been identified, subject to further detailed design and ongoing route refinement. An overview of the OHTL Corridor is shown in Figure 2-2. The preferred route at each constrained location is shown in Figure 2-7 (Katherine), Figure 2-8 (Pine Creek) and Figure 2-9 (Adelaide). The estimated overall length of the OHTL Corridor has reduced slightly to approximately 783 km.

As engineering and design progresses, further refinements of the OHTL Corridor may occur. Any refinement will consider project stakeholders' requirements, environmental and social areas of sensitivity, geotechnical investigations and engineering design, including detailed flood modelling. A Constraints Planning and Field Development Procedure (Appendix 4.1), sacred site clearances and ongoing engagement with project stakeholders will be completed with the aim of firstly avoiding placement of infrastructure in locations which may cause adverse impacts. Where the principle of avoidance is not possible, the Proponent will identify management options to mitigate potential adverse impacts.

2.3.2 Route Selection

The areas of interest presented in the Draft EIS have been reviewed during multiple internal project team workshops where a range of factors were considered. These included constraints mapping layers depicting land access, identified areas of cultural heritage significance, ecology, geology, and flooding potential. A detailed review of NTG's strategic planning policy documents, as well as direct engagement across Government, has also occurred. This has assisted the project team to understand how the OHTL Corridor can co-exist with the strategic land use objectives in each location and ensure the factors underpinning the NTG's policy position are well understood.

Importantly, engagement with impacted landowners has also occurred to ensure that the opportunity for securing appropriate tenure exists.

The alternative route alignments for the OHTL Corridor were reviewed by the project team and deemed 'not preferred' after being assessed against a number of project performance objectives. These alternative locations are discussed in Section 2.8.

2.3.2.1 Katherine

The preferred route of the OHTL Corridor at Katherine is generally adjacent to the existing railway corridor (Figure 2-7). The preferred route begins at approximately KP 453 to facilitate crossing the Victoria Highway before navigating through several parcels of land and crossing the Katherine River. Once on the northern side of the Katherine River, the preferred route is generally aligned with the railway corridor to minimise any potential impacts. The OHTL Corridor re-enters the railway corridor at approximately KP 467.

A combination of spatial constraints in the railway corridor, driven by the need to cross the Victoria Highway, the Katherine River, and the Stuart Highway, are the key factors that necessitated a route re-alignment. The *Katherine Regional Land Use Plan 2014* also identifies a potential heavy vehicle bypass that is generally consistent with the preferred route of the OHTL Corridor. Co-locating this infrastructure has the potential to reduce potential impacts on the wider community while simultaneously offering a legitimate route through Katherine.

The EPA direction also notes potential for PFAS in this area. This is addressed in Chapter 4: TEQ and Chapter 6: Hydrology.

2.3.2.2 Pine Creek

The preferred route of the OHTL Corridor at Pine Creek begins at approximately KP 542 and is generally adjacent to the railway corridor on the eastern side of the Stuart Highway (see Figure 2-8). This alignment extends for approximately 4 km until the route preferences proximity to the railway corridor, crosses the Kakadu Highway, and re-enters the railway corridor at approximately KP 546.

The preferred route prioritises a location proximate to the existing railway corridor to minimise impacts on surrounding land uses and landowners.

In the absence of detailed strategic planning objectives for the Pine Creek region, the preferred route seeks to minimise impacts on future land uses by co-locating with existing linear infrastructure. While the OHTL Corridor is adjacent to the Stuart Highway for a portion of this section, a traffic engineering solution can be developed in consultation with NTG to ensure that the co-location of infrastructure does not undermine the potential future duplication of the highway.

2.3.2.3 Adelaide River

The preferred route of the OHTL Corridor at Adelaide River begins at approximately KP 620 and extends east of the township predominantly through pastoral and rural land. The OHTL re-enters the railway corridor west of Lake Bennett at approximately KP 690.

The preferred route considers the strategic land use objectives identified in the *Coomalie Planning Concepts and Land Use objectives 2000* and the conceptual Murrakai Dam identified in the Land Use Structure in the *Darwin Regional Land Use Plan (DRLUP) 2015*.

The spatial constraints of the existing railway corridor, where the corridor is too narrow and passes urban and other no accessible/suitable areas for the OHTL and other complexities with suitable route and locations to re-enter the railway corridor earlier than KP 690, result in this alternative option being the longest at approximately 65 km.

2.3.2.4 Existing Railway Corridor – Katherine to Lake Bennett

Ongoing route optimisation has indicated that potential variable railway corridor widths exist between Katherine and Lake Bennett. The main factor in the potential for variable widths is inconsistencies between the available mapping cadastre files. This will be subject to ground truthing in Q1 2023.

The variable widths range between approximately 30-60 m. The narrowest corridor widths exist north of Lake Bennett which present engineering complexities however, most of the railway corridor in this section is greater than 50 m wide. Engineering solutions are being considered to offset the spatial constraints in these sections and may result in modified OHTL specifications and construction methodology.

2.3.2.5 NTG Utilities Corridor

At Livingstone, the OHTL Corridor enters the proposed NTG utilities corridor for approximately 66 km until it terminates at the DCS in Murrumujuk. Ongoing discussions with NTG are considering options to optimise the alignment to mitigate potential impacts. One minor route modification is required at approximately KP 745 to avoid a population of *Typhonium taylori* which is listed as endangered under the *EPBC Act*. A proposed option to avoid impacts to the species is for the OHTL to exit the NTG utilities corridor and enter the adjacent NTG's proposed main roads corridor for a distance of approximately 1 km before re-entering the NTG utilities corridor and continuing to the DCS (refer to Chapter 5 for further details).

2.3.3 Footprint

The OHTL footprint requirements are broadly consistent with the specifications proposed in the Draft EIS with minor amendments due to more suitable route alignment, curvature of the OHTL Corridor and a broader understanding of the electrical safety clearance requirements of the OHTL Corridor. The revised OHTL footprints are summarised in Section 2.1, Table 2-2, and Figure 2-5 below.

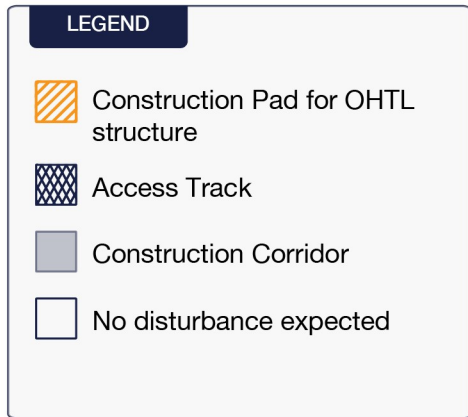
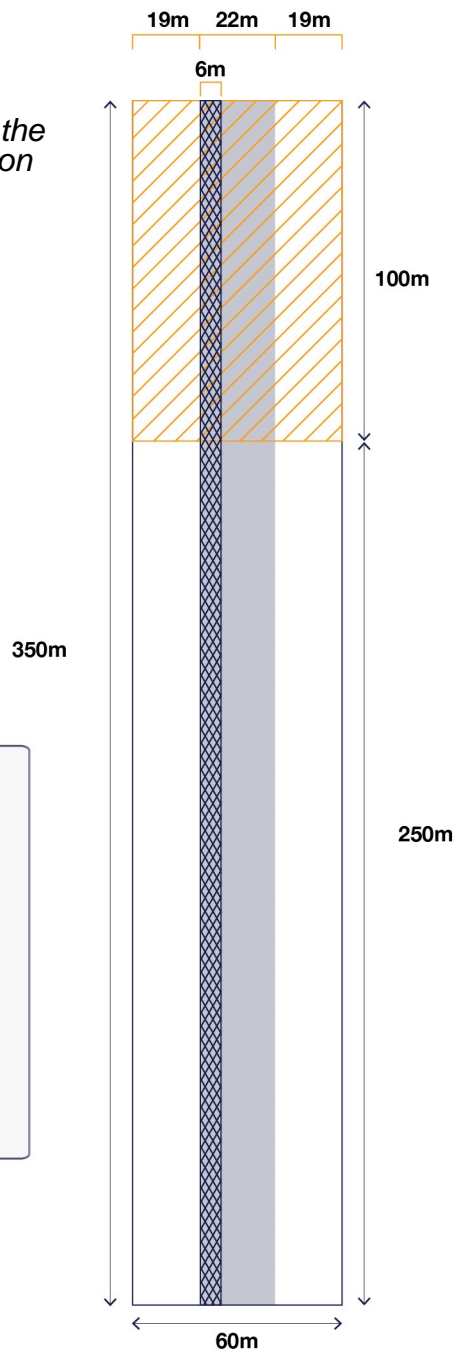
Consistent with the Draft EIS, the OHTL requires a 60 m wide OHTL Corridor (previously called 'OHTL easement') and a temporary construction footprint containing a 22 m wide construction corridor (including an approximately 6 m wide Access Track) with construction pads of 60 m (wide) x 100 m (long) for each OHTL structure (inclusive of poles or lattice towers). OHTL structures will have estimated spans ranging between 200 - 450 m apart. Shorter OHTL spans may be required in areas of higher wind loading, and for constraint areas.

Where variable railway corridor widths are encountered, construction and operational requirements for the OHTL will be modified accordingly and consider the Constraints Planning and Field Development Procedure at Appendix 4.1.

The permanent operations footprint will contain the retained Access Track and structure pad area of 16 m x 16 m for each OHTL structure. The increase in retained structure pad area since the Draft EIS accounts for the potential increase in the height of OHTL structures up to approximately 60 m. The remainder of the construction structure pads will be reinstated with vegetation.

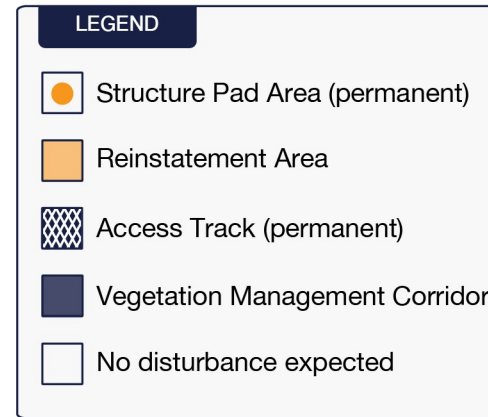
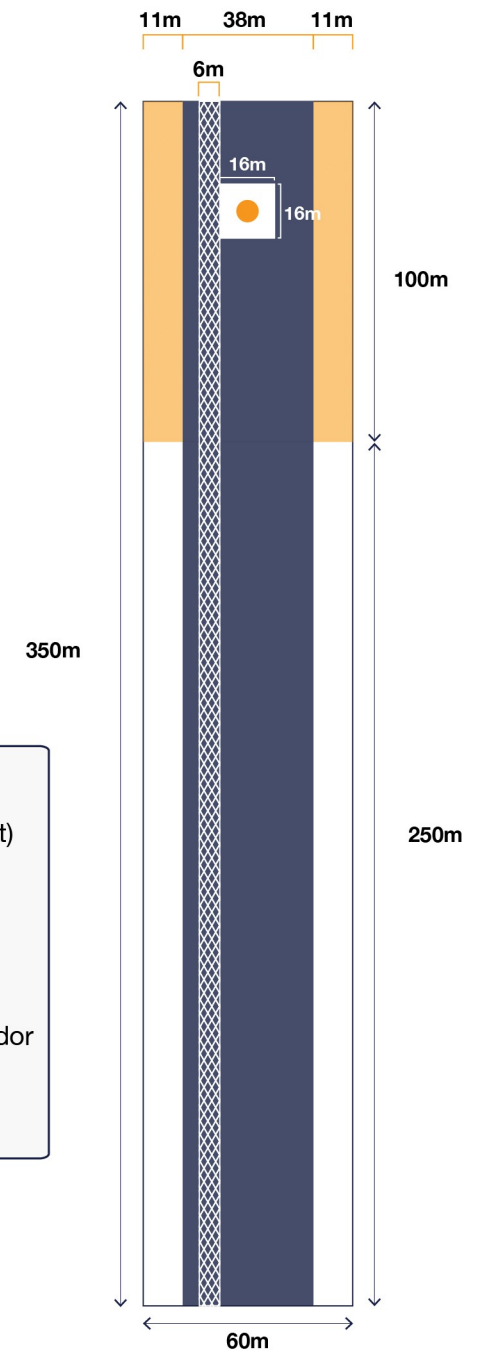
Vegetation management to maintain low vegetation cover (below approximately 6 m in height) within an approximate 38 m wide corridor (or appropriate to OHTL dimensions) will support optimal electrical safety during the operational phase. Further details about the vegetation management requirements are presented in the OHTL Vegetation Management Framework at Appendix 5.4.

Figure 2-5: Typical example of the OHTL construction and operation footprint dimensions and configuration



OHTL Construction Footprint

Conceptual example for one structure and adjoining conductor wires



OHTL Operations / Reinstatement Footprint

Conceptual example for one structure and adjoining conductor wires

2.3.4 Design of Structures

The Draft EIS indicated that the OHTL structure heights would be between 44 m and 56 m. Further OHTL engineering now indicates that in some areas, structure heights may need to be up to 60 m depending on topography, or when adjacent to co-located infrastructure. Design will also take into consideration wind loading when refining the type of structure and height as the OHTL moves north toward Darwin. At this time, it is likely that lattice towers will be the preferred choice for the structures to minimise weight, transport movements, and cost, with steel poles used in areas where lattice towers are not suitable.

Figure 2-6 shows the indicative OHTL structure designs which are being considered at this time.

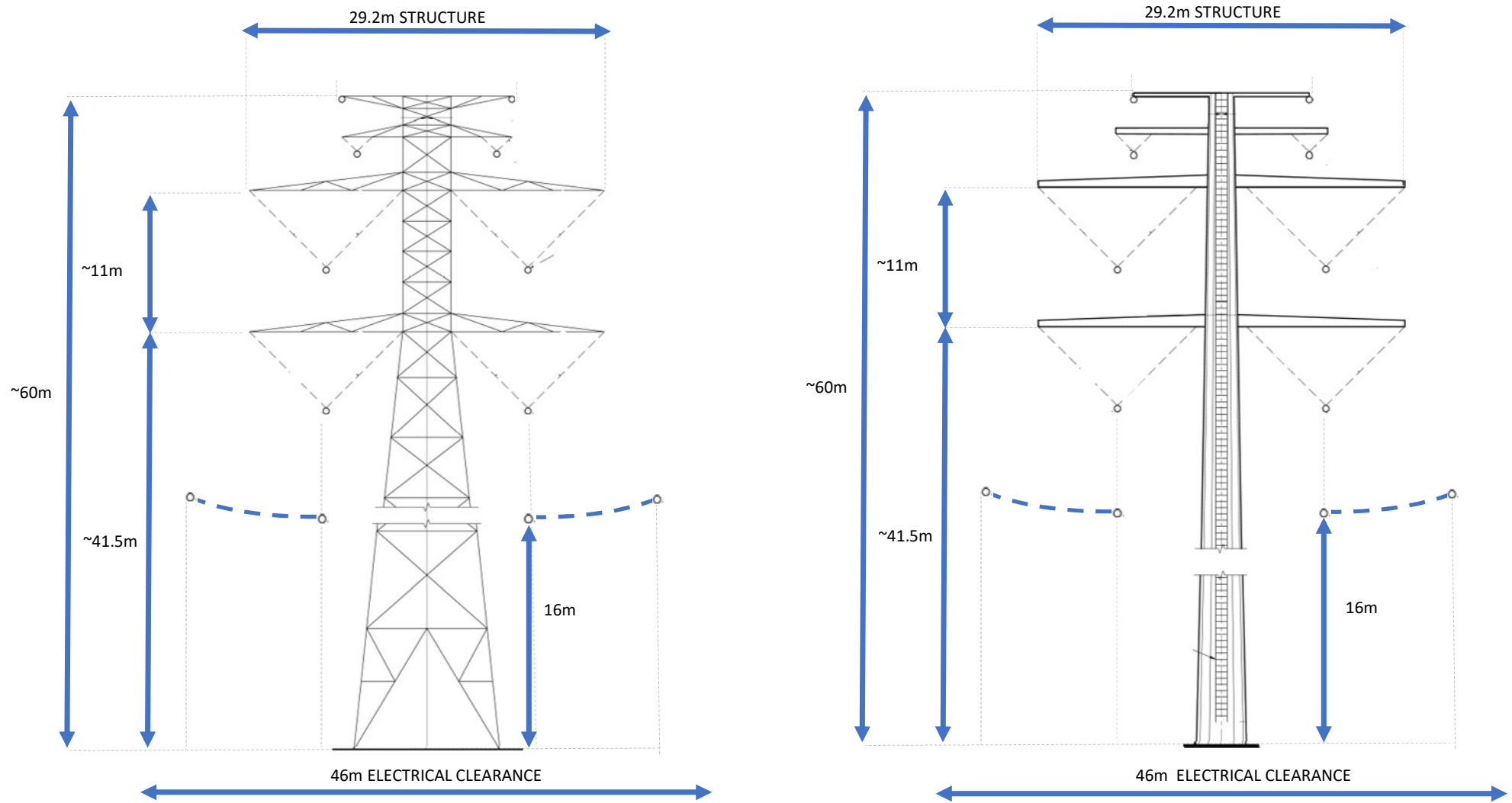


Figure 2-6: Indicative OHTL Structures (Lattice Towers on Left; Steel Monopoles on Right)

Undergrounding of the transmission line was considered during concept development phase. However, it is not being proposed for the Project. Undergrounding requires a trench or series of parallel trenches greater to be installed along the entire length of the OHTL Corridor which involves significant ground disturbance and potentially a larger footprint of impact. Trenches must also be increased in width to allow for benching as excavations become deeper to ensure personnel safety and cannot avoid impacts to riverbanks and riparian zones.

Approximately 783 km of continuous trenching would not allow avoidance of any areas of significance. By opting for overhead transmission there is more flexibility in spanning areas of environmental, cultural and heritage significance by minimising the amount of surface disturbance.

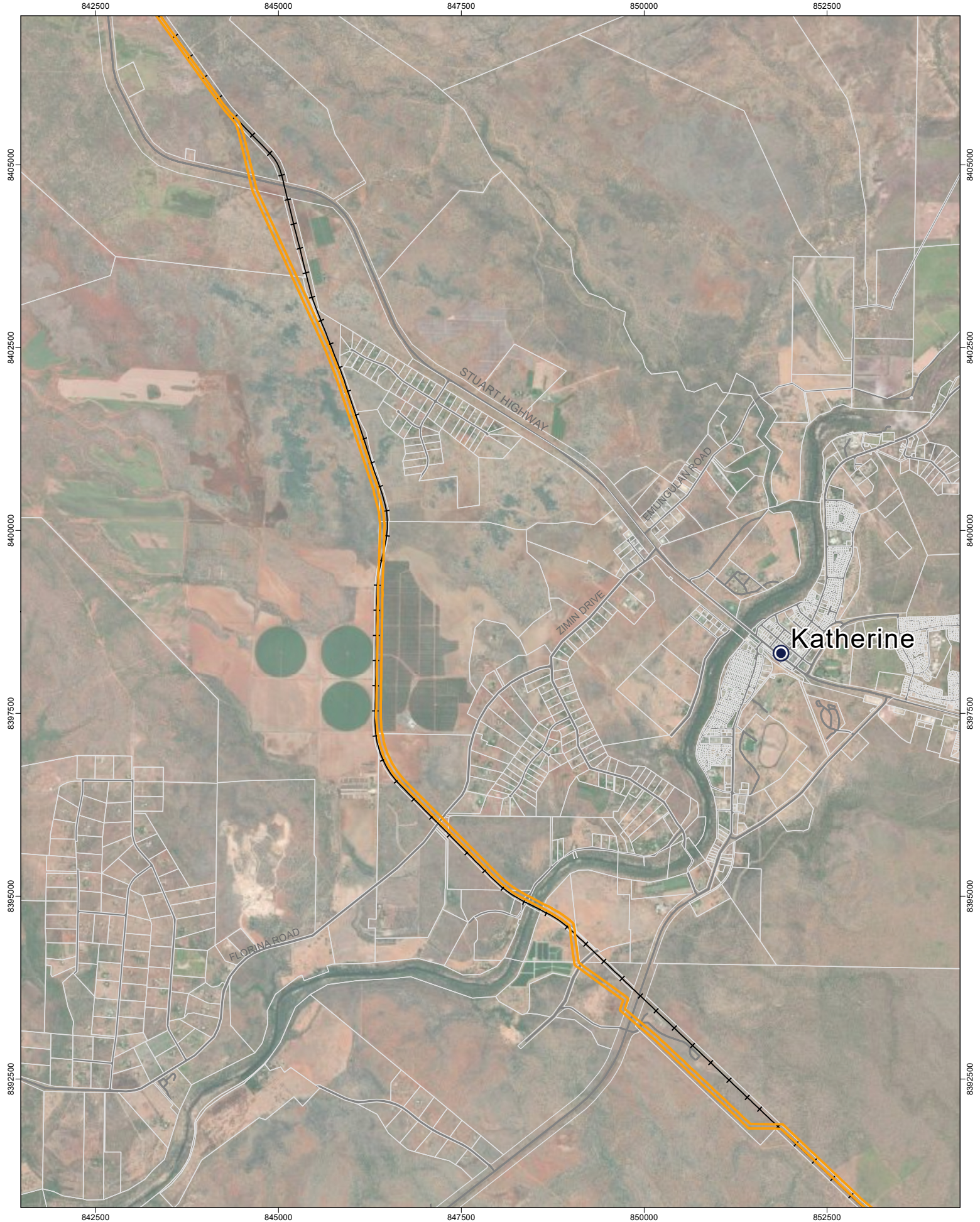
Additionally, buried cables are enclosed, and therefore there is limited heat dissipation due to air flow. This can restrict the power level which can be transmitted by underground cables. No trenching is planned for within the OHTL Corridor. Previously it was considered for the burial of a fibre optic cable however, this will now be strung on the towers, if required.

2.3.5 Construction

The OHTL construction methodology is consistent with the activities outlined in the Draft EIS. Batch Plant volumes and locations are subject to ongoing refinement and OHTL design requirements. Temporary Mobile Construction camp locations for the construction of the OHTL are also being refined and are unknown at this time. The OHTL design and construction methodology, including siting of any Temporary Mobile Construction Camps, are subject to the Environmental Design Criteria and Standards (Appendix 2.1) and Constraints Planning and Field Development Procedure (Appendix 4.1).

2.3.6 Operations

The Draft EIS Sections 2.5.1 and Table 2-2 describe an operational footprint for each structure as 12 m x 6 m. This has been increased to 16 m x 16 m where lattice towers are installed and is used to provide an upper-bound conservative estimate of disturbance in the impact assessments. Groundcover will be planted in some areas and vegetation management in these areas will be important. Safety considerations will define the allowable height of any trees and shrubs in this area. Regular pruning of taller vegetation will be required to ensure that there are no potential interactions with the Transmission System. See Appendix 5.4 OHTL Vegetation Management Framework for additional detail.



Legend

- Existing railway line
- Cadastre
- OHTL preferred route at Katherine

Source: NTG data - Cadastre and conservation areas, Australian Government data - Railway and roads, ESRI - Imagery

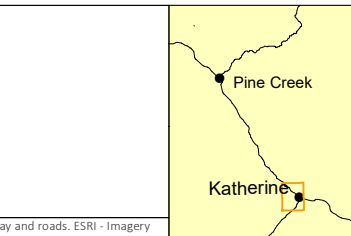


Figure 2-7: OHTL Preferred Route at Katherine

Project: **Australia-Asia PowerLink**

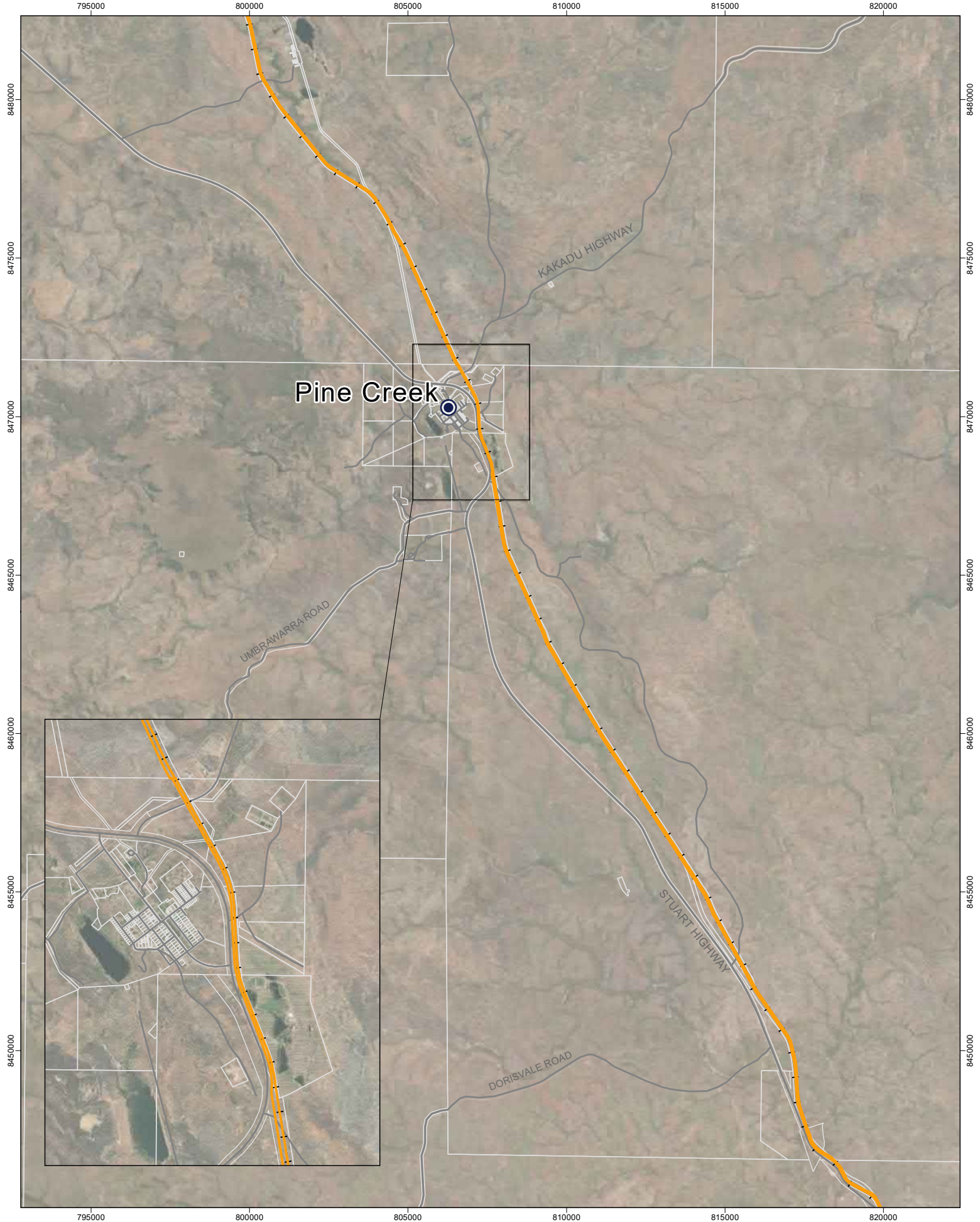
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Date: 10/11/2022 | Figure: 1 of 1 | Revision: A

Scale: 1:65,000 | Datum: GDA2020

Coordinate System: MGA 52 | A4

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Legend

- Existing railway line
- ▭ Cadastre
- ▬ OHTL preferred route at Pine Creek

Source: NTG data - Cadastre and conservation areas, Australian Government data - Railway and roads



Figure 2-8: OHTL Preferred Route at Pine Creek

Project: **Australia-Asia PowerLink**

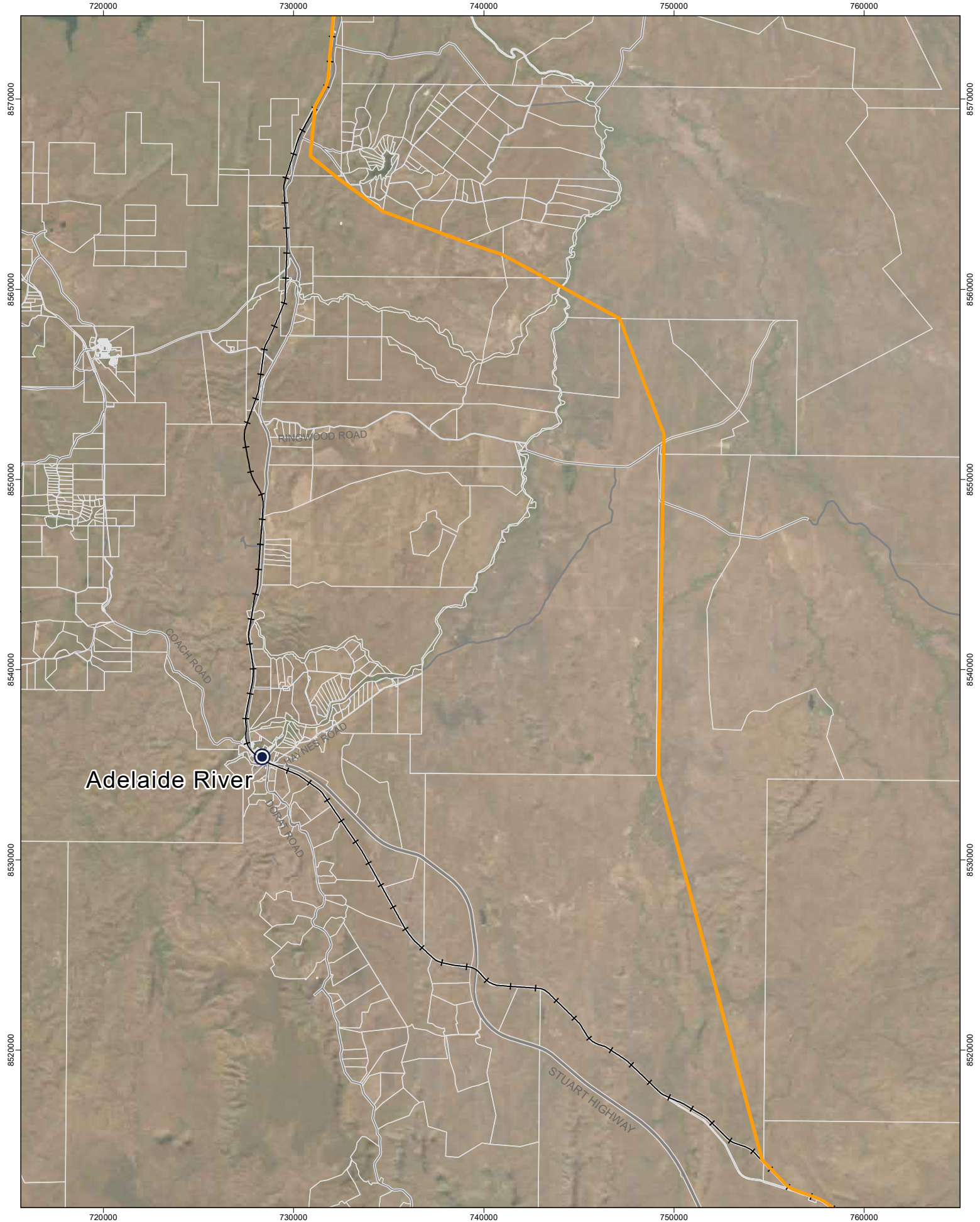
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Date: 10/11/2022 | Figure: 1 of 1 | Revision: A

Scale: 1:150,000 | Datum: GDA2020

Coordinate System: MGA 52 | A4

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Legend

- Existing railway line
- ▭ Cadastre
- ▬ OHTL preferred route at Adelaide River

Source: NTG data - Cadastre and conservation areas, Australian Government data - Railway and roads



Figure 2-9: OHTL Preferred Route at Adelaide River

Project: Australia-Asia PowerLink		Reference #: AAPL_GNR_CTA_GEN_MAP_0369	
		Date: 10/11/2022 Figure: 1 of 1 Revision: A	
Scale: 1:250,000	Datum: GDA2020		
Coordinate System: MGA 52	A4		

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2.3.7 Electrodes

The Draft EIS noted the potential need to install two ground Electrodes as part of the OHTL, since a bipole HVDC system requires a grounded electrical current return path in the event of a fault.

The proposed Electrodes for the Project are considered ‘low duty’ which means they have ‘no requirement for continuous or long-time operation.

Earth Electrodes are an important part of any grounding system. The Electrode provides a zero-volt reference for an electrical system which can be in the ground, on the shoreline, or in the sea. The Electrode is used to dissipate current into the earth’s mass, which can accept excess current during fault mitigation and remain electrically neutral. The ground, if properly selected and designed, has the capacity to accept electrons from a charged object to neutralise that object.

A Ground Electrode is comprised of a metallic grid or rods (or other conductive material), that is buried at a prescribed depth and connected to the electrical infrastructure by ground wire (usually copper wire). The purpose is to connect the HVDC grounding system with the groundmass at a point where the soil offers very low resistivity, thus allowing safe passage of direct current.

Further details related to the Electrode, the site selection process, construction, and operation are included in Appendix 12.1: Land Based Electrode Technical Report.

2.3.7.1 Location and Footprint

One Electrode will be installed to service the Solar Precinct and one will be installed to service the DCS. These are shown in Figure 2-12. The site selection process follows industry best practice and is described in Appendix 12.1: Land Based Electrode Technical Report.

For this Project, a 2 ha area was considered when identifying potential locations for the Electrodes. The selection of the electrode design will determine the disturbance footprint within this area, as a shallow horizontal Electrode will have a greater surface footprint than a deep Electrode. The type of Electrode and material required to construct the Electrodes is dependent on the soil resistivity profile and surrounding infrastructure.

The Electrode north-east of the DCS will be situated in an upper shallow seasonal aquifer, which is unconfined and recharges over the wet season. The Electrode proposed to be constructed to the west of the Solar Precinct has a contrasting geological profile and is unlikely to have saline groundwater profile. These factors can influence the efficiency at which the Electrode dissipates current.

The Electrode’s elements are likely to be configured in a ring (see Figure 2-10) as this provides optimal current distribution.

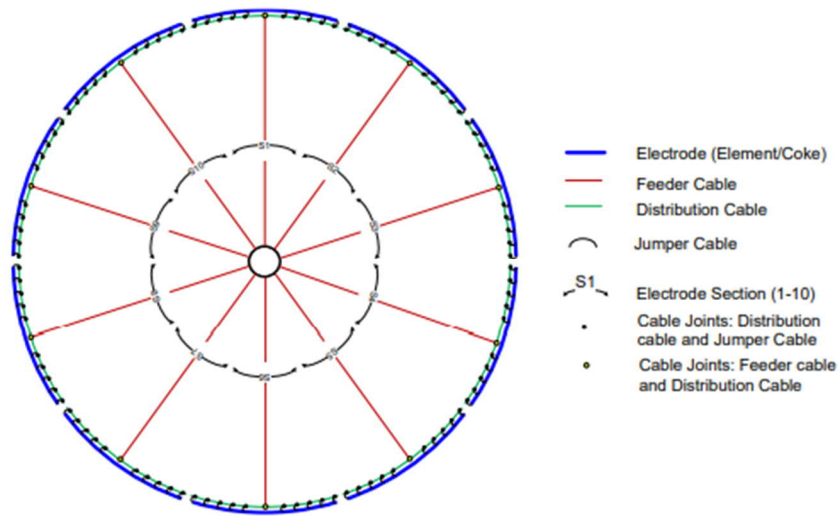
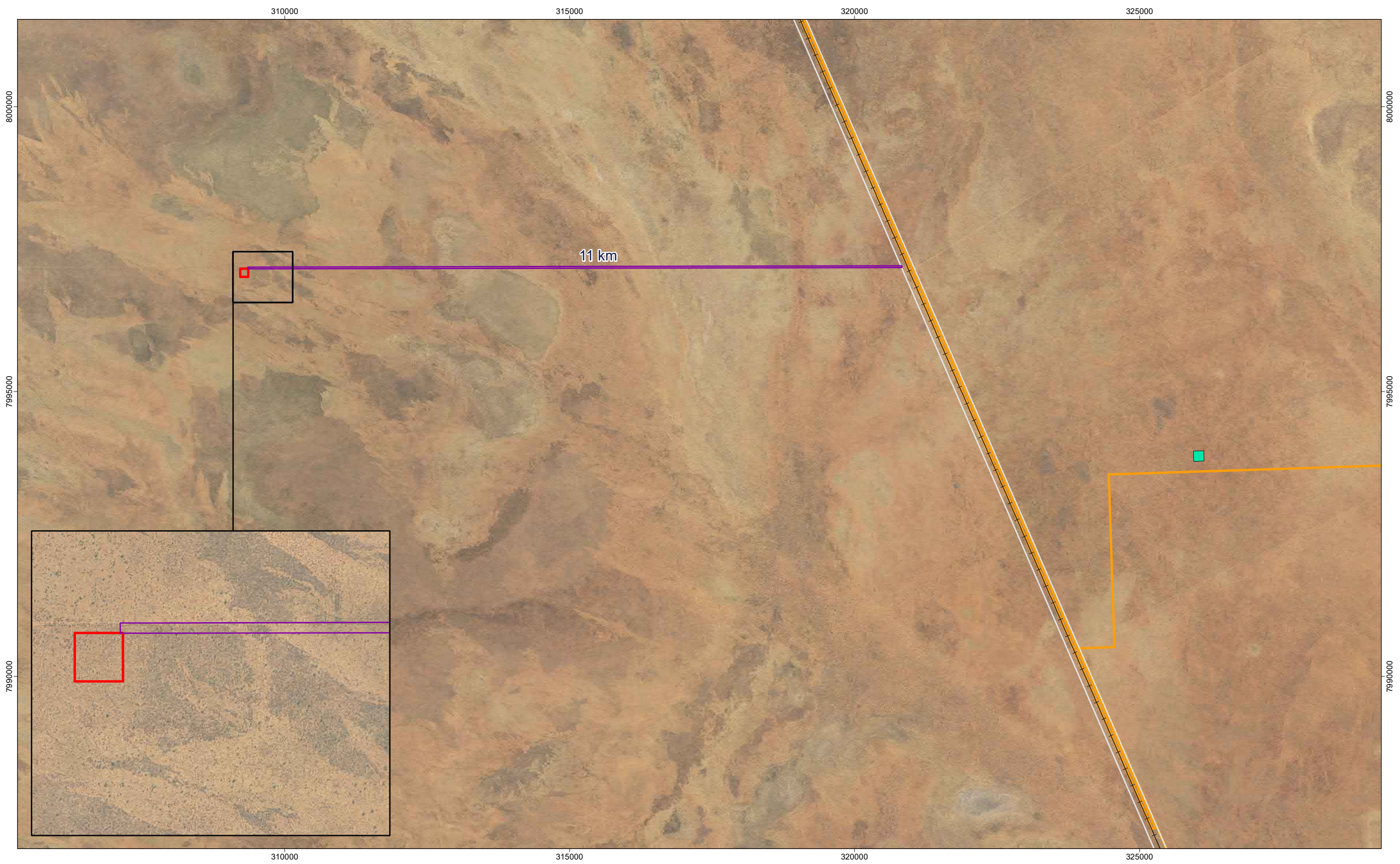


Figure 2-10: Shallow Electrode general arrangement.



11 km

Legend







-  OHTL Corridor
-  Railway Line
-  HVDC Electrode Line Corridor
-  Powell Creek Electrode
-  Ancillary Infrastructure
-  Solar Precinct



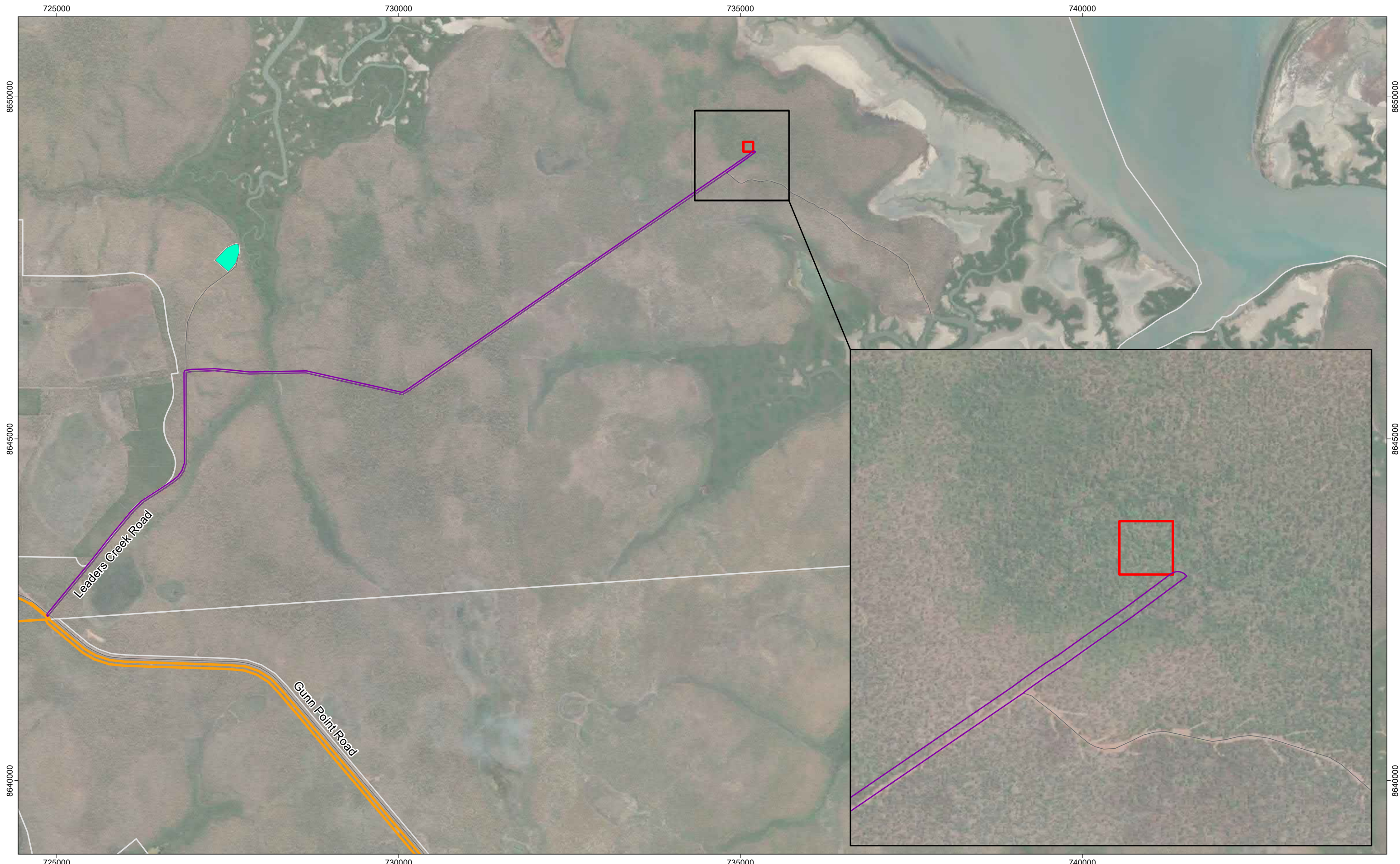
Figure 2-11: Powell Creek Electrode

Project: Australia-Asia PowerLink	Reference #: AAPL_GNR_CTA_GEN_MAP_0296	Figure: 1 of 1	Revision: A
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Coordinate System: MGA Zone 53	Datum: GDA2020	Date: 06/11/2022	
		Scale: 1:60,000	

Source:
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Legend

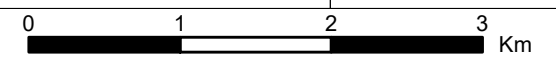
- Road
- Cadastre
- HVDC Electrode Line Corridor
- Darwin Converter Site Electrode
- AALink Infrastructure
- Leaders Creek Fishing Base



Figure 2-12: Darwin Converter Site Electrode

Project: Australia-Asia PowerLink	Reference #: AAPL_GNR_CTA_GEN_MAP_0297	Figure: 1 of 1	Revision: A
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Coordinate System: MGA Zone 52	Datum: GDA2020	Date: 06/11/2022	
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Scale: 1:50,000



Source: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
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2.3.7.2 Key Components

2.3.7.3 Materials

The materials used for HVDC Electrodes are a combination of the following and are dependent on the type and design of the Electrode, and the resistivity of the surrounding soil:

- Silicon-iron/high silicon iron alloys
- Electrode (SiCrFe) (high resistance to corrosion, but brittle)
- Steel or mild steel
- Copper
- Titanium
- Coated mesh electrodes or graphite (not commonly used because of low mechanical strength) electrode.

All land Electrodes are surrounded by coke¹ to ensure good contact to soil.

2.3.7.4 HVDC Electrode Line

Each Electrode is connected to the converter site through a distribution line known as a HVDC Electrode Line. The function of the HVDC Electrode Line is to provide a low resistance connection between the converter site and the ground Electrode.

This will be designed in accordance with AS7000: 2016 Overhead line design and is comparable in scale, height and appearance to conventional overhead distribution lines and poles. The height of these poles is approximately 12 m. An Access Track will follow the length of the HVDC Electrode Line. The HVDC Electrode Line and Access Track will be sited within a 30 m wide corridor (HVDC Electrode Line Corridor), with an estimated 10 m wide disturbance footprint.

For the Powell Creek Electrode, there are no existing tracks or roads to the location, and a new access will be installed

For the DCS Electrode, design will consider the best pathway and will aim to make use of an easement adjacent to the existing public gravel road. Following this alignment provides access to assist with the construction effort and simultaneously reduce the environmental impacts by limiting vegetation clearing.

2.3.7.5 Construction

The type of Electrode and material required to construct the Electrodes is dependent on the soil resistivity profile. The types of ground Electrodes which are currently being considered for design are listed in Table 2-5.

¹ A porous fuel generated by heating certain grades of coal in anaerobic conditions, typically used as a raw material in the production of steel.

Table 2-5: Type of Electrode Construction under Consideration

Type of Electrode Construction	Description
Shallow Horizontal Electrode	Buried in shallow trenches. Consists of a coke filled ground bed surrounding the element. Multiple configurations for these types of electrodes including linear, circular, or irregularly shaped to best fit the available area. Cover a large footprint impacting cost and may be difficult to acquire land.
Vertical Electrode	Buried to depths of up to 200 m to reach a layer of low resistivity and higher moisture content than surface. Constructed in wells and backfilled with coke or a mixture of graphite and bitumen.
Deep Well Electrode	Buried at depths of up to 1 km to reach a layer of lower resistivity. Petroleum coke is used to provide the electrical interface between the metallic elements and the soil.

Soil resistivity testing is being completed in Quarter 4 2022, and this will provide the basis for the initial design of the two Electrodes. The design of the two Electrodes is expected to be completed by Quarter 1 2023.

Trenching and the use of heavy equipment including an excavator is required to construct the Electrode.

2.3.7.6 Operation

The Electrodes installed as a part of this system are intended to be utilised in fault or outage situations and are not operated continuously. Industry wide, electrodes are noted to be in operation for 20 hours in a year to less than 500 hours a year. A survey of electrode operators indicated that the earth return operating time for a bipolar system was less than 3% and almost entirely related to controlled maintenance periods (HVDC Ground Electrode Overview, 2010.)

In a planned outage, which is used to complete routine maintenance once a year, the Electrode is likely to be used for one to two hours to transition the system. The system will be designed to have high reliability with approximately 98.5% system availability at the converter station required to meet this reliability target.

Given the design reliability target, the incidence of unplanned outages (and the resulting Electrode utilisation) should be low. The system designers indicate that if the system is affected by a fault, the Electrode may be in use for up to 48 hours or the time needed to repair the fault. However, general operating practice dictates that after six hours, the system is typically reconfigured from electrode-return to using the other pole as a metallic return if the fault was not on the OHTL.

Earthing and cathodic protection of infrastructure in, and in close proximity, mitigates EMI, which has been noted as a concern and has potential to cause corrosion when in constant operation over a long period. An effective cathodic protection system on adjacent infrastructure is required as a primary measure to control associated corrosion. This will ensure that potential corrosion risks are managed. It has been noted that cathodic protection on major, long distance gas transmission (energy pipelines) is a mandatory requirement under Australian Standard (AS/NZS) 2885.

Design of the transmission system also considers the potential for interference and aims to avoid any effects by ensuring that the OHTL and Electrode are not installed parallel to any existing infrastructure. This is expected to reduce any residual effect by being installed at a right angle to any identified existing infrastructure.

2.4 DCS

The DCS covering approximately 124 ha remains unchanged, with approximately 60 ha in the direct disturbance footprint. The revised indicative layout of the internal infrastructure is presented in Figure 2-3.

2.5 Cable Transition Facilities

The Cable Transition Facilities include the Underground Cable Corridor, the Land Sea Joint Station, and the Shore Crossing Site. The footprint and construction methodology for these facilities is generally consistent with the Draft EIS.

No Horizontal Directional Drilling (HDD) is proposed for any project activities during construction or operations. Alternative sites were considered for the Cable Transition Facilities; however, the proposed location is preferred for the following reasons:

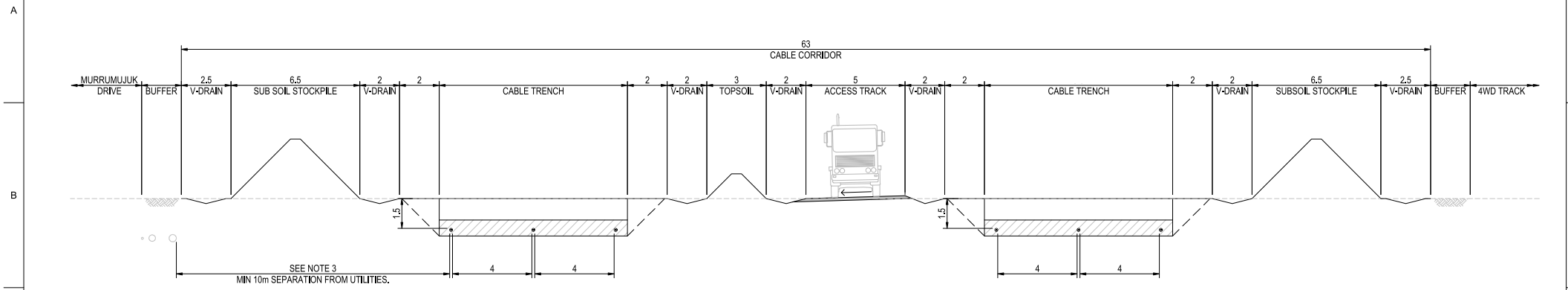
- HDD is not considered necessary and will likely result in increased construction timeframes and is a higher risk activity. There are also engineering challenges with using HDD in an area with sandy, looser material. Lubricants such as bentonite and other substances used for HDD are hard to contain, especially within loose sandy material and often result in unavoidable release to the immediate surrounding environment. Construction activities during the wet season are not preferred however, accurate scheduling is subject to detailed design and supply chain constraints. Should construction occur during the wet season, the Project will manage the potential impacts through implementation of plans and strategies in accordance with applicable regulations and legislation.
- Buffers to sensitive and significant habitat outlined by the NT Land Clearing Guidelines will be considered during all construction and maintenance activities. The site layout of the DCS and Underground Cable Corridor route has been optimised to increase the distance and isolate the seasonal swamp in the south-west portion of the site. The width of the Underground Cable Corridor has also been subsequently reduced from 70 m to approximately 63 m (See Figure 2-3). Specific mitigation and management measures during construction are outlined in Chapter 16.
- Public access to the Tree Point Family Outstation – Durdugu and Tree Point Conservation Area and Gunn Point Beach will be retained through the construction and operational phases of the Project. Alternate access will be maintained at all times if fencing of trenches and work areas is required during construction. No fencing during the operational phase of the Cable Transition Facilities' footprint is proposed. Re-instatement of disturbed areas within this footprint will be consistent with pre-development conditions, subject to detailed design.
- Alternative sites considered for the Cable Transition Facilities include the original location in Middle Arm as well as land proximate to the Murrumujuk site (see Alternatives Assessment Table 2-7).

2.5.1 Underground Cable Corridor

The previous minimum lateral spacing between underground cables in the Underground Cable Corridor was identified to be 2 m apart. Further design and planning have noted that the lateral spacing between cables will be approximately 4 m apart. This may require each cable trench width

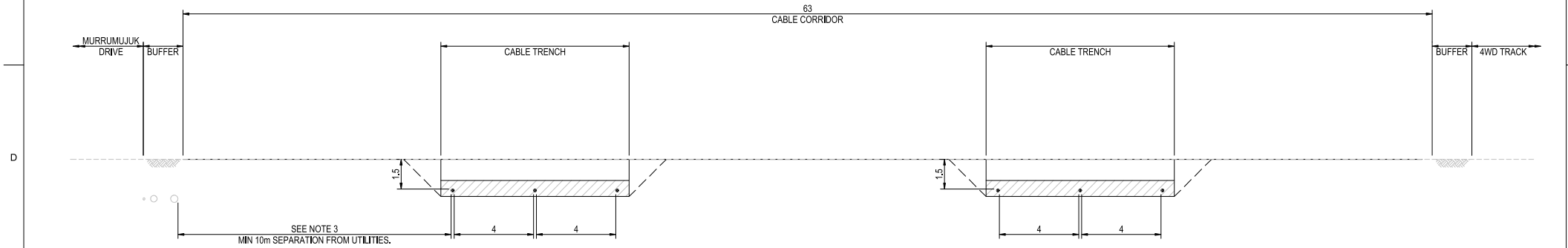
to increase from 4 m wide to approximately 13.5 m wide. Cable burial depth will be between 1.5 – 2 m.

The total Underground Cable Corridor will be reduced to approximately 63 m wide from the 70 m wide corridor originally designated in Table 2-2 and Section 2.7.1 (Chapter 2) of the Draft EIS. Typical cross sections for construction and operation are shown in Figure 2-13 and Figure 2-14.



TYPICAL SECTION - HVDC UNDERGROUND CABLE CORRIDOR (CONSTRUCTION)
 SCALE 1:100

Figure 2-13 Typical Section - HVDC Underground Cable Corridor (Construction)



TYPICAL SECTION - HVDC UNDERGROUND CABLE CORRIDOR (POST CONSTRUCTION)
 SCALE 1:100

Figure 2-14 Typical Section - HVDC Underground Cable Corridor (Operations)

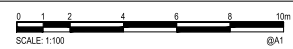
NOTES

- CONCEPT DRAWING ONLY. LAYOUT OF INFRASTRUCTURE AND SPACING SUBJECT TO CHANGE DURING DETAILED DESIGN.
- DRAWINGS OF INFRASTRUCTURE ARE INDICATIVE ONLY.
- MINIMUM 10m SEPARATION DISTANCE BETWEEN HVDC CABLE AND ADJACENT UTILITIES TO MAINTAIN THERMAL INDEPENDENCE.

Concept - For Discussion Only

PRELIMINARY

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AAPOWERLINK
 HVDC UNDERGROUND CABLE
 SKETCH
 TYPICAL SECTION - CORRIDOR

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REFERENCE DRAWINGS										
REVISIONS										

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2.5.2 Shore Crossing Site

Alternate methods to lay the cables within the Land Sea Joint Station have been investigated by the engineering team to minimise nearshore impacts, as described in Section 2.7.3 (Chapter 2) of the Draft EIS.

There is a focus on reducing trench opening time and the associated potential for erosion and sediment impacts. Each trench will be approximately 2 m deep and is only expected to be exposed for approximately one week, subject to treatment of any Penitential Acid Sulphate Soils (PASS) presence. Methodology for installations will be dependent on construction planning and availability of required resources. Final decisions on cable installation methods will be confirmed during detailed design.

The duration of cable installation activities at the shore crossing site will be approximately 10 - 12 weeks for three cables and fibre optic during optimal construction conditions (favourable tides and weather, absence of PASS etc.) If poles are not installed consecutively during one disturbance period, construction timeframes would reduce. For example, if only one pole plus fibre optic were installed initially construction timeframes may reduce to approximately four to six weeks. A second construction effort would be re-scheduled of an equivalent timeframe when pole 2 is installed.

Should PASS be encountered, mitigation measures will be taken to ensure any disturbed areas are properly managed. This may involve disposing of contaminated material to a licensed facility and the subsequent sourcing and use of clean fill to backfill the excavated trench. Construction timeframes may subsequently increase beyond the 10 - 12 weeks depending on extent of any PASS encountered.

Cable depth at the Land Sea Joint Station will be between 1.5 – 2 m consistent with the Underground Cable Corridor and Shore crossing depths. There is no intent or need to fence any infrastructure from the boundary of the DCS to the low water mark in Shoal Bay, including the Land Sea Joint Station once construction is complete.

2.6 Subsea Cable System

The Subsea Cable System is not expected to produce any harmful chemical products during construction or operations. Subsea cable technology is well understood, and each cable includes multiple layers of insulation and protection to ensure adequate corrosion resistance. Potential impacts associated with the installation and construction phase of the Subsea Cable System are discussed in Chapters 8 and 9.

2.6.1 Subsea Cable System Route

In Section 2.8.2 (Chapter 2) of the Draft EIS, two route options were presented and assessed, route A and route B. Further investigations have selected route B (southern route) as the preferred Subsea Cable System alignment, subject to detailed design. A map of the Route B alignment is presented in Figure 2-4.

A minor realignment of Route B was undertaken to allow for increased spacing of bends where the cable system crosses the Santos pipeline and Vocus fibre optic cable. At this time, there is no change in corridor width or disturbance footprint due to this realignment.

2.6.2 Construction

Further details around cable laying procedures and options being considered are provided below.

Pole 1 cable and MER cable will be laid at the same time from the same subsea cable laying vessel. There are two options for the timing of Pole 2 cable laying. The first scenario involves only one subsea cable laying vessel, whereby Pole 2 cable is laid two to three years after Pole 1 and MER. The second scenario involves two subsea cable laying vessels, whereby there may be a shorter interval between laying as two vessels can lay cables at the same time. This allows the Project to specify the timing interval for laying if required. Both scenarios are dependent on procurement procedures, cable manufacturing contracts and scheduling priorities.

Fibre optic cable will be internally bundled into the subsea cables (no visual or physical impact) for 150 km from NT shoreline. This allows for nearshore fault detection.

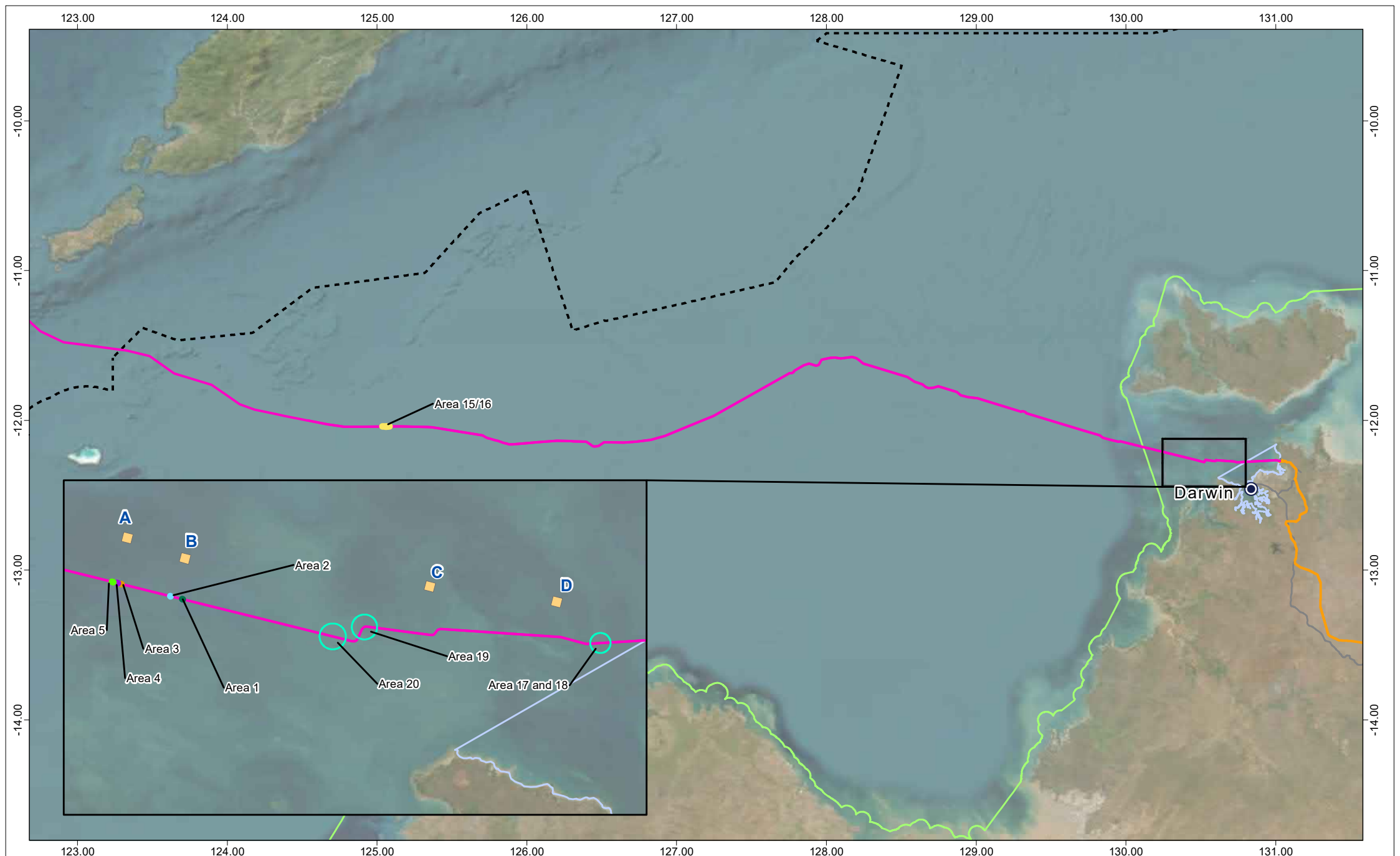
To bury the Subsea Cable System along areas of soft sand sediments, a trenching tool may be used. The trencher can only be operated on slopes that do not exceed 12 to 15°. If seabed irregularities exist such as sandwaves, they will need to be pre-swept during pre-installation clearing works. This is because sand waves tend to be mobile, and their peaks and troughs move with time. Where unstable sandwaves occur, it is therefore necessary to remove the tops from the sand waves and expose a stable area of seabed for cable laying.

Select sandwave locations along the Subsea Cable System alignment may require removal to facilitate cable installation. Where the subsea cable corridor allows for individual cables to navigate around sandwaves, the constraint will be avoided. If the sandwave area cannot be avoided, the height of the non-mobile layer will be identified to inform whether the preferred cable installation method of the mass flow-excavator can be used. Where the non-mobile layer exceeds the mass flow-excavator capacity, dredging will be required.

When the hopper of the dredging vessel is full, it will travel to a nominated spoil disposal ground and release the material while moving slowly forward. Given that the sediments in the sandwave areas are sandy, most of the spoil is expected to settle to the seabed below the point of discharge and little turbidity is anticipated. Subsequent sediment operations would follow a different vessel path to spread the spoil over the disposal ground.

Figure 2-15 shows the locations of currently identified sandwaves requiring removal and potential spoil disposal grounds within the NT's Coastal Waters. Detailed sandwave removal locations will be subject to further pre-construction surveys to confirm sandwave extent and the height of the non-mobile layer prior to cable installation. Final spoil ground locations, as well as spoil ground locations within the CWTH Marine Area beyond the NT's Coastal Waters will be confirmed in consultation with the NT EPA and DCCEEW, as relevant, prior to Subsea Cable System installation activities commencing.

Assessment of potential impacts in the marine environment from Subsea Cable System activities within the zone of influence are discussed in Chapters 8 and 9 and Appendix 8.3.



Legend

Subsea Cable System	Darwin harbour boundary	Sandwave
Land Based AAPowerlink Infrastructure	Potential Spoil Disposal Grounds	Area 1
Commonwealth Marine Area	Sandwave Area	Area 4
Coastal Waters (State and Northern Territory Powers) Act 1980		Area 2
		Area 3
		Area 15 / 16



Figure 2-15: Subsea Cable System - Sandwave Areas and Potential Spoil Disposal Grounds

Project: Australia-Asia PowerLink	Reference #: AAPL_GNR_CTA_GEN_MAP_0345	Figure: 1 of 1	Revision: A
Coordinate System: GDA 2020	Datum: GDA 2020	Date: 02/11/2022	
		Scale: 1:3,500,000	A4

Source: NTG data - Cadastre and roads. Imagery: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
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2.6.3 Operation

Minor sediment removal may be required to be undertaken during the operation of the Project to rectify service faults. However, the quantities of sediment and methods of sediment removal and disposal which would be required are unlikely to trigger consideration of the NAGD (CWTH of Australia, 2009) or the Guidelines for the Environmental Assessment of Marine Dredging in the NT (NT EPA, 2013).

2.7 Construction and Workforce

Section 2.10 of the Draft EIS describes the construction schedule and associated workforce. At this time there are no significant changes to this information.

The main road authority for the land proximate to the utilities corridor is either NTG or Litchfield Council. The Project will develop detailed Traffic Impact Assessments (TIA) to inform Construction Traffic Management Plans for specific project sites in accordance with the relevant standards and guidelines. Consultation with the relevant road authorities and project stakeholders will be undertaken when the scope and schedule of specific project sites is more progressed.

No Temporary Construction Accommodation is proposed along the NTG utilities corridor or at the DCS.

2.8 Alternative Analysis Summary

Throughout this chapter, there has been a discussion of various alternatives considered for this Project. A qualitative assessment approach to rank attributes of each alternative according to selected performance objectives was undertaken; performance objectives and their ratings are defined in Table 2-6. The results of the alternatives assessment when considered against environmental, social, technical, and economic attributes are summarised in Table 2-7. Figures showing alternative locations for key work areas are provided in Figure 2-16 to Figure 2-21, located after Table 2-7.

Table 2-6: Ranking Matrix and Performance Objectives

Performance Objective Attribute Categories	
Environmental and Social Performance Objectives	
Preferred	Alternative has the least adverse effect(s) without mitigation when compared to other alternatives; may also provide positive benefits.
Acceptable	Acceptable alternative: adverse effect addressed with mitigation.
Challenging	Alternative has significant adverse effects, and there are technical, financial, or other barriers to mitigation.
Unfeasible	Unacceptable adverse effects that could not be reasonably mitigated.
Technical Performance Objectives	
Preferred	Alternative option is most likely to be effective to implement, with the lowest risk and contingencies (mitigation) in place to address risks.
Acceptable	Implementation of alternative likely to be effective, with contingencies to address risks.

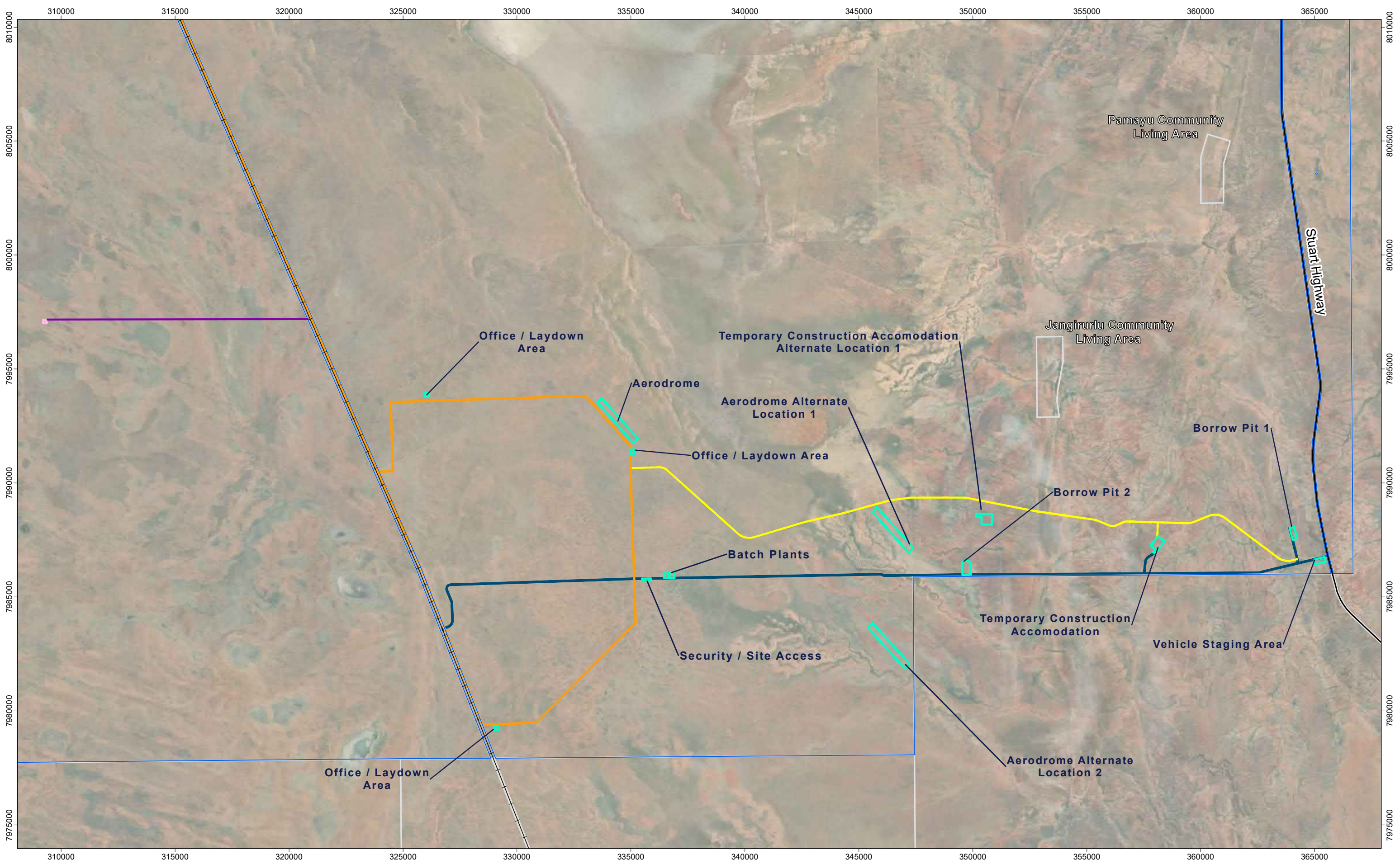
Performance Objective Attribute Categories	
Challenging	Significant barriers to implement, or to reduce risk to acceptable levels, even with contingencies.
Unfeasible	Unacceptable risk, even with contingencies, or alternative is unfeasible to implement.
Economic Performance Objectives	
Preferred	Lowest cost option or gives the best return on investment.
Acceptable	Reasonable cost or gives an acceptable return on investment.
Challenging	High costs, leading to budgetary issues.
Unfeasible	Not economically viable under project budgets.

Table 2-7: Alternatives Analysis

Alternative	Attribute rating against performance objectives				Overall Rating
	Environmental	Social	Technical	Economic	
Solar Precinct – AI inside the Solar Precinct	Included within the current designated footprint. Consolidated impact in the gazetted area. Multiple temporary disturbances associated with construction infrastructure needing to be moved as land is cleared (increased construction waste).	Dust and noise generated in the area immediately adjacent to AI. Reduced amenity for construction workforce may negatively impact worker retention.	Significant design constraints on the arrangement of the solar arrays. A review of solar panel technology indicates full area of the Solar Precinct may be required for panel installation and associated electrical infrastructure. No separation distances allowable. Regular moving of AI due to moving construction work front.	Challenges to schedule and cost for construction due to requirement for regular moving AI out of the construction work zone. Tenure obtained for gazetted area.	Unfeasible
	Acceptable	Acceptable	Unfeasible	Challenging	
Solar Precinct – AI outside the Solar Precinct	Additional disturbance footprint outside existing gazetted area. Increased creek crossings required for Access Tracks to Temporary Construction Accommodation. Single, permanent location of Batch Plant and other construction infrastructure (reduced construction waste).	Reduced noise and dust from construction works due to lower density of activity. Improved worker conditions at Temporary Construction Accommodation's facilities as located further from construction site. Increased amenity for construction workforce. Additional engagement with relevant stakeholders.	Allows for improved design for the Solar Precinct. Safe layout for AI as less constrained by construction. Improved accessibility during construction and operation.	Closer to Aerodrome limiting worker travel time once on site. Located outside the gazetted area. Schedule and cost associated with one set of construction for temporary AI.	Preferred
	Acceptable	Acceptable	Preferred	Preferred	
Solar Precinct – two Access Roads	Increased number of creek crossings required by Access Tracks. Increased disturbance footprint (noting existing tracks are followed where possible to reduce clearance requirements). Reduced intensity of vehicle movements on each road so reduction in the dust emissions from a single road.	Alternative means of exit for construction workers and emergency vehicles if the road is blocked or becomes unusable following a heavy rainfall event.	Upgrading existing tracks to allow for increased all weather access. Allows for heavy use during construction without damaging the final operational road. Provides additional access to the site. Allows better access to AI. All weather road can be installed early to facilitate site preparation for construction.	Increased cost to install and maintain two roads. Decreased schedule risk due to increased capacity for material delivery to site.	Preferred
	Acceptable	Preferred	Preferred	Acceptable	
Solar Precinct – Singular Access Road	Reduced area of disturbance Reduced number of creek crossings required. Increased intensity of vehicle movements on each road resulting in higher dust and noise emissions from the road.	Increased risk of isolating workers onsite or at the Temporary Construction Accommodation if the road is blocked or becomes unusable following a heavy rainfall event.	Constrained access to site if the main road is obstructed. Installation required prior to construction to facilitate construction. Increased wear on road surface due to volumes of heavy vehicles moving across the road during construction.	Increase in cost to maintain and repair the road during construction. Increased dilapidation potential. Risk to schedule from road capacity for material movement to site via road access.	Challenging
	Acceptable	Challenging	Challenging	Challenging	
Solar Precinct – Aerodrome location Elliott airstrip	Increased GHG emissions from using a combination of transport from main cities, using existing facilities and road transport to access site for the construction work crew. Additional surface disturbance required for upgrades of existing facilities. Proximity to Lake Woods increasing probability of bird strikes and interactions with protected fauna.	Increased pressure on regional airports and airstrip facilities in the surrounding areas. Increased movement and traffic through populated centres. Increased noise impact affecting populated centres for existing facilities. Increased travel time for workers to access site.	Will require multiple sites for workforce to access the site. Requires expansion of existing facilities resulting in increase safety risk to current operations due to size. Potential need to change designation under CASA. Increased wear and tear on public roads.	Additional time and cost to transport workforce to site. Up to one to two days travel to access the site depending on commercial flight schedule. Risk in the event of flight cancellations by commercial airlines.	Unfeasible
	Challenging	Unfeasible	Unfeasible	Unfeasible	
Solar Precinct – Aerodrome selected site	Placement outside of Lake Woods flood extent. Surface disturbance required but can be sited to reduce environmental impacts as not restricted to expanding existing infrastructure. Lower GHG emissions as only one form of transport required (air travel) and reduced requirement for bus travel from surrounding towns. Greater distance to Lake Woods reduces the risk of bird strike and interaction with protected fauna.	Surface disturbance required but can be sited to reduce impacts to culturally significant sites as not restricted to expanding existing infrastructure. Does not put pressure on existing infrastructure. Decreased movement and traffic through populated centres. No noise impact to Elliott township from increased air and vehicle traffic. Reduced travel time for workers when flying to site.	Glint and Glare Study completed on multiple locations to confirm location and safety considerations. Increased emergency access to site, including for emergency services for use by surrounding land holders.	Reduces schedule and cost associated with transporting workforce to site.	Preferred
	Preferred	Preferred	Preferred	Preferred	
Solar Precinct – Solar panels to Landfill	Increased volume of e-waste to landfill. Valuable metals lost from the supply chain. Limited access to landfill facilities.	Increased pressure on landfill facilities in the NT.	Solar panels need to be transferred to a disposal site. Shortened life span due to focus on removal and replacement rather than repair and reuse.	Removal, haulage, and disposal cost to consider. Purchasing additional panels.	Challenging
	Challenging	Challenging	Challenging	Challenging	

Alternative	Attribute rating against performance objectives				Overall Rating
	Environmental	Social	Technical	Economic	
Solar Precinct – Diverting Solar Panels from Landfill	Decreased volume of e-waste to landfill. Consideration of circular economy elements. Provision of materials for secondary production. Reduced project footprint.	Potential for recycling panels to generate social benefits such as jobs or provision of power to communities.	Aim to extend lifespan of panels where possible. Further studies may improve technology of solar panels and of recycling and reuse of materials.	Increased cost to Project, further studies to be completed to quantify cost of this option.	Preferred
	Preferred	Preferred	Preferred	Acceptable	
OHTL – Adelaide River Rail Corridor	Traverses a large patch of <i>Helicteres macrothrix</i> . Footprint predominantly located within rail corridor to reduce additional clearance and disturbing new areas.	Route directs through Adelaide River township with impacts from noise and dust on a larger number of receptors.	Comparable with other options.	Comparable with other options.	Acceptable
	Acceptable	Acceptable	Acceptable	Acceptable	
OHTL – Adelaide River Preferred option	Avoidance of protected flora and fauna species with the exception of Eucalyptus open forests which is approximately equal between the two options. Footprint disturbing new areas.	Route directs through Adelaide River township with impacts from noise and dust on a larger number of receptors. Increased disturbance of riparian vegetation.	Straightest alignment resulting in a slight amendment of distance to cover.	Comparable with other options.	Preferred
	Preferred	Acceptable	Preferred	Acceptable	
OHTL – Pine Creek Option areas	Predominantly pastoral land with potential for increased disturbance footprint.	Land Access and tenure complexities.	Comparable with other options. Potentially challenging terrain but opportunity for preferred OHTL corridor width of 60 m	Comparable with other options.	Acceptable
	Acceptable	Challenging	Acceptable	Acceptable	
OHTL – Pine Creek Preferred Option	Within the rail corridor in existing areas of disturbance. Limits clearing required and species impacted.	Limited impact on freehold land and pastoral land. Co-location with similar linear infrastructure (Stuart Highway). Avoidance of sacred sites.	Straightest alignment resulting in a slight amendment of distance to cover.	Comparable with other options.	Preferred
	Preferred	Preferred	Preferred	Preferred	
OHTL – Katherine Rail Corridor	Closer to Katherine/Tindal RAAF base. Potential additional volume of PFAS contamination to be managed.	Directly pass Katherine Railway station, further distance from Novis Quarry.	Comparable with other options.	Comparable with other options.	Challenging
	Challenging	Challenging	Challenging	Challenging	
OHTL – Katherine Preferred Option	Further from Katherine/Tindal RAAF base (source of PFAS contamination).	Pass behind Katherine Railway station, closer to Novis Quarry.	Straightest alignment resulting in a slight amendment of distance to cover. Follows proposed Katherine Heavy Vehicle bypass to limit disturbance and overall amenity impacts.	Comparable with other options.	Preferred
	Preferred	Preferred	Preferred	Preferred	
OHTL Installation method – undergrounding	Continuous disturbance of land for 788 km. No capacity to avoid areas of environmental significance. Increased area of reinstatement required. Increased intersection of PASS and PFAS contaminated soils and sediments requiring management.	No capacity to avoid areas of social and cultural significance. No noise impacts to adjacent landowners during operations.	Decreased potential for heat dissipation which may affect the efficiency of the conductors.	Significant cost to underground.	Unfeasible
	Challenging	Challenging	Unfeasible	Unfeasible	
OHTL Installation method – overhead	Can be strung across areas of significance, avoiding disturbance for up to 400 m. Can be strung across riparian areas and waterways. Potential for bird strikes.	Increased visibility of transmission line. Potential for noise generation by corona effect impacting on adjacent landowners during operations as well as construction.	Increased access for maintenance and operation. Increase heat dissipation.	Reduction in cost to install and maintain in comparison with undergrounding.	Preferred
	Preferred	Preferred	Preferred	Preferred	

Alternative	Attribute rating against performance objectives				Overall Rating
	Environmental	Social	Technical	Economic	
DCS Site (Middle Arm) *including Cable Transition Facilities and Subsea Cable System	Impact on sensitive mangrove habitat. Potential for cumulative impacts to develop from cable system burial/maintenance dredging. Increased construction footprint in PASS.	Disruption to recreational boat users for works proximate to Middle Arm. Increased interaction with vessel traffic during cable burial/laying activities.	Extensive congestion from existing and proposed subsea infrastructure. Terrestrial infrastructure locations constrained by existing and proposed future land uses. Planned maintenance dredging increased risk for cable system during operations. Increased complexity due to water depths and extent of Shore Crossing Site.	Increased construction costs and duration. Increased project risk.	Unfeasible
	Challenging	Unfeasible	Unfeasible	Challenging	
DCS (northern Gunn Point) *including Cable Transition Facilities and Subsea Cable System	Increased disturbance footprint due to converter site being further from beach requiring more trenching for underground cable corridor and limited existing access. Infrastructure would need to consider existing creeks/watercourses and associated riparian vegetation. Closer to land identified as Zone CN (Conservation) and Zone PS (Public Open Space) under the <i>NT Planning Scheme 2020</i> .	Closer to existing recreational users and campers on Gunn Point Beach. Conflict with strategic land use plans for the Gunn Point area. Limited Cultural Heritage information available.	Increased environmental factors constrain construction methodology. Poor vehicle access to required infrastructure sites.	Increased OHTL length and subsequent construction costs. Increased logistics complexity for construction phase due to poor vehicle access.	Unfeasible
	Challenging	Unfeasible	Challenging	Preferred	
DCS (Murrumujuk) *including Cable Transition Facilities and Subsea Cable System	Environmental conditions and factors well understood. Infrastructure located in areas that are partially disturbed. No mangrove habitat. Reduced disturbance footprint for infrastructure due to existing access to all infrastructure sites.	Increased understanding of cultural heritage factors as more information available to inform further surveys. Consistent with NTG Planning Scheme and current zoning. Separation from primary camping and recreational areas to the north. Maintains public access.	Reduced complexity due to smaller construction footprint. Shorter OHTL. Existing bituminised road to DCS. Unsealed road access to other project infrastructure sites.	Shorter OHTL reduces cost. Future development of broader Gunn Point region not prejudiced by proposed location.	Preferred
	Preferred	Preferred	Preferred	Preferred	
Cable Transition Facilities HDD	Challenging to manage PASS if encountered.	Requires large mobilisation footprint. Increased and deeper ground penetration.	Installation of HVDC cables needs to be carefully managed. Requires specialised equipment and skills. HDD in sandy environments can be abrasive and harsh on equipment. Increased uncertainty of drilling conditions.	Significantly increases cost. Equipment repairs challenging in remote environment and may protract construction period.	Challenging
	Challenging	Challenging	Challenging	Challenging	
Cable Transition Facilities trenching	Larger surface disturbance footprint. Increased risk of dust during construction. Increased risk of disturbance of PASS, although easier to manage.	Increased possibility of interacting with social or cultural heritage sites/objects and values.	Improved control of a complex work front during construction. Increase in access to monitor work front, and subsea cable, closely.	Decreased cost in comparison to HDD. Limited risk associated with obtaining equipment and skill sets needed for install.	Preferred
	Acceptable	Acceptable	Preferred	Preferred	
Subsea Cable Route A	Marine route not surveyed	Comparable to Route B	Additional crossings of existing marine infrastructure. Intersects existing dredge disposal area.	Increased cost due to risks associated with infrastructure crossings and location in existing dredge disposal area	Unfeasible
	Challenging	Acceptable	Unfeasible	Challenging	
Subsea cable Route B	Marine environment well understood with survey data supporting route alignment.	Avoids known high value recreational fishing areas.	Avoids existing dredge disposal area. Limits crossings of existing subsea infrastructure.	Reduces operational risk by reducing infrastructure crossings.	Preferred
	Preferred	Preferred	Preferred	Preferred	



Legend		
	OHTL Corridor	
	Gravel Access Track	
	Main Access Track	
	Existing railway line	
	Cadastre	
	Powell Creek Station	
	Solar Precinct	
	Ancillary Infrastructure	
	Solar Precinct Electrode	



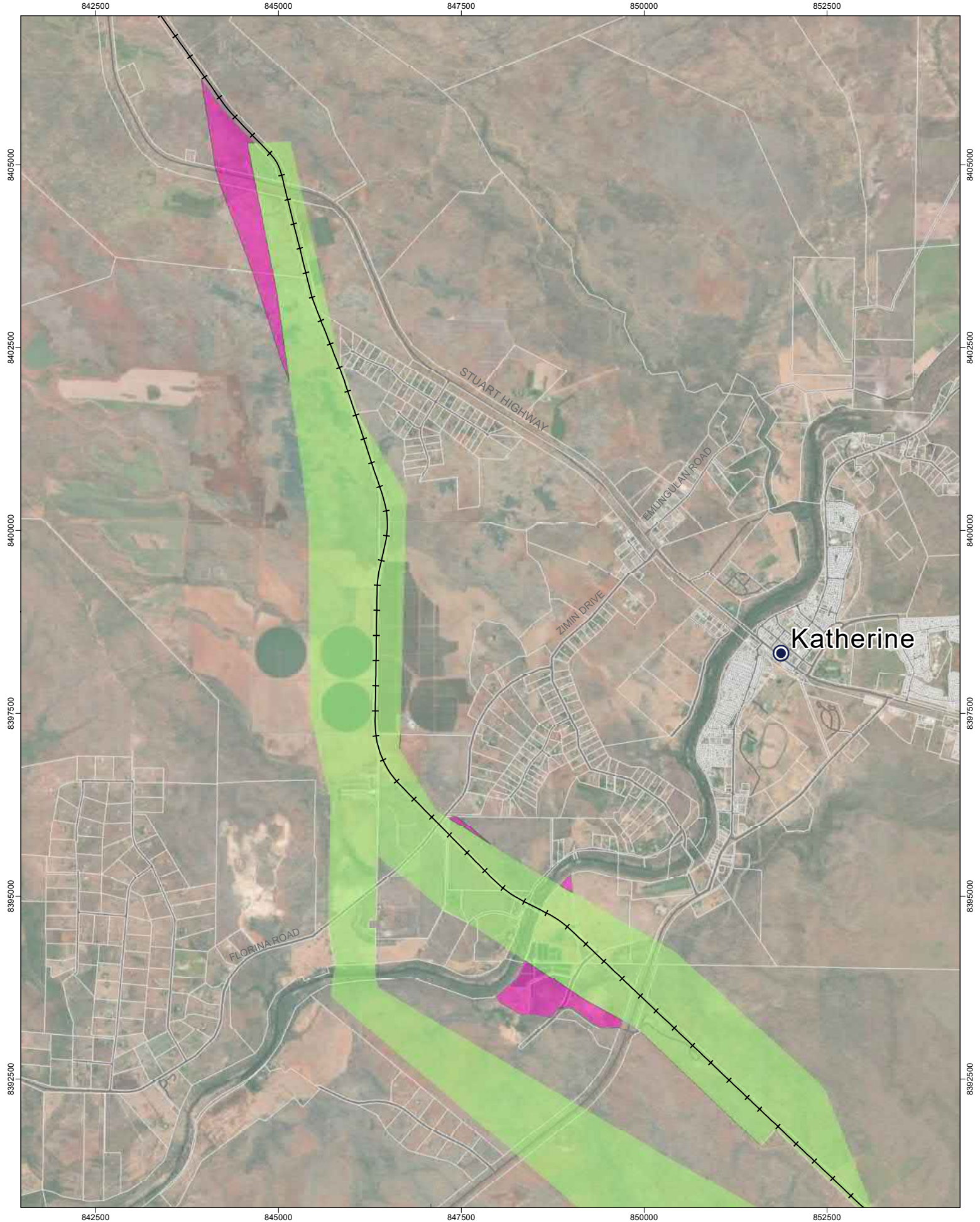
Figure 2-16: Powell Creek Ancillary Infrastructure Zone Alternative Options

Project: Australia-Asia PowerLink	Reference #: AAPL_GNR_CTA_GEN_MAP_0342	Figure: 1 of 1	Revision: A
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Coordinate System: MGA Zone 53	Datum: GDA2020	Date: 06/11/2022
		Scale: 1:150,000



Source: Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
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Legend

- Existing railway line
- ▭ Cadastre
- Additional Areas Of Potential Alternate Options
- Original areas of OHTL Route Alternate Options

Source: NTG data - Cadastre and conservation areas, Australian Government data - Railway and roads, ESRI - Imagery



Figure 2-17: OHTL Alternative Options - Katherine

Project: **Australia-Asia PowerLink**

Reference #: AAPL_GNR_CTA_GEN_MAP_0292

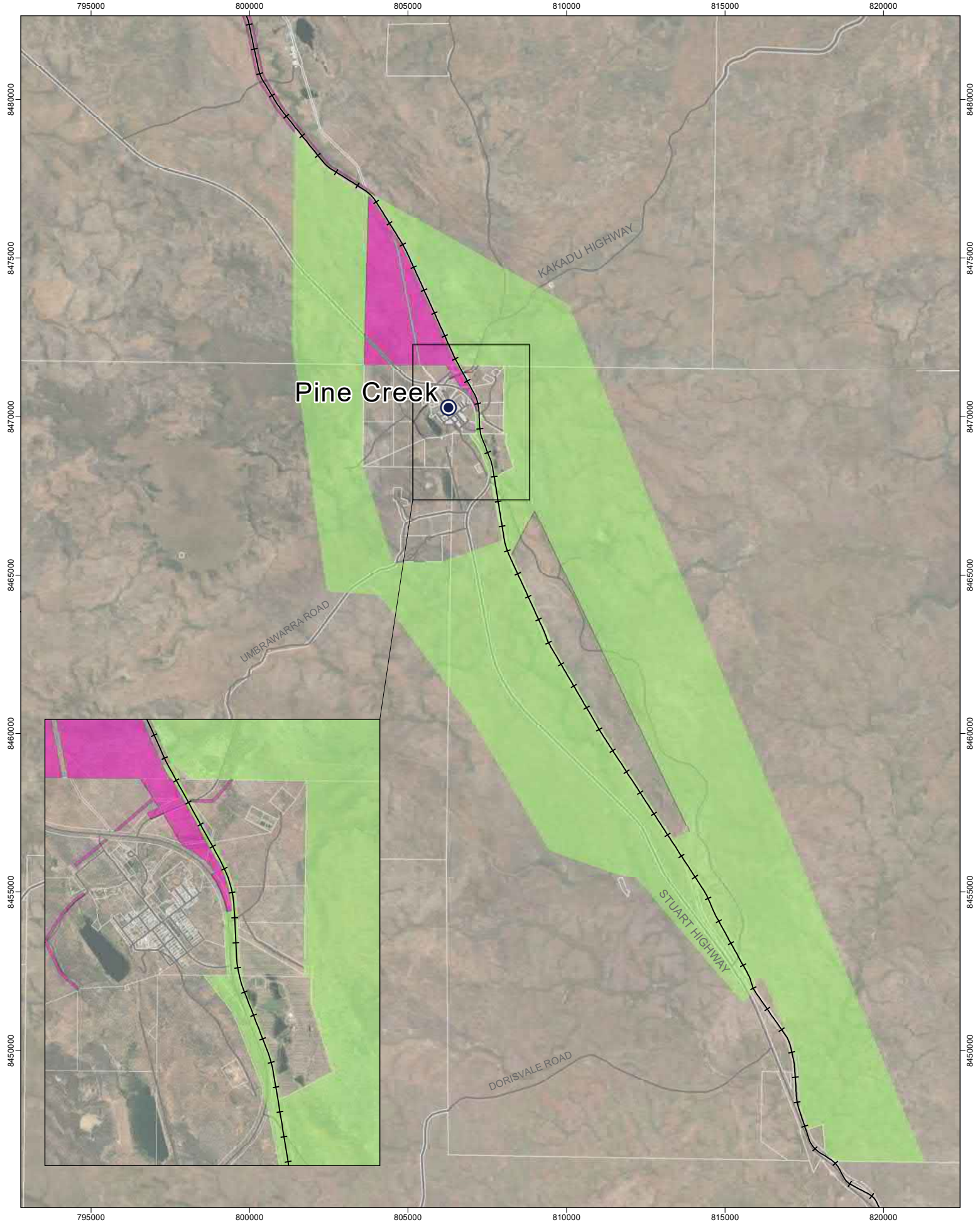
Date: 10/11/2022 | Figure: 1 of 1 | Revision: A

Scale: 1:65,000 | Datum: GDA2020

Coordinate System: MGA 53 | A4

SUN CABLE AUSTRALIA-ASIA PowerLink

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Legend

- Existing railway line
- ▭ Cadastre
- Additional Areas Of Potential Alternate Options
- Original areas of OHTL Route Alternate Options

Source: NTG data - Cadastre and conservation areas, Australian Government data - Railway and roads



Figure 2-18: OHTL Alternative Options - Pine Creek

Project: **Australia-Asia PowerLink**

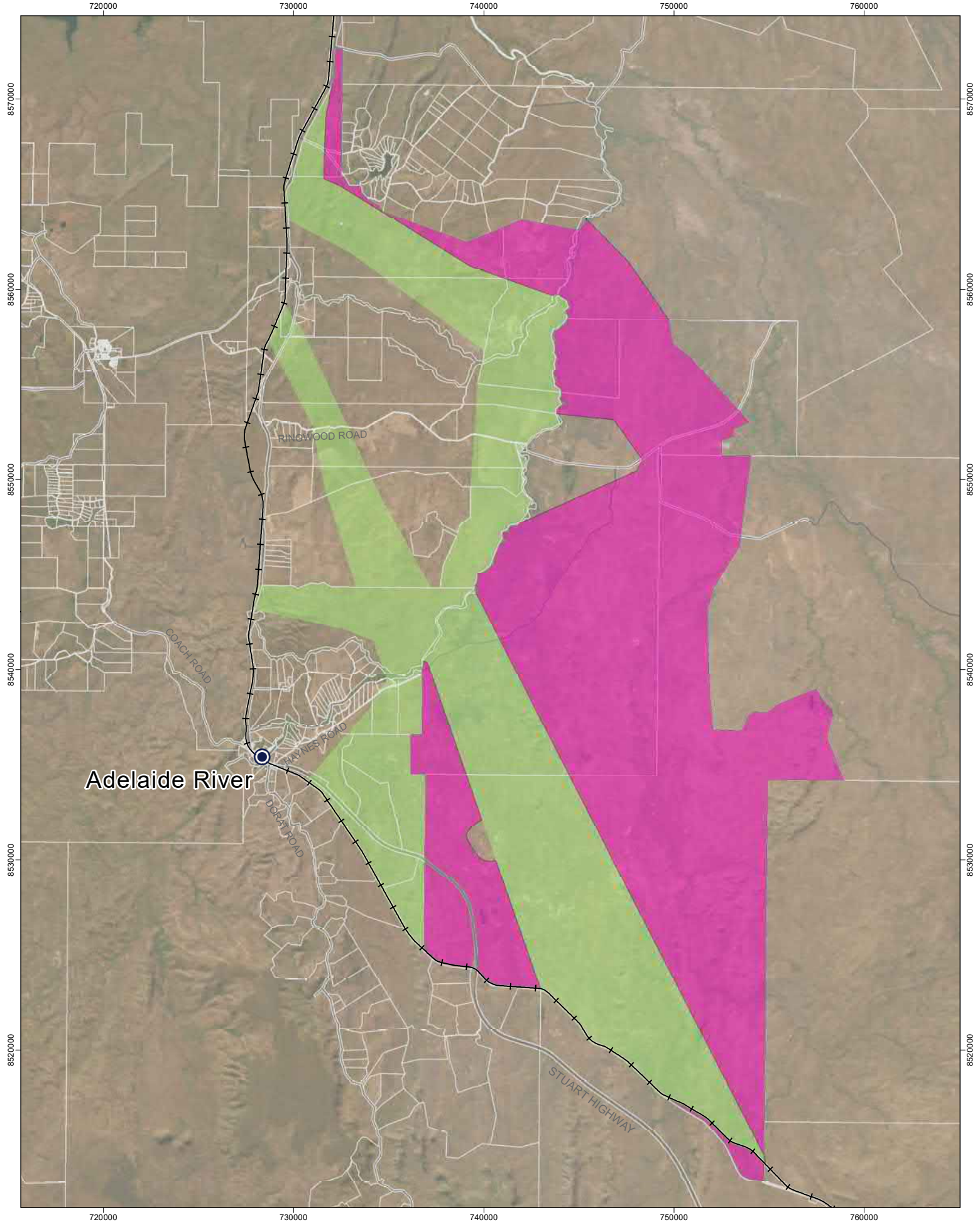
0 1 2 3 4 5
Kilometres

Scale: 1:150,000 Datum: GDA2020

Coordinate System: MGA 52 A4

Reference #: AAPL_GNR_CTA_GEN_MAP_0293
Date: 10/11/2022 Figure: 1 of 1 Revision: A

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Legend

- Existing railway line
- Cadastre
- Additional Areas Of Potential Alternate Options
- Original areas of OHTL Route Alternate Options

Source: NTG data - Cadastre and conservation areas, Australian Government data - Railway and roads



Figure 2-19: OHTL Alternative Options - Adelaide River

Project: **Australia-Asia PowerLink**

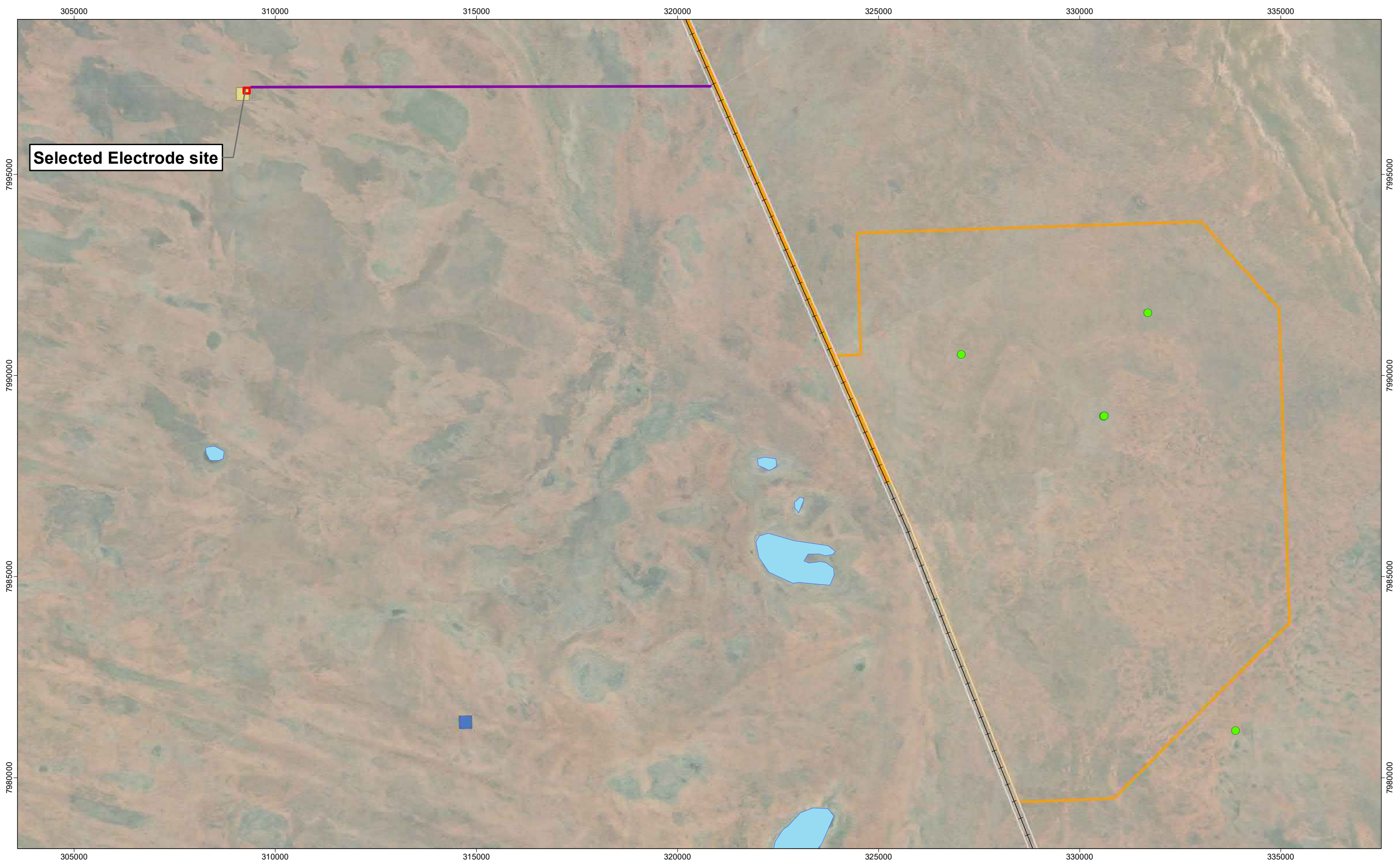
Reference #: AAPL_GNR_CTA_GEN_MAP_0294

Date: 10/11/2022 | Figure: 1 of 1 | Revision: A

Scale: 1:250,000 | Datum: GDA2020

Coordinate System: MGA 52 | A4

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Selected Electrode site

Legend

- Heritage Features
- OHTL Corridor
- Existing railway line
- Solar Precinct
- HVDC Electrode Line Corridor
- Cadastre
- Preferred Electrode Area of interest (10.24 Ha)
- Alternate Electrode Area of interest (10.24 Ha)
- Seasonal inundation areas



Figure 2-20: Powell Creek Electrode Site Alternative Options

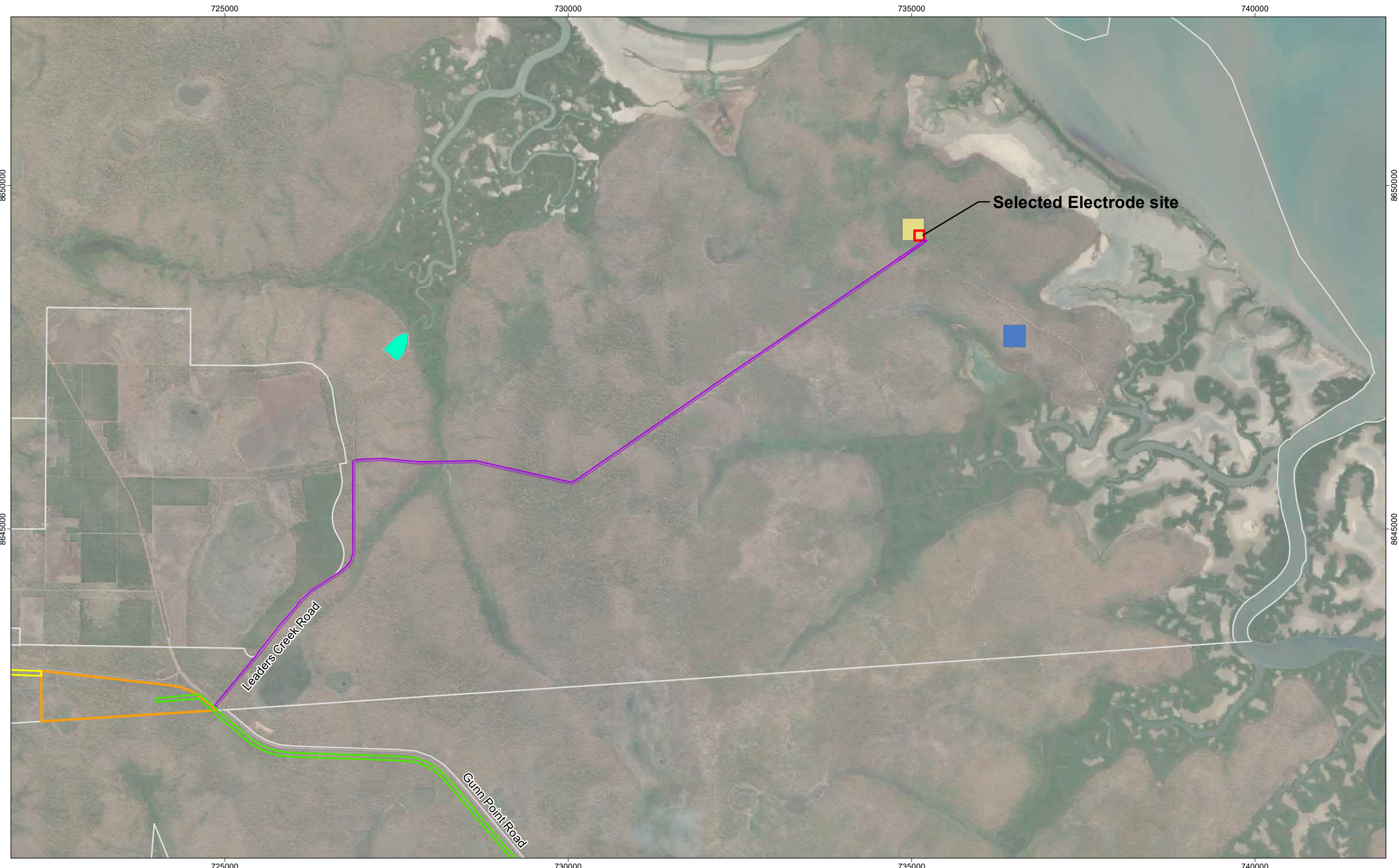
Project: Australia-Asia PowerLink	Reference #: AAPL_GNR_CTA_GEN_MAP_0343	Figure: 1 of 1	Revision: A
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Coordinate System: MGA Zone 53	Datum: GDA2020	Date: 01/11/2022	
		Scale: 1:85,000	A4



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725000 730000 735000 740000

8650000

8650000

8645000

8645000

725000 730000 735000 740000

Legend		
Roads	Darwin Converter Site	Preferred Electrode Area of Interest (10.24 Ha)
Cadastre	OHTL Corridor	Alternate Electrode Area of Interest (10.24 Ha)
Leaders Creek Fishing Base	Underground Cable Corridor	
HVDC Electrode Line Corridor	Darwin Converter Site Electrode	



Figure 2-21: Darwin Converter Electrode Site Alternative Options

Project: Australia-Asia PowerLink	Reference #: AAPL_GNR_CTA_GEN_MAP_0344	Figure: 1 of 1	Revision: A
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Coordinate System: MGA Zone 52	Datum: GDA2020	Date: 01/11/2022
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0 1 2 3 Kilometres Scale: 1:50,000 A4

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2.9 NT EPA Direction Reponses

2.9.1 General Project Description - Comment 1

The TOR includes matters to be addressed in the EIS including a description and maps of the proposed action. The NT EPA acknowledges that some components of the proposal are options, may not be required, or are subject to further consideration/assessment/design/access and the like. However, uncertainties about options must be resolved in the Supplement. It must be clear what the proposed action is (including a selected subsea cable corridor, OHTL route, trenching options etc.), the limitations and extent of the proposed action and environment protection measures proposed.

The TOR includes matters to be addressed in the EIS, however the draft EIS deferred provision of some key information to the Supplement.

In general, further assessment and supporting information is required including (but not limited to):

- Terrestrial ecosystem environmental values (including matters considered under the EPBC Act)
- Water use and interference with a waterway
- Marine ecosystems
- Outcomes of stakeholder engagement, including how the information gaps identified in the draft EIS have been addressed.

2.9.1.1 Information required in the Supplement

Provide an updated proposal description including a selected subsea cable corridor, OHTL route, electrode areas etc.

2.9.1.2 Response

This SEIS provides an updated proposal description for the Project. Further refinements have been described in detail throughout Chapter 2.

2.9.2 Two Access Tracks - Comment 2

Land clearing of 269 ha outside the Solar Precinct is proposed for construction of an airstrip and two roads. The two roads comprise:

- An unsealed 30 km access track/all-weather access road for scoping and preliminary works
- A sealed 42 km main access road.

It is not clear why the access track and access road cannot be the same route to avoid or mitigate potential impacts (e.g., on TEQ, ecosystem values and hydrological processes) by having one road only.

2.9.2.1 Information required in the Supplement

Provide further information to:

- Advise if one road only is feasible and if so, which one
- If not feasible to have only one road, provide justification for the construction of two roads to access the solar precinct
- Describe how the environmental decision-making hierarchy (Part 2 of the EP Act) has been addressed.

2.9.2.2 Response

Section 2.2.3.1 describes the need for establishing two Access Roads to the Powell Creek Solar Precinct. The summary for the alternatives analysis for this is outlined in Table 2-7.

2.9.3 AI - Comment 3

Table 2 of the TOR outlines the information requirements relating to the proposal description, including the requirements for site layout maps and design.

The location of additional infrastructure associated with the Solar Precinct is not provided on the maps and components are not adequately described in the scope of the proposal.

2.9.3.1 Information required in the Supplement

Provide further information to address Table 2 of the TOR including, but not limited to:

- Show the location of additional infrastructure at the Solar Precinct as listed in sections 2.4.3.3 to 2.4.3.6 of the draft EIS
- Ensure that maps are provided at a scale relevant to all components
- Provide multiple maps for large and fine scale detail as necessary.

2.9.3.2 Response

Section 2.2 outlines the AI which will be installed at the Solar Precinct. Additional maps have been included in Appendix 2.2.

2.9.4 Alternatives and justification - Comment 4

Table 2 of the TOR outlines the information requirements relating to the proposal description and justification of alternatives to project design.

Section 2.4 of the Draft EIS includes a list of infrastructure at the Solar Precinct, with some components requiring further information for environmental assessment as follows.

Airstrip with terminal and helipad (adjacent the Solar Precinct). Section 2.4.3.2 notes that the final location of the proposed airstrip will be subject to agreement with the Civil Aviation Safety Authority (CASA), pastoralists, and other relevant parties. The airstrip will include fuel storage and firefighting storage areas.

Section 2.4.3.4 mentions installation of bulk storage tanks for aviation fuel then describes the establishment of temporary self-bunded fuel storage for a list of dangerous goods/hazardous chemicals including aviation turbine fuel.

It is not clear whether potential environmental impacts from fuel storage and bird strike have been considered in the location of the airstrip within the 0.2% AEP zone on the boundary closest to Lake Woods. Alternative location(s) of the airstrip and associated fuel storage are not provided.

Concrete batching and water supply. Section 2.4.3.3 identifies services required for the Solar Precinct including groundwater extraction for concrete batching and to service the construction camp. Water demand is estimated up to 1500 ML per annum. The draft EIS identifies that finalisation of water source is reliant on the completion of a detailed water balance.

Temporary landfill during construction. Section 2.4.3.5 mentions the landfill option is subject to further studies and may not be required.

It is not clear if the landfill is part of the proposed action, what is meant by a temporary landfill (is it short-term use during construction phase and all waste will then be removed from site and the landfill remediated), what site options are being considered and the potential environmental impacts of the landfill.

2.9.4.1 Information required in the Supplement

Provide further information addressing Table 2 of the TOR about Solar Precinct infrastructure including, but not limited to:

- Alternative location(s) considered for airstrip and dangerous goods/hazardous chemicals storage
- Justification of the preferred location including consideration of Part 2 of the EP Act
- The location, size, and water requirements of concrete batching activities
- An estimate of the waste volume associated with the Solar Precinct and AI during construction
- Clarify what is meant by a temporary landfill and what type and volume of material is intended to be landfilled
- Confirm whether the landfill is part of the proposed action
- For all infrastructure that is part of the proposed action address the relevant matters of the TOR including:
 - Maps of the proposed location
 - Assessment of potential environmental impacts
 - Consideration of Part 2 of the EP Act.

2.9.4.2 Response

Section 2.2 provides the additional information requested the AI which will be installed at the Solar Precinct.

2.9.5 Borrow Pit - Comment 5

Section 2.4 lists borrow pits (outside the Solar Precinct) will be required for construction. Section 2.4.4.5 indicates 1.5 million cubic metres of crushed rock will be extracted. Figure 2-15 shows an indicative borrow adjacent to the Stuart Highway.

It is not clear what the footprint of the proposed borrow pit area is compared to previous borrow activities or how many borrow pits will be used.

It is not clear what measures are proposed to prevent dust if rock crushing is occurring at the borrow pit area adjacent to the Stuart Highway.

It is noted that borrow material for remaining proposal components will be sourced from local suppliers.

2.9.5.1 Information required in the Supplement

A map of the indicative borrow pit/s and environmental values at an appropriate scale to view previous and proposed clearing

- A map of the indicative borrow pit/s and environmental values at an appropriate scale to view previous and proposed clearing
- An estimate of the total material requirement, total area, and footprint in hectares (ha)
- Assessment of all borrow pit areas and potential significant impacts from materials extraction including avoidance and mitigation measures and rehabilitation actions
- An outline the proposed rehabilitation criteria and timing.

2.9.5.2 Response

Section 2.2.3 includes additional detail requested for the Borrow Pit sizing and the location is included in Figure 2-5.

2.9.6 E-Waste - Comment 6

Section 2.4.5 identifies that some electronic components at the solar precinct, including batteries and solar panels, will reach the end of their usable life prior to project closure. The Referral identifies reuse in non-commercial settings, or recycling as potential disposal options for these components, however, the proponent has not provided any assessment of the availability or economic feasibility of these options.

It is the NT EPA's expectation that e-waste will not go to landfill and implementation of recycling will be available near commencement of the proposed action.

2.9.6.1 Information required in the Supplement

Describe the options investigated for reuse and recycling of sub optimal solar panels.

Identify potential third party solar panel reuse options with consideration of how panel degradation would affect the feasibility of such options.

Identify a hierarchy of preferred options to deal with sub-optimal solar panels consistent with the waste management hierarchy and describe how the identified options would be investigated.

2.9.6.2 Response

Section 2.2.3.4 outlines the Project's approach to the generation of waste from solar panels.

2.9.7 Batch Plants - Comment 7

It is not clear if the electrode area of interest forms part of the proposed action:

The Executive Summary mentions that the electrode area is under investigation.

- Section 2.5.3.4 mentions that a ground electrode located more than 8 km from each converter location is an alternative to a dedicated metallic earth return.
- An electrode area of interest at Darwin and west of the Solar Precinct is shown on each of Figures 2-27 and 2-28: however, it is not on many of the EIS maps or discussed in many of the environmental factor sections.
- Section 2.5.3.4 indicates each electrode site will be 2 ha; however, in Figures 2-27 and 2-28, the areas of interest appears to be greater than 2000 ha and 20 000 ha respectively. It is not clear why the area of interest is much larger than the electrode site.

The depth of ground electrodes is described as shallow in remote areas near or below the water table. Given the future development of Gunn Point area and water depth in arid environments, further information on location, extent and future land use for both electrode and power line connections is required. No detail of ground electrodes has been provided.

Section 2.5.3.4 provides a list of attributes that will be considered during site selection; however, uncertainty remains about potential environmental impacts in the absence of additional information.

2.9.7.1 Information required in the Supplement

Provide further information relating to the electrodes and the areas of interest:

- Confirm whether the electrode areas of interest are part of the proposed action
- Advise/confirm the spatial extent of the electrode area
- Advise/confirm the total disturbance footprint within the electrode area including access to the electrode sites
- Details of ground electrodes and any potential impacts from construction, installation and operation of ground electrodes including avoidance and mitigation measures.

2.9.7.2 Response

This information is described in Section 2.3.7.

2.9.8 Batch Plants - Comment 8

Section 2.5.4.4 identifies that it is possible that mobile concrete batching plants will be established at intermediate work bases to supply concrete for power pole foundations. Section 2.6.4.2 identifies that a concrete batching plant may be required or may be sourced from external suppliers for the DCS.

2.9.8.1 Information required in the Supplement

Provide details about the location, size, and water requirements for concrete batching along the length of the OHTL, DCS and Cable Transition Facilities.

2.9.8.2 Response

This information is currently being reviewed. Indicative values are outlines in Table 2-1 and in Section 2.2.

2.9.9 Undergrounding - Comment 9

Table 2 of the TOR outlines the information requirements relating to the proposal description and justification of alternatives to project design.

The draft EIS notes two options for installation of an optic cable, via suspension with OHTL or underground via a 1.2 m trench; however, no further detail is provided in the draft EIS.

DITT's Industry Development submission notes that in Appendix F to the draft EIS the proponent considers that burial of the OHTL is not an option for the proposed action. The draft EIS does not provide any justification nor supporting evidence about why the proposed action does not include underground power cables and what significant environmental impacts are avoided by the preferred option of using overhead power cables.

2.9.9.1 Information required in the Supplement

Provide further information addressing Table 2 of the TOR for trenching works, along the railway corridor and alternative routes/deviations of the OHTL, including but not limited to:

- Scope of trenching works for the optic cable along the length of the OHTL
- Clarification of whether and/or where the OHTL may be installed underground in areas to avoid sensitive receptors
- Proposed timing, methods, and area of impact for trenching activities
- Justification for alternatives proposed and criteria for selecting a preferred option, in particular why transmission lines cannot be buried for their entire length
- Evidence based assessment of any potentially significant impacts on environmental values not described in the draft EIS.

2.9.9.2 Response

This is described in Section 2.3.

2.9.10 Deviations - Comment 10

The draft EIS has not assessed potentially significant impacts within the broad areas that are being considered for alternative routes/deviations from the railway corridor at Katherine, Pine Creek, and Adelaide River.

2.9.10.1 Information required in the Supplement

Provide further information about the OHTL where it deviates from the railway corridor, including but not limited to:

- The preferred route/deviation including consideration of Part 2 of the EP Act
- Justification and criteria used to select the preferred route
- Construction and rehabilitation requirements in proximity to Adelaide River and Katherine River
- Avoidance and mitigation measures with regard to PFAS and the proposal footprint in the vicinity of Katherine
- Assessment of potential significant impacts on environmental values not described in the draft EIS particularly regarding terrestrial ecosystems and community values.

2.9.10.2 Response

This is described in Section 2.3.

2.9.11 Cable Transition Facilities - Comment 11

The draft EIS describes the Cable Transition Facilities as three separate components to transfer power from onshore to offshore:

- Underground Cable Corridor (2.7 km x 70 m wide = 19 ha)
- Land Sea Joint Station (1.5 ha fenced compound)
- Shore Crossing Site (temporary 500 x 500 m = 25 ha area) where offshore cables are laid across and then buried through the intertidal zone and beach.

Figure 2-39 indicates HDD as an option in the legend; however, no corresponding text/justification is provided in the draft EIS.

The TOR for Marine Environmental Quality require description of potential impacts associated with proposed construction including direct impacts to seabed from cable laying, anchors, HDD at shore crossing, trenching and rock armouring.

The NT EPA recognises the important of HDD to mitigate disturbance to sensitive coastal vegetation at the shore crossing site.

Access to Tree Point Family Outstation – Durdugu and Tree Point Conservation Area managed by DEPWS is via the access road proposed to be altered during construction of cable transition facilities for up to 30 months.

2.9.11.1 Information required in the Supplement

Provide site layout and design information as required by the TOR for construction of the cable transition facilities, including but not limited to the:

- Use and extent of HDD to avoid sensitive vegetation
- Alternatives considered and the preferred method, include consideration of Part 2 of the EP Act
- Justification and trade-offs for the preferred site, design, and method
- Timing of works
- Application of NT Land Clearing Guidelines, specifically buffers to sensitive and significant habitat under the Planning Act 1999
- Mitigation and management measures proposed to address any potentially significant impacts on terrestrial and marine ecosystem values and community access and use during construction
- Detail about reinstatement actions and outcomes proposed for the shore crossing site
- Residential and public access during construction.

2.9.11.2 Response

This is described in Section 2.5.

2.9.12 Marine Corrosion - Comment 12

It is unclear whether there is potential for marine impacts arising from corrosion protection using a bipole with metallic return as this has not been discussed in the draft EIS.

2.9.12.1 Information required in the Supplement

Provide further information on how the subsea corrosion protection system works including, but not limited to:

- Whether any harmful chemical products would be produced in seawater
- Any associated impacts, particularly in sensitive areas such as marine parks and Shoal Bay
- Measures for avoidance and mitigation.

2.9.12.2 Response

This is described in Section 2.6.

2.9.13 Subsea Cable System Route - Comment 13

The Subsea Cable System route, including two inshore route options, was selected based on review of available geophysical data. The proponent advised that further surveys of the near-shore route options A and B were planned for early 2022 to confirm this approach.

DIPL's submission notes that the location of current route option A coincides with the location of potential, long term, dredged material disposal grounds. DIPL has engaged with the proponent in this regard and understands its preferred route is option B.

However, if option A is to be considered, the proponent must demonstrate that these sites can still be used in the future, as dredge material disposal sites after the subsea cables have been installed (i.e., that the installation of subsea cables does not preclude the use of these areas for a long term dredged material disposal ground). The proponent is encouraged to continue to engage with DIPL if it intends to pursue option A.

2.9.13.1 Information required in the Supplement

Specify which subsea cable route option has been selected.

Provide confirmation about the preferred route of the subsea cable including but not limited to:

- Any locational changes to the proposed route based on survey results
- Addressing EIA information requirements in the TOR about marine environmental quality and marine ecosystem values (and see below in Sea section).

2.9.13.2 Response

This is described in Section 2.6.

2.9.14 Dredging Impacts - Comment 14

Tables 9 and 10 of the TOR required assessment of potential impacts on Marine environmental quality and Marine ecosystems factors including description of potential impacts associated with proposed construction including direct impacts to seabed from cable laying, anchors, HDD at shore crossing, trenching and rock armouring.

Information has not been provided regarding the location, amount, and disposal options for dredge/pre-sweeping spoil.

2.9.14.1 Information required in the Supplement

Address tables 9 and 10 of the TOR.

Provide information required in a dredge and dredge spoil placement management plan including:

- Expected location of dredging/pre-sweeping
- Predicted zone of impact and zone of influence
- Expected volume of dredge/pre-sweeping spoil
- Location of spoil disposal
- Assessment of potential impacts of dredging and spoil disposal including avoidance and mitigation measures.

2.9.14.2 Response

This is described in Section 2.6.

2.9.15 Temporary Accommodation - Comment 15

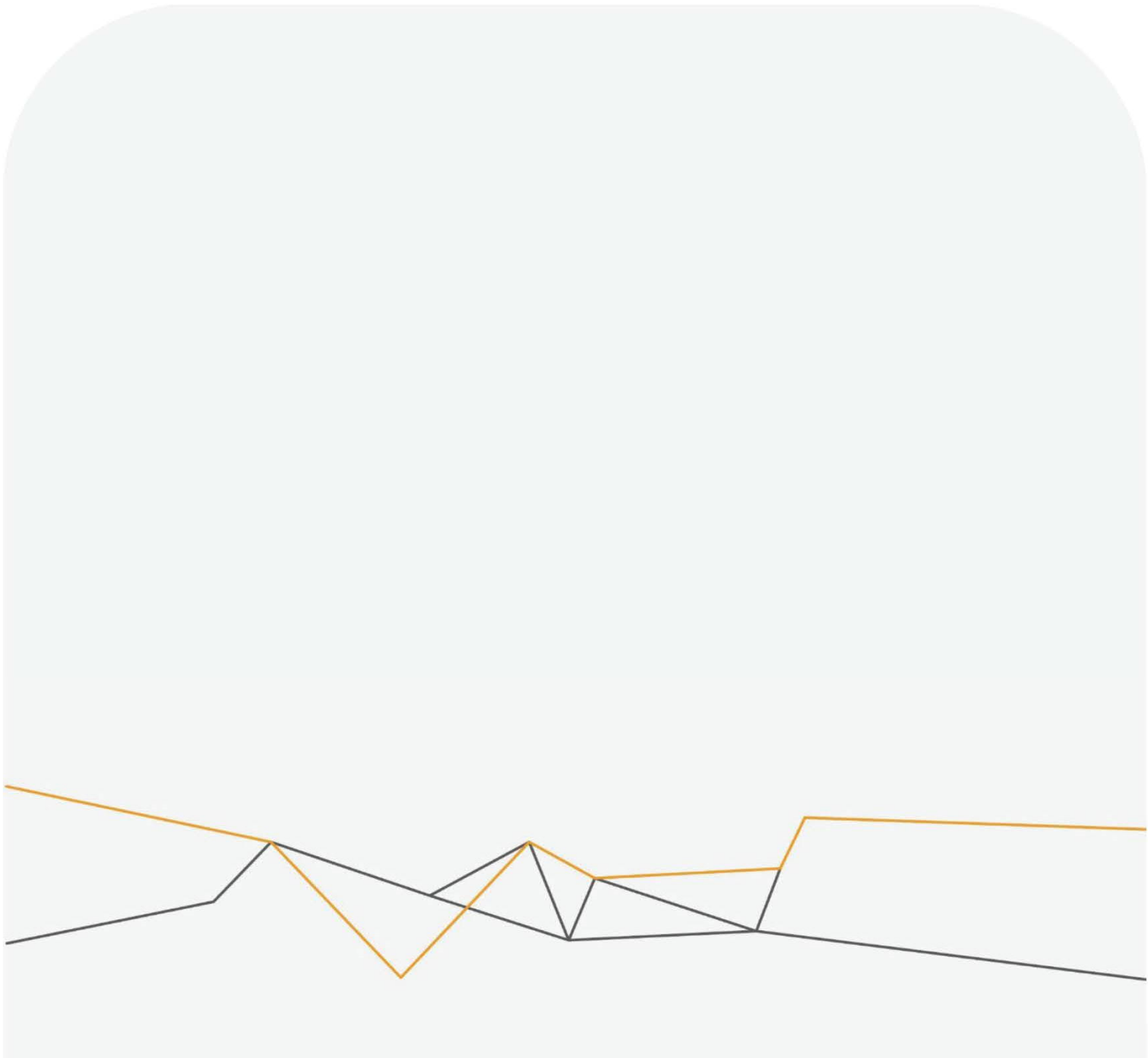
The draft EIS identifies that six mobile fly camps are proposed to be established at 100 km interval locations between Elliott and Darwin for the 460 construction workforce over 30 months. Expected 4 work fronts operating at any time. Workforce will use existing accommodation providers where local facilities allow. Temporary camps to be established in remote areas will be used for 6 months each, housing up to 20 people. Cleared pads of 1 ha areas for camps will be reinstated using the cleared materials following removal of camp infrastructure. Laydown areas will use existing cleared areas where possible. The proponent is currently developing the staging for the OHTL including accommodation and laydown areas.

2.9.15.1 Information required in the Supplement

Provide the location of temporary accommodation, within or external to the railway corridor and in the Litchfield municipality utilities corridor, DCS and cable transition station.

2.9.15.2 Response

This is described in Section 2.6



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