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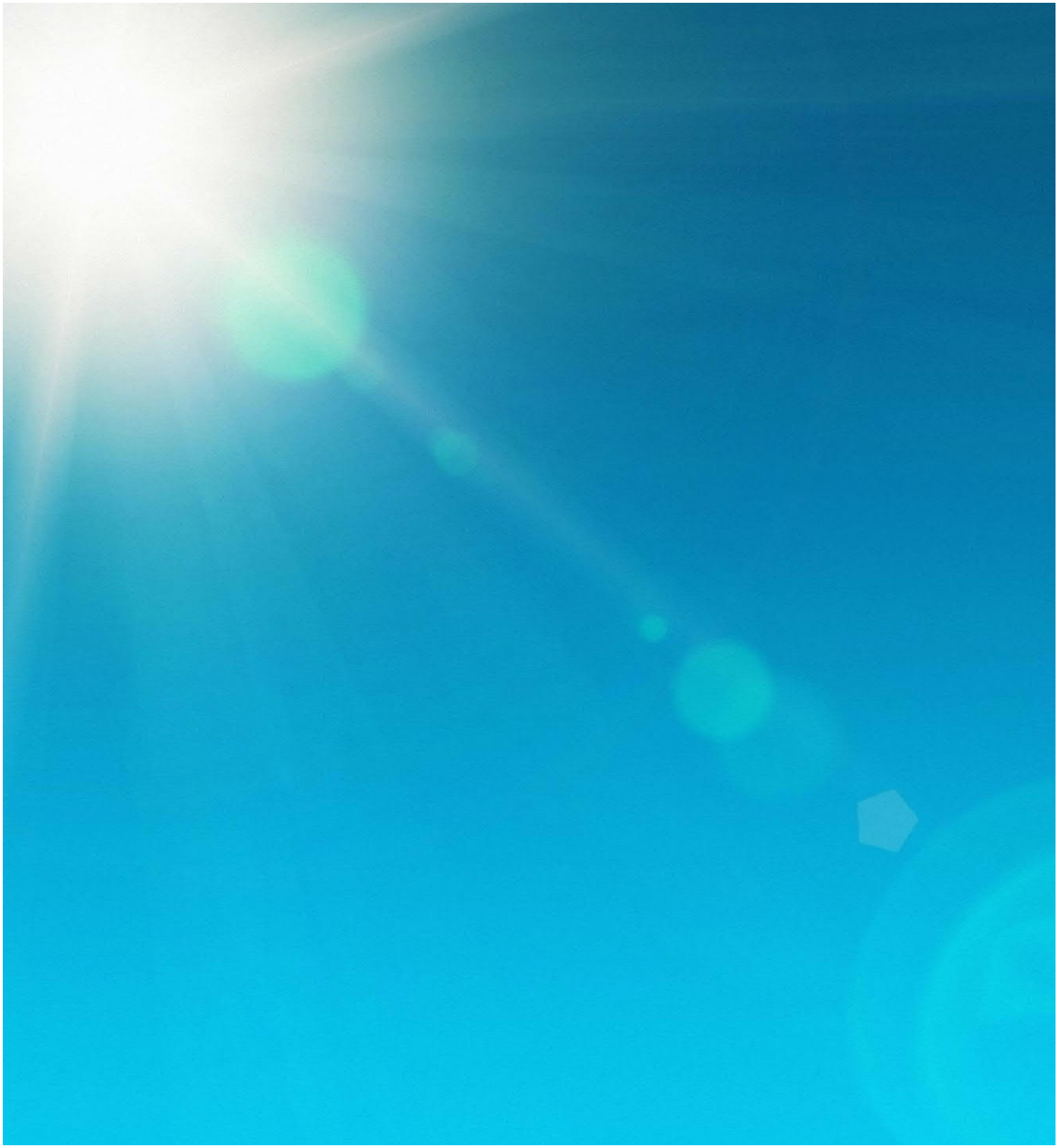
Chapter 3 – Impact Assessment

Australia-Asia PowerLink Environmental Impact Assessment



Chapter 3 Impact Assessment

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Revision history

Revision	Date	Purpose	Reviewed by	Approved by
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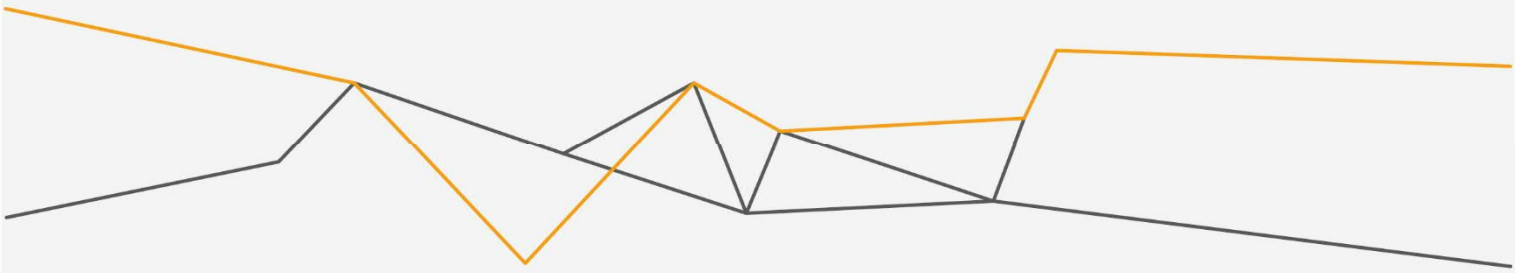

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3 Impact Assessment

This chapter describes the approach and methods used to identify and assess the significance of potential environmental impacts associated with the AAPowerLink proposal. The Environmental Impact Assessment (EIA) process was undertaken by qualified and experienced impact assessment professionals from EcOz Environmental Consultants in collaboration with Sun Cable, and with advice and input from a range of technical specialists. The Environmental Impact Statement (EIS) team, qualifications and experience are provided in Appendix D.

The objectives of the EIA process were to:

- Identify potentially significant impacts that could result from the activities that will occur at each location and at each stage of the development
- Determine the actions that can be feasibly and practically undertaken by Sun Cable to avoid or mitigate these impacts
- Evaluate the significance of residual environmental impacts that are likely to occur and (if required) provide for offsets.

The outcomes of the EIA process are documented in the EIS and will inform the NT Environment Protection Authority (NT EPA) determination of whether the potential impacts are significant, whether to recommend the proposal be approved, and if approved, the relevant approval conditions.

Key terms used in the impact assessment process are defined in Table 3-1.

Table 3-1. Environmental Impact Assessment (EIA) key terms and concepts

Term	Meaning
Proposal footprint	The geographical extent and boundary of the area that will be directly affected by construction and operation of the AAPowerLink (i.e., land clearing footprint or area of seabed disturbance for the Subsea Cable System).
Area of influence	The areas surrounding the AAPowerLink footprint that have the potential to be impacted by the construction or operations activities. This includes the spatial extent of off-site impacts to people and communities, human health and amenity, water quality, water availability, terrestrial, aquatic, and marine ecosystems.
As Low as Reasonably Practicable (ALARP)	ALARP is a principle used in risk assessment and describes the level to which environmental impacts are expected to be avoided of mitigated. For an impact to be ALARP it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportional to the benefit gained.
Avoidance	The principle of designing the proposed actions to avoid adverse impacts on the environment in accordance with the principles of environmental decision-making outlined in section 26 of the *Environment Protection Act 2019*.
Environmental factor	Environmental factors – as defined by the NT EPA (2021) – are broad groups of environmental aspects that may be impacted by a proposed action. There are 14 environmental factors in the NT EPA Factors and Objectives framework, 12 of which could be impacted by the AAPowerLink and are assessed in this draft EIS (refer Table 3-2 and Table 3-4 below). The NT EPA has set an objective for each factor that is referenced in determining whether impacts are likely to be significant.

Term	Meaning
Environmental context	Environmental context refers to the sensitivity, value and quality of the environment including consideration of significance to stakeholders and beneficial uses. Environmental context is a key determinant of the significance of environmental impacts – see significant impact definition below.
Environmental value	The qualities or uses of the environment that society seeks to protect.
Direct impact	An event or circumstance that is a direct consequence of activities associated with the AAPowerLink construction or operations. Direct impacts occur via a direct interaction of the activities with a component of the environment (e.g., land clearing impacting vegetation or cable laying and burial impacting the seabed).
Indirect impact	An event or circumstance that is an indirect consequence of the activities associated with the AAPowerLink construction or operations and the action is a substantial cause of that event or circumstance. Indirect impacts occur as a result of the project activities via impact pathways (e.g., impacts to water quality or availability indirectly affect downstream water users).
Intensity (of an impact)	Intensity refers to the strength or concentration of impacts. The intensity of an impact is determined by considering is scale (geographic extent), magnitude of change and duration/frequency. Intensity is a key determinant of the significance of environmental impacts – see significant impact definition below.
Matters of National Environmental Significance (MNES)	MNES are matters protected under the Commonwealth EPBC Act. There are nine MNES. The AAPowerLink EIS is required to assess impacts to three of those (refer Table 3-4 below).
Mitigation	Action taken to minimize, reduce or control the harm or severity of an impact.
Residual impact	The impact that remains after all feasible and practicable mitigation measures have been implemented.
Offset	A measure designed to compensate for a significant residual impact of an action on the environment as defined in the *Environment Protection Act 2019*.
Significant impact	As defined by the *Environment Protection Act 2019:* An impact of major consequence having regard to: (a) the context and intensity of the impact; and (b) the sensitivity, value and quality of the environment impacted on and the duration, magnitude, and geographic extent of the impact.
Cumulative impact	Changes to the environment that are caused by the residual impacts of an action in combination with the residual impacts of other past, present, and reasonably foreseeable future activities.

3.1 Matters addressed in the EIS

The EIS addresses potential impacts to environmental matters protected under both the *Environmental Protection Act 2019 (NT)* (*EP* Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (*EPBC Act*). Sun Cable submitted a referral to the NT EPA and Australian Government Department of Agriculture, Water and Environment (DAWE) in October 2020 which was released for stakeholder consultation for a 6-week period. Due to changes in the proposed actions, a significant variation to the proposal was submitted to the NT EPA and DAWE in August 2021 which was also circulated for a 6-week period.

The referral and subsequent consultation processes[1], identified 12 environmental factors and three Matters of National Environmental Significance (MNES) that require detailed assessment in the EIS (Table 3-2). Table 3-3 outlines the environmental factors that do not require further assessment. Through the referral process, it was determined that the likelihood of these environmental factors being significantly impacted was low, and therefore the requirement for further assessment was removed.

The final EIS Terms of Reference (ToR) issued by the NT EPA outline the information requirements for each factor and MNES. The EIS addresses these requirements as per the cross-reference table provided in Appendix A and also provides information in relation to any other impacts that were identified through the EIA process. Potential impacts were identified with reference to the EIS ToR issued by the NT EPA, issues raised by stakeholders (see Section 3.3) and professional judgement of the EIS team based on their knowledge and understanding of the AAPowerLink components (described in Chapter 2) and potential interactions of the construction and operations activities with the receiving environment.

Table 3-2. NT EPA environmental factors relevant to the AAPowerLink proposal

Theme	Factor	Objective	EIS chapter
LAND	Terrestrial environmental quality	Protect the quality and integrity of land and soils so that environmental values are supported and maintained.	4
	Terrestrial ecology	Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity, and ecological functioning.	5
WATER	Hydrological processes	Protect the hydrological regimes of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	6
	Inland water environmental quality	Protect the quality of groundwater and surface water so that environmental values including ecological health, land uses, and the welfare and amenity of people are maintained.	7
	Aquatic ecosystems	Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity, and ecological functioning.	8
SEA	Marine environmental quality	Protect the quality and productivity of water, sediment, and biota so that environmental values are maintained.	9
	Marine ecosystems	Protect marine habitats to maintain environmental values including biodiversity, ecological integrity, and	10

[1] Sun Cable referred the AAPowerLink to the NT EPA 16 October 2020 as a 'Proponent Initiated EIS Referral' initiating the assessment process under the EP Act. The referral and a draft ToR for the EIS were placed on public comment for a period of 30 business days, following which the NT EPA issued an approved ToR for the EIS on 19 January 2021. An amended ToR was issued by the NT EPA on 5 October 2021 following a significant variation being made to the proposal. Details of the referral process are provided in Chapter 1 Section 1.5.1.1.

Theme	Factor	Objective	EIS chapter
		ecological functioning.	
AIR	Air quality	Protect air quality and minimise emissions and their impact so that environmental values are maintained.	11
	Atmospheric processes	Minimise greenhouse gas emissions so as to contribute to the NT Government's target of achieving net zero greenhouse gas emissions by 2050.	12
PEOPLE & COMMUNITY	Community and economy	Enhance communities and the economy for the welfare, amenity, and benefit of current and future generations of Territorians	13
	Culture and heritage	Protect sacred sites, culture, and heritage.	14
	Human health	Protect the health of the Northern Territory population.	15

Table 3-3. Environmental factors not requiring assessment

Theme/factor	Significant impact is unlikely because...
LAND Landforms	The proposal does not involve any activities that will alter distinct physical landforms, such as hills or mountains. The proposal footprint is located on landform types that are locally and regionally dominant and widespread.
SEA Coastal processes	The Shore Crossing Site is the only proposal component that interacts with the coast. Cable laying activities will involve temporary disturbance of the beach and intertidal zone, with no long-term impacts to would be likely to interfere with coastal processes (e.g., near-shore circulation patterns). Assessment of impacts to coastal habitats and species is addressed under the Terrestrial and Marine ecosystems factors. The potential impacts associated with installation of the subsea cables are addressed under the Marine Environmental Quality and Marine Ecosystems factors.

Table 3-4. Matters of National Environmental Significance requiring assessment

MNES	EPBC Act Section	EIS Chapter
Listed threatened species and communities	18 & 18A	16
Listed marine and/or migratory species	20 & 20A	
Commonwealth marine environment – from the edge of territorial waters to the edge of the continental shelf	23 & 24A	

3.2 Project components addressed in EIS

This EIS documents the findings of the EIA undertaken covering construction and operation of the following AAPowerLink components as described in Chapter 2.

- Solar Precinct
- OHTL
- Darwin Converter Site
- Cable Transition Facilities
- Subsea Cable System (Route Options A & B).

Through the AAPowerLink planning and design process, some options for changes and additions to the proposal components have been identified to address technical constraints and to manage capital expenditure. The following components are currently under further consideration with final site selection to be confirmed:

- **OHTL route deviations** are being considered at Katherine, Pine Creek and Adelaide River to avoid route obstacles as described in Chapter 2. Alternative routes through these areas will aim to avoid land use conflicts and further minimise the impacts to the community where possible
- **Addition of ground electrodes** for the Solar Precinct and Darwin Converter Site is being considered as an alternative to installing a Metallic Earth Return wire along the whole ~800 km length of the OHTL (refer Chapter 2 Section for details). The ground electrode option is being considered because it has potential to significantly reduce capital expenditure, with reducing tower heights which improves visual amenity, and reducing the size of the pole foundations.
- **Subsea Cable System Route** options A & B are being considered, with the preferred option to be selected following geophysical survey work scheduled in early 2022. The survey work will inform selection of a route that avoids or minimises impacts to environmentally sensitive areas and any identified heritage features. The EIA process has considered impacts associated with both route options.
- **Alternative pre-sweeping** methods are under consideration to establish a flat work surface for cable laying and burial along the Subsea Cable System route. This is described in detail in Chapter 2. The preferred method along each section of the subsea cable route will be informed by the geophysical survey work referred to above, which in turn will determine whether Sun Cable need to seek approval for offsite spoil disposal locations.

Work was underway to further assess and finalise these options at the time of writing. Therefore, the EIA findings presented in the EIS do not cover these changes or additions. The relevant sections of Chapter 2 Proposal Description provide details of the approach that will be undertaken to further evaluate the options, including avoiding and mitigating environmental impacts, which are described further in Chapter 17 Environmental Management. The outcomes of this work will be presented in the Supplementary EIS.

3.3 Stakeholder concerns addressed in EIS

Sun Cable have conducted stakeholder engagement to inform the EIS by highlighting concerns and potential benefits to the affected communities in line with NTEPA guidelines and the core values of the *International Association of Public Participation* (IAP2). Table 3-5 summarises the concerns raised by all stakeholder groups during Sun Cable's engagement and how they have been addressed in the EIS. Sun Cable are committed to ongoing stakeholder engagement; information on how to engage with Sun Cable is included in Chapter 1 and details of how Sun Cable will record and action all stakeholder information going forward is described in Chapter 17.

Table 3-5. Concerns raised by stakeholders and how address in the EIS

Stakeholder Group	Concern Raised	Chapter of EIS addressed	How addressed.
Aboriginal Stakeholders	Onshore and underwater trenching for subsea cable installation impacting on fishing.	10 - Marine ecosystems	Impacts to marine species are identified and assessed in the marine ecosystems chapter. As no significant impacts to marine species have been identified, impacts to fishing are considered unlikely.
Residents and communities	Impacts of subsea cable on recreational fishing.	10 - Marine ecosystems	Impacts to marine species are identified and assessed in the marine ecosystems chapter. As no significant impacts to marine species have been identified, impacts to fishing are considered unlikely.
Aboriginal Stakeholders	Importance of avoiding sacred sites, black soil country and springs.	13 – Community and Economy 14 – Culture and Heritage	Identified as a potential impact and mitigation measures proposed.
Aboriginal Stakeholders	Concern about potential health impacts (biting insects, noise, air quality).	15 - Human health	Identified as potential impacts and mitigation measures proposed.
Government	Impacts of the subsea cable on the Oceanic Shoals Marine Park.	16 - MNES	Identified a potential impact and assessed in the MNES chapter.
Aboriginal Stakeholders	Concerns regarding road maintenance.	17 – Environmental Management Plan	Environmental and community grouping plans for monitoring and maintenance are outlined in Environmental Management Plan chapter.
Industry	Interaction of the project with other projects including: Channel Island Power Station Other solar farms Darwin harbour operations	18 - Whole of Environment	The cumulative impacts of the AAPowerlink Project and other current and developing projects in the NT has been assessed in the Whole of Environment chapter. Interactions between the projects will be addressed directly with stakeholders outside of the EIS.
Residents and communities	Disposal of project infrastructure including waste disposal of panels.	2 - Project Description	Consideration of this concern has been factored into the design of the project. The project description proposes a component recycling industry to manage these wastes.
Government	Concern regarding increased vehicle movements because of DIDO policies and fuel / chemical transport could increase accidents and road safety	2 - Project Description	Consideration of this concern has been factored into the design of the project. The project focuses on sourcing local workforce or use of FIFO workforce. DIDO workforce will be limited. Fuel and chemical transport will comply with all relevant

Stakeholder Group	Concern Raised	Chapter of EIS addressed	How addressed.
	incidents.		legislation, standards, and codes of practice.
Residents and communities	Concerns about FIFO or DIDO work. Suggestions to increase work from local community and accommodation	2 – Project Description	Consideration of this concern has been factored into the design of the project. The project focuses on sourcing local workers or use of a FIFO workforce. DIDO workforce will be limited.
Residents and communities	Queries around rehabilitation and potential offsets for land clearing	4 - Terrestrial ecosystems	Identified and assessed as a potential impact in Terrestrial ecology chapter, mitigation measures proposed. As the residual impact is not considered significant no offset has been proposed.
Environmental and community groups	Concern over land clearing.	4 - Terrestrial ecosystems	Identified and assessed as a potential impact in Terrestrial ecology chapter, mitigation measures proposed.
Residents and communities	Concerns around coastal erosion from human impact.	4 - Terrestrial environmental quality	Identified and assessed as a potential impact in Terrestrial environmental quality chapter.
Residents and communities	Avoid transport of weeds and seeds	5 - Terrestrial ecology	Identified and assessed as a potential impact in Terrestrial ecology chapter, mitigation measures proposed.
Environmental and community groups	Clearance of 12,000 ha native vegetation Concerned about route through Black Jungle Conservation Reserve & Oceanic Shoals Marine Park	5 - Terrestrial ecology 16 - MNES	Potential impacts identified and assessed in Terrestrial ecology and MNES chapters.
Aboriginal Stakeholders	Concern about reduction in fauna as a result of the project including reduced capacity for hunting.	5 - Terrestrial ecosystems	Potential impacts on fauna identified and assessed in Terrestrial ecology chapter. As no significant residual impacts on game fauna were identified the potential impact of the project on hunting is unlikely.
Residents and communities	Impact of Darwin Converter site / OHTL on Monsoon vine thicket and conservation zones.	5 - Terrestrial ecosystems	Identified and assessed as a potential impact in Terrestrial ecology chapter, mitigation measures proposed.
Environmental and community groups	Concerns about bird strike of OHTL and route of OHTL through Black Jungle Conservation Park. Particularly concerned with impacts on hunting	5 - Terrestrial ecosystems	Potential impacts on fauna identified and assessed in Terrestrial ecology chapter. As no significant residual impacts on game fauna were identified the potential impact of the project on hunting is unlikely.

Stakeholder Group	Concern Raised	Chapter of EIS addressed	How addressed.
	interests.		
Environmental and community groups	Concerns about bird strike on power lines causing death or injury of birds or leading to a power outage.	5 - Terrestrial ecosystems	Identified and assessed as a potential impact in Terrestrial ecology chapter, mitigation measures proposed.
Aboriginal Stakeholders	Concern about impact of project on species.	5 – Terrestrial ecosystems 10 – Marine ecosystems 16 – MNES	Potential impacts on species are assessed in the Terrestrial ecology, Marine ecology and MNES chapters and mitigation measures proposed where necessary.
Pastoral operators	Sun Cable's ability to respond to bushfires.	5 – Terrestrial ecosystems	Identified as a potential impact in the Terrestrial ecosystems chapter and mitigation measures proposed.
Aboriginal Stakeholders	Issues with flooding.	7 - Inland water environmental quantity	Sun Cable's infrastructure has been sited outside the 1 in 2,000-year ARI flooding event where possible. Potential for infrastructure placement to change inland water flow regimes is identified as an impact and assessed in Hydrological processes.
Aboriginal Stakeholders	Ability of the Traditional Owners to access the site.	Addressed directly with stakeholder	The operational areas of the site will be fenced for safety reasons, land access across the remainder of the site will remain.
Residents and communities	Concern OHTL block access roads to properties.	Addressed directly with stakeholder	OHTL will not block access roads.
Residents and communities	Visual impact of OHTL, suggested underground cables.	Addressed directly with stakeholder	Sun Cable explained it was more disruptive to the environment, more expensive and less efficient for power transfer to use underground lines.
Government	Subsea cables being laid within the NAXA defence zone.	Addressed directly with stakeholder	Sun Cable is conducting Environmental and community grouping consultation with stakeholders to finalise the subsea cable route.
Industry	Impact of subsea cable installation on other cables and pipelines and potential for anchoring of ships to disturb cable.	Addressed directly with stakeholder	Sun Cable is conducting environmental and community grouping consultation with stakeholders to finalise the subsea cable route.
Pastoral operators	Potential impact on pastoral property including: Workforce disrupting pastoral	Addressed directly with stakeholder	Environmental and community grouping consultation with stakeholders around impact of project on existing operations.

Stakeholder Group	Concern Raised	Chapter of EIS addressed	How addressed.
	activities OHTL impacting on mustering operations.		
Aboriginal Stakeholders	Consideration of cultural competency of employees and sub-contractors and how policy addresses barriers to employment	Appendix I – Social Impact Assessment Appendix J – Social Impact Management Plan	Identified in SIA and management plans proposed in SIMP.
Aboriginal Stakeholders	There are many potential benefits from the project that should be realised. Concern about over representing the benefits. Importance of local jobs and training, Benefits provided for region, not just international communities, Opportunities to provide power to communities and outstations, Traditional Owner equity in the project, Consultation with Traditional Owners and neighbouring groups, Climate change reduction, Ecological sustainability, and Long term benefits / opportunities.	Appendix I – Social Impact Assessment Appendix J – Social Impact Management Plan	Identified in SIA and management plans to realise benefits proposed in SIMP.
Residents and communities	Discussion around barriers to employment and potential benefits to the community. Concern about social impacts including: Increased pressure on health and	Appendix I – Social Impact Assessment Appendix J – Social Impact Management Plan	Identified in SIA and management plans to realise benefits and manage impacts proposed in SIMP.

Stakeholder Group	Concern Raised	Chapter of EIS addressed	How addressed.
	emergency services.		
Government	Maximise the benefits to the NT including employment.	Appendix I – Social Impact Assessment	Identified in SIA and management plans to realise benefits and manage impacts proposed in SIMP.
	Concern regarding potential social impacts including: Worker behaviour especially for FIFO or DIDO workers Availability of accommodation	Appendix J – Social Impact Management Plan	
Industry	Consideration of electricity supply to Tiwi Islands.	Appendix I – Social Impact Assessment Appendix J – Social Impact Management Plan	Identified in SIA and plans to realise benefits proposed in SIMP.
Environmental and community groups	Concerns raised about employment programs in the past. Several issues were put forward for consideration: The number of people attending training programs compared with the number of available jobs Length of job availability.	Appendix I – Social Impact Assessment Appendix – Social Impact Management Plan	Identified in SIA and plans to realise benefits proposed in SIMP.

3.4 Impact assessment approach and methods

The purpose of the EIA process is prescribed by Section 42 of the *EP Act*. The EIA approach and methods adopted for the AAPowerLink EIA were designed to address the requirements of the Act. The approach also aligns with the *International Principles of Environmental Assessment Best Practice* (IAIA, 1999) and the following key guideline documents:

- *Guidelines for Preparing an Environmental Impact Statement* (NT EPA 2021)
- *Matters of National Environmental Significance – Significant Impact Guidelines 1.1* (DoE) (2013)
- *AS/NZS 31000:2009 Risk Management – Principles and Guidelines*
- *HB 203:2012 Managing environment-related risk*

The key steps in the EIA process are described in Table 3-6. The results of the EIA for the construction and operations phases of the AAPowerLink are collated in the registers provided in Appendix E and the results relevant to each environmental factor are summarised in the relevant EIS chapter.

Social impacts and opportunities were assessed separately as part of a stand-alone Social Impact Assessment (SIA) process undertaken by a qualified SIA practitioner. The SIA uses a bespoke set of assessment criteria that incorporate community/stakeholder perceptions and provide for the assessment of both impacts and opportunities. The approach and methods used, and findings, are detailed in Appendix I and are summarised in Chapter 13 Community and Economy.

Table 3-6: Key steps in the environmental impact assessment process adopted for the AAPowerLink EIS

Key Steps in the Environmental Impact Assessment Approach Adopted for the AAPowerLink	
Step 1	**Characterise environmental values/sensitive receptors** The spatial boundaries for the EIA were established initially by defining a 'proposal footprint' and 'area of influence' for each environmental factor, which was then refined through the EIA process. The environmental values and sensitive receptors within the assessment boundaries were identified and characterised by the EIS team, based on findings from field surveys, consultation with stakeholders and desktop review. The assessment focussed on identifying: • Parts of the environment that are rare, endemic, unusual, important, or otherwise valuable • Any parts of the environment that are particularly sensitive or vulnerable to impacts • History of disturbance/impact and current condition. Accepted field baseline survey methods and guidelines were used where relevant. Stakeholder consultation described in Chapter 1 was also used to identify environmental values and sensitive receptors.
Step 2	**Identify and assess potential impacts** Potential impacts assessed in the EIS were identified with reference to the EIS ToR issued by the NT EPA, issues raised by stakeholders and professional judgement of the EIS team based on their knowledge and understanding of the AAPowerLink components and potential interactions with the receiving environment. For each project component described in Chapter 2 Proposal Description, events/incidents that have potential to cause environmental impacts were identified by the EIS team. Direct, indirect, offsite, and upstream impacts were considered based on knowledge and understanding of cause-and-effect pathways for impacts to each environmental factor. Impacts were assessed using predictive models and/or professional judgement of cause-effect relationships, with the level of assessment determined by the degree of risk posed to environmental values.
Step 3	**Apply impact avoidance and mitigation measures** Impact avoidance and mitigation measures were determined by applying the hierarchies for environmental decision-making and waste management section set out in Division 2 of the EP Act. Where possible this involved siting and designing the AAPowerLink to avoid adverse impacts on the environment. Where avoidance was not feasible or practicable, management options were identified by the Sun Cable team to mitigate adverse impacts to the greatest extent practicable. Options were developed with reference to accepted design standards and guidelines where available, compliance with regulatory standards, advice received from stakeholders and the Sun Cable teams experience with respect to the feasibility, practicality, and effectiveness of implementing such measures.
Step 4	**Assess residual impacts** After considering the implementation of avoidance and mitigation measures, potential residual impacts were assessed. For each potential impact the 'likelihood' and 'intensity' of residual impacts were rated using the criteria provided in Table 3-7 and Table 3-8. For each potential impact, any information gaps/uncertainties that preclude reliable assessment, as well as any uncertainty about the effectiveness of proposed controls were identified. Each impact was assigned a level of certainty using the categories in Table 3-10.
Step 5	**Evaluate significance of residual impacts** The significance of residual impacts was then evaluated taking into consideration the sensitivity, value, and quality of the receiving environment (environmental context) using the criteria provided in Table 3-9. For impacts that were rated as having a low level of certainty, the precautionary principle was adopted, and a higher residual impact rating assigned.

Key Steps in the Environmental Impact Assessment Approach Adopted for the AAPowerLink
Residual impact ratings were assigned as described in Table 3-11. The ratings indicate whether the residual impact is likely to be significant based on the findings of the EIA. However, it is the role of the NT EPA to determine if an impact is 'significant'. Significance of impacts to listed threatened and migratory species was undertaken with reference to the EPBC Significant Impact Guidelines 1.1 (DEWHA 2013) and EPBC Act Policy Statement 3.21 – Industry guidelines for avoiding, assessing, and mitigating impacts on EPBC Act listed migratory shorebird species (DOE 2015).

Table 3-7. Likelihood categories and criteria

Likelihood category	Criteria
Unlikely	The impact is not expected to occur because there are no sources of impact associated with the AAPowerLink activities, and/or no pathways or receptors present. The impact has not been reported in association with similar development activities.
Possible	The impact would not occur as part of normal operations but could occur in association with incidents and emergencies and/or there is some uncertainty as to whether the impact is likely to occur due to information gaps in relation to the impact source, pathways, or receptors. The impact has been reported to occur in association with incidents and emergencies that have occurred on similar development activities.
Likely	The impact will occur in most circumstances. The impact routinely occurs on similar development activities.

Table 3-8. Intensity (severity) ratings and criteria adopted for the AAPowerLink EIA

More Severe → Less Severe

Scale: The spatial extent of the impact, considering both the impact footprint (direct disturbance) and/or area of influence, including (indirect disturbance).			
Widespread	**Regional**	**Localised**	**Limited**
Impact that affects more than 1,000ha or extends more than 10km from activities.	Impact affects up to 1,000ha or areas 1-10km from activities.	Impact affects limited areas (up to 100ha) or is limited to within <1km from activities.	Impact affects a small area (less than 10ha) in the immediate proximity of activities.
Magnitude: The degree or amount of change from natural conditions.			
Major	**Moderate**	**Minor**	**Negligible**
Relevant thresholds or criteria for environmental protection are exceeded to the point that environmental values are impaired and the ecological function and/or extent of sensitive receptors are affected.	Relevant thresholds or criteria for environmental protection are reached or slightly exceeded, but environmental values, ecological integrity and function, including and sensitive receptors are not affected.	Impact is measurable but relevant thresholds or criteria for environmental protection are met.	No discernible impact on existing environmental conditions.
Duration: The frequency of the impact and the time over which the impact persists.			
Permanent /irreversible	**Long-term**	**Medium-term**	**Short-term**
Impact is enduring; values are unlikely to recover.	Impact occurs over an extended period covering the construction and operational phases, values eventually recover.	Impact occurs intermittently and/or only during the construction phase, after which values recover.	Impact occurs sporadically and/or lasts for a few days to weeks, after which values recover

Table 3-9. Environmental value ratings and criteria adopted for the AAPowerLink EIA

High Value → Low Value			
Context: Sensitivity, value and quality of the environment including consideration of significance to stakeholders and beneficial uses			
High	**Medium**	**Low**	**Very Low**
Very sensitive land uses, or receptors are present that have very limited resilience to change AND/OR Environment contains values that are important at a regional or national scale.	Sensitive land uses or receptors are present but have some resilience to change. AND/OR Environment contains values that are important at a local scale and/or have beneficial use.	Environment is intact (has inherent value as an undisturbed landscape). AND There are no sensitive receptors or land uses present. AND The environment does not contain any aspects that are valuable or otherwise important or unique.	Environment is degraded. AND There are no sensitive receptors or land uses present. AND The environment does not contain any aspects that are valuable or otherwise important, or unique.

Table 3-10. Certainty ratings and criteria adopted for the AAPowerLink EIA

Low	Limitations in baseline data and/or impact assessment and/or the effectiveness of proposed controls is not certain. Further work is required to adequately assess and mitigate impacts to ALARP.
High	There is an acceptable level of certainty in relation to the values/receptors present and the scale, magnitude, and duration of impacts to those values/receptors.

Table 3-11. Residual impact ratings adopted for the AAPowerLink EIA

Ratings and Description
Minor: A minor residual impact is unlikely to be significant.
A minor impact generally has two or more of the following characteristics: Scale: Limited/Localised Magnitude: Negligible/Minor Duration: Short-term/ Medium-term/Reversible. **OR** There are no sensitive receptors or land uses present, and the environment does not contain any aspects that are valuable or otherwise important or unique (i.e., Very Low/Low rating), and there is moderate to high degree of certainty about the likelihood and intensity of the impact, and the effectiveness of proposed mitigation measures.
Moderate: A moderate residual impact has potential to be significant. The significance depends on the acceptability of the impacts and the effectiveness of mitigation measures.
A moderate impact generally has two or more of the following characteristics: Scale: Localised/Regional Magnitude: Moderate Duration: Medium-term/Long-term **AND/OR** There are sensitive receptors or land uses present, or environmental aspects that are valuable or otherwise important or unique (i.e., Medium-High value rating), and there is a low degree of certainty about the impact, and the effectiveness of proposed mitigation measures.

Ratings and Description
Major: A major residual impact is likely to be significant. The level of acceptability will depend on offsets or benefits compensating for the impact.
Impact generally has two or more of the following characteristics: Scale: Regional/ Widespread Magnitude: Moderate/Major Duration: Long-term/Permanent **AND** There are sensitive receptors or land uses present, or environmental aspects that are valuable or otherwise important or unique (i.e., Medium-High value rating).

3.5 Approach to assessing cumulative impacts

Cumulative impacts were considered by assessing residual impacts of the AAPowerLink together with residual impacts from other past, present existing and reasonably foreseeable future developments. The assessment also considered facilitated or induced development activities, which could result from further actions made possible by the AAPowerLink. The developments and activities considered as part of the Cumulative Impact Assessment (CIA) are detailed in the sections below. The results of the CIA for each factor are discussed in the relevant chapters of the draft EIS (i.e., Chapters 4-15) and a summary is provided in Chapter 18 Whole of Environment.

3.5.1 Existing (past and present) land uses and developments

The existing land uses or developments within the AAPowerLink disturbance footprint or area of influence or nearby to the proposal area that could contribute to cumulative impacts are discussed below.

3.5.1.1 Solar Precinct

Pastoral land use

The existing pastoral land use is considered unlikely to contribute significantly to cumulative impacts that would overlap with the potential residual environmental impacts associated with the AAPowerLink and therefore was not further considered as part of the CIA. The Solar Precinct is located on Powell Creek Station, which is an operational pastoral lease. There has been land clearing on the station over time for pastoral infrastructure such as access tracks and bores, but no large-scale land clearing. Groundwater bores are used as a water supply; however, extraction is not metered as pastoral activities are exempt from water licencing under the *Water* Act. Ecological surveys undertaken within the Solar Precinct footprint (Appendix O) did not observe any evidence of significant environmental impacts from the existing land use; however, it would be reasonable to assume that there would be impacts on the station typically associated with cattle grazing (e. g. loss of ground cover, erosion, disturbance of watercourses and spread of invasive or noxious weeds). In terms of social, cultural, and economic values, the existing pastoral land use mainly has a positive impact on the region and access is maintained for native title holders.

Mining

There are currently no major operating mine sites in the Barkly region (NT Government, 2021a). Until recently the Bootu Creek mine, a manganese ore mine located approximately 110 km north of Tennant Creek, had been operating since 2006; however, mining ceased at the of end of 2021. Mining land use is considered unlikely to contribute significantly to cumulative environmental impacts that would overlap with the potential residual environmental impacts associated with the AAPowerLink, because the mine sites are located a significant distance from the Solar Precinct site. However, there is potential for cumulative social and economic impacts associated with future mining proposals, especially if they were to overlap with the construction phase of the AAPowerLink. Cumulative social impacts from mining and other development

activities in the Barkly region were considered in the CIA and are discussed in Chapter 13 Community and Economy.

3.5.1.2 Overhead Transmission Line

The Overhead Transmission Line (OHTL) corridor is predominantly within the existing Railway Corridor over the first 722 km from the Solar Precinct north to Livingstone, which will minimise cumulative impacts associated with vegetation clearing and habitat fragmentation compared to establishing a new, greenfield corridor. The OHTL may divert to/from the Railway Corridor in sections in response to local conditions, community concerns and technical constraints, which are uncovered through the detailed design phase. The OHTL diversion routes will be selected to minimise impacts on environmental values as detailed in Chapter 2 Proposal Description. The key residual environmental impact associated with the existing Railway Corridor is weed infestation and this was considered in the CIA as discussed in Chapter 5 Terrestrial Ecosystems.

The final 66 km of the OHTL corridor from Livingstone to the Darwin Converter Site at Murrumujuk, will be located inside a designated future Utilities Corridor and adjacent to the Gunn Point Road, which will minimise the potential for future cumulative impacts associated with vegetation clearing and habitat fragmentation compared to establishing a separate corridor. This section of the OHTL traverses some areas where extractive mining activities take place, which has involved vegetation clearing and ground disturbance. Ecological surveys undertaken within the OHTL corridor (Appendix P) did not observe any evidence of significant environmental impacts from the existing land uses, which include conservation land and pastoral activities on Koolpinyah Station. The existing land uses are considered unlikely to contribute significantly to cumulative impacts that would overlap with the potential residual environmental impacts associated with the AAPowerLink and therefore were not further considered as part of the CIA.

3.5.1.3 Darwin Converter Site and Cable Transition Facilities

The Darwin Converter Site and Cable Transition Facilities are located at Murrumujuk, where there is existing road access along the Gunn Point Road. The recently surfaced Gunn Point Road has made this area much more accessible and therefore busier, with several beach access points along Murrumujuk Drive, including adjacent to the Cable Transition Facilities. The area to the north of the site has been historically cleared for pine plantations and the old Gunn Point Prison Farm, and there are numerous informal access tracks as the area is a popular fishing, camping and leisure area due to its proximity to Darwin. The key environmental impacts associated with existing land uses are erosion and introduced weed species. There is potential for the AAPowerLink to expand the area of land affected by these impacts, in particular at the Shore Crossing Site on Gunn Point Beach. The key residual environmental impact associated with the existing land uses are localised areas of erosion and weed infestation, and increased bushfire risk, and these were considered in the CIA as discussed in Chapter 5 Terrestrial Ecosystems.

3.5.1.4 Subsea Cable System

The Subsea Cable System route options traverse Shoal Bay where there are no current activities that are likely to have caused impacts to the marine ecosystem. Around 50-80 km offshore, the Subsea Cable System route crosses the Bayu-Undan gas pipeline, and between 50 - 300 km offshore the route crosses the North-west telecommunications cable up to three times. These impact a narrow corridor of seabed and benthic habitats, which are likely to have recovered since installation occurred over 15 years ago. Cumulative environmental impacts are only likely to occur if there was a need for pipeline repair and this overlapped with AAPowerLink construction or repairs. This is a very unlikely event and therefore has not been further considered in the CIA.

3.5.2 Reasonably foreseeable future activities

There is a number of reasonably foreseeable future activities that could contribute to cumulative impacts along with the AAPowerLink. The activities considered in the AAPowerLink CIA are described in the sections below. These are located in the Barkly region where the Solar Precinct is located, Darwin Region where the OHTL (Utilities Corridor) and Darwin Converter Site are located and in the marine environment of outer Darwin Harbour and the Timor Sea where the Subsea Cable System will be laid. As there is limited detail and significant uncertainty with respect to the scope of these future activities, it is difficult to predict environmental impacts that could be residual after the implementation of avoidance techniques and mitigation measures by another proponent. The assessment of cumulative impacts associated with reasonably foreseeable future activities is focused on identifying what these impacts could be to provide context for the NT EPA's assessment of the AAPowerLink and future proposals. These are summarised in the Chapter 18 Whole of Environment.

3.5.2.1 Barkly Region

The following reasonably foreseeable future activities were considered in the CIA relating to the AAPowerLink Solar Precinct:

- Barkly Regional Deal and associated developments - This 10-year, $78.4 million commitment commenced in 2019 and aims to stimulate the Barkly region through economic growth and improving social outcomes. The plan includes several infrastructure components, including a weather radar, a youth justice facility, new housing, air strip upgrades, a student boarding facility, and several smaller infrastructure projects.
- Beetaloo Sub-Basin onshore gas developments – This is a significant gas basin situated between Katherine and Tennant Creek. The Basin has been identified by the NT Government as a high priority infrastructure initiative, to support the development of this gas basin for domestic and international use (Infrastructure Australia 2021a). Several companies are currently conducting, or looking to conduct, basin shale gas exploration in the Beetaloo Sub-Basin, and it is possible the basin could be developed in the next 5-10 years, which could then overlap with the AAPowerLink construction phase.
- Mining - There are several companies undertaking exploration and mining feasibility studies in the Barkly region. It is reasonably foreseeable that there will be future mining developments in the region and these projects may coincide with the AAPowerLink.

3.5.2.2 Darwin Region

The following reasonably foreseeable future activities were considered in the CIA relating to the AAPowerLink OHTL and Darwin Converter Site:

- Gunn Point Peninsula – Priority Development Zone - The Mapping the Future Project states the objective for the Gunn Point Peninsula is to be a rural centre with rural lots, tourism, horticulture, and a deep-water port at Glyde Point with associated industrial facilities.
- Future Renewable Energy Hub (Gunn Point Peninsula) - The Gunn Point Peninsula is also identified as a 'Future Renewable Energy Hub' in the Darwin-Katherine Electricity System Plan (NT Government, 2021b). The plan identifies that to achieve the NT Governments target of 50% renewable energy by 2030, will require investment in large-scale solar will be required in a shared location close to existing transmission lines.
- Project Sea Dragon – A prawn hatchery is proposed to be built as part of this project and is situated directly east of the Darwin Converter Site, with water intakes and discharge pipelines crossing Gunn Point Beach into Shoal Bay. A Development Permit has been issued under the *Planning Act*; however, it is uncertain when the facility will be constructed.

- Middle Arm Sustainable Development Precinct - The Northern Territory Government is working with industry and the Australian Government to transform Middle Arm into a globally competitive, sustainable precinct with a focus on low emission petrochemicals, renewable hydrogen, carbon capture storage and minerals processing. Further development of Middle Arm is supported by access to renewable energy sources (Land Development Corporation 2021).

3.5.2.3 Shoal Bay and Timor Sea

The following reasonably foreseeable future activities were considered in the CIA relating to the AAPowerLink Subsea Cable System:

- Santos Darwin Pipeline Duplication Project - Santos proposes to construct and operate the Darwin Pipeline Duplication (DPD) Project, to allow gas from the Barossa gas field in the Timor Sea, to be transported to Darwin LNG facility. The gas pipeline would be approximately 100 km in NT waters and 23 km in Commonwealth waters and will duplicate a section of the existing Bayu-Undan pipeline and include a shore crossing at Wickham Point in the Greater Darwin Area. The AAPowerLink Subsea Cable System route crosses the DPD route. This project was referred to the NT EPA and the referral documents indicate planed construction in 2023.

3.5.2.4 All regions

The renewable energy generated by the AAPowerLink has potential to drive economic development in the NT, by providing a significant source of low-cost electricity. The type and scale of development that could occur is difficult to predict, but it is reasonably foreseeable that mining and manufacturing-based industries could be made more feasible by having access to this resource.

3.6 References

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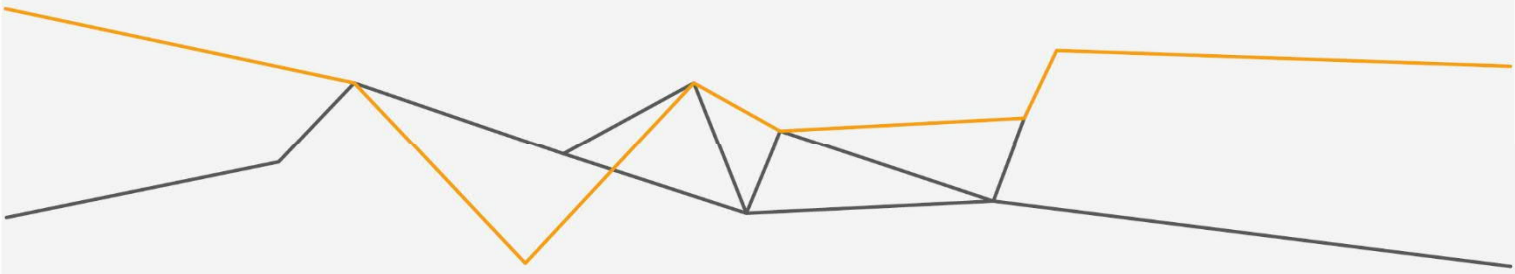

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