Berrimah Freight Terminal Expansion

Environmental Risk Assessment Report

Aurizon Operations

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0.2	3 November 2023	E. Aliotti L. Yallop	J. Woodworth	
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Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Aurizon Operations (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

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SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

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1.0 Introduction

1.1 Project Background

Aurizon Operations Ltd (Aurizon) commissioned SLR Consulting Australia Pty Ltd (SLR Consulting) to undertake an environmental risk assessment for the proposed Berrimah Freight Terminal Expansion. The proposed expansion will create a larger terminal with an integrated logistics focus, which will provide an ability to service both bulk and containerised freight, large container storage area, and potential for warehousing or colocation with incumbent freight forwarders. This report forms part of a larger set of documents prepared for the client by SLR Consulting for the environmental approval process.

The Berrimah Freight Terminal Expansion Project Area (the Project Area) is located approximately 6 km east of Darwin in the Darwin Coastal bioregion of the Northern Territory, on:

- 338 Berrimah Road, East Arm (existing rail terminal, Section 5411 Hundred of Bagot on plan S2000/191B)
- 330 Berrimah Road, East Arm (Section 5412 Hundred of Bagot on plan S2000/191B) and
- part of 270 Berrimah Road, East Arm (Section 6082 Hundred of Bagot on plan S2008/197B).

1.2 Risk Assessment

In accordance with the environment impact assessment guidance for proponents prepared by the Northern Territory Environment Protection Authority (NT EPA), and standard good practice, a risk assessment has been developed for the Project. The risk framework and assessment as described below has been used to identify the nature of risks and potential impacts associated with the Project and will be used to inform the development of appropriate management measures for identified risks.

In accordance with Table 1 of the NT EPA *Environmental Impact Assessment Guidance for Proponents (V2)* (NT EPA 2021a[1]), the risk assessment framework for the Project has been developed and implemented in accordance with international best practice standard methodologies including:

- AS/NZS ISO 31000:2018: Risk management— Principles and guidelines (Standard).
- HB 203:2006: Environmental risk management — Principles and process (Guide).

This risk assessment has also been developed with consideration of the NT EPA *Environmental Factors and Objectives* (NT EPA 2021b[2]). The framework has been developed and assessment completed to ensure that residual impacts can be managed in a way that the objectives of each environmental factor and stakeholder expectations can be met.

The Project and associated activities have been subject to a site-specific risk assessment conducted on 23 March 2023 by SLR and Aurizon Project Team members. The objective of

[1] https://depws.nt.gov.au/__data/assets/pdf_file/0003/816906/Guide-to-the-NT-environmental-impact-assessment-and-approval-process.pdf

[2] https://ntepa.nt.gov.au/__data/assets/pdf_file/0020/804602/guide-ntepa-environmental-factors-objectives.pdf

the risk assessment was to ensure that any significant risks were identified, evaluated and 'treated' to mitigate these risks. The risk assessment framework provides a mechanism for the proponent to identify and proactively address potential significant risk. It also demonstrates to stakeholders and regulators that the proposed Project risks have been considered in accordance with relevant guidelines and good practice, and that risk mitigation is appropriate to minimise any potential impacts.

2.0 Risk Assessment Process

The requirement for a risk assessment for the Project was identified after discussions with the Department of Environment, Parks and Water Security (DEPWS) with specific consideration of potential impacts to terrestrial ecosystems, mangroves and hydrological processes. In accordance with the NT EPA Environmental Impact Assessment Guidance for Proponents (NT EPA 2021a[1]), the risk assessment accounts for six environmental factors:

- Terrestrial environmental quality.
- Terrestrial ecosystems.
- Hydrological processes.
- Inland water environmental quality.
- Aquatic ecosystems.
- Community and economy.

This section describes how potential environmental risks from the implementation of the Project have been identified, evaluated and treated. Aurizon has considered risks arising from all phases of the Project including construction, commissioning and operations.

Aurizon has undertaken consultation with the relevant stakeholders to determine the perceived key risks associated with the Project and to develop the risk assessment and management of key risks.

2.1 Review

The risk assessment will be re-evaluated when a significant change is made to the Project. This will ensure any new risks can be identified and treated to be maintained at a "As Low As Reasonably Practicable" (ALARP) level.

2.2 Risk Identification

Risk relates to the effect of uncertainty on objectives. These objectives are primarily environmental goals within the objectives of the NT EPA for each environmental factor applicable to the Project. Risks are determined and assessed using a combination of the likelihood of occurrence and the consequence of an event. Identifying risks for the Project construction, commissioning and operational phases are based on the failure of control(s) associated with the environment, people, infrastructure or equipment in hazardous situations. The assessment considered potential direct, indirect and cumulative impacts.

Identifying the source of the risk, the likelihood of occurrence and the consequence of that occurring; the treatment or mitigation of the risk to reduce its impact, and determining the remaining residual risk has been undertaken using a standard qualitative risk matrix (**Table 1).** This process is aligned to the AS /NZS ISO 31000:2018 standard. This framework also aligns with the NT EPA Environmental Impact Assessment Guidance for Proponents (NT EPA 2021a[1]), which states:

"*Provide information that permits the general reader to understand the likelihood of occurrence and severity of each potentially significant environmental impact presented by*

the proposal. Consideration of risks presented by the proposal may be guided by undertaking a risk assessment consistent with the AS/ISO 31000 risk management series…..the analysis, including development of likelihood and consequence ratings for inherent and residual risk assessments, is to be based on referenced and relevant actual data and modelled predictions as appropriate." (p.15 - 16)

2.3 Risk Matrix

The assessment of risk has been conducted through pragmatic consideration of the circumstances around risks, identifying necessary controls to address potential impacts and assuming effective implementation of planned and committed mitigation of potential impacts. While prioritisation has been given to avoidance as per the environmental decision- making framework, mitigation is proposed, where possible, to achieve a reduced residual risk (risk after mitigation) to below "Extreme" or "High" risk outcomes to the extent that is reasonably practicable.

Table 1 provides a summary of the qualitative risk matrix adopted and the levels of risk for the various consequence and likelihood combinations.

Table 1 Qualitative Risk Analysis Matrix

	Consequence				
Likelihood	(1) Insignificant	(2) Minor	(3) Moderate	(4) Major	(5) Significant
(A) Almost certain	Moderate	High	Very High	Very High	Very High
(B) Likely	Moderate	Moderate	High	Very High	Very High
(C) Possible	Low	Moderate	Moderate	High	Very High
(D) Unlikely	Low	Low	Moderate	Moderate	High
(E) Rare	Low	Low	Low	Moderate	Moderate

Definitions of likelihood are provided in **Table 2**. Likelihoods are categorised around the probability of occurrence, within the context of reasonable timeframes and frequencies given the Project life. A brief description of each risk classification and interpreted outcome is also provided below in **Table 3**.

Table 2 Definition of Likelihood Classification

Rating	Likelihood	Frequency	Probability	Occurrence as Percentage
A	Almost certain	More than once per month	The event is expected to occur at some time as there is a history of continuous occurrence with similar projects/activities	91-100%
B	Likely	Less than once per month, but more than once per year	There is a strong possibility the event will occur as there is a history of frequent occurrence with similar projects/activities.	61-90%
C	Possible	Less than once per year, but more than once per five years	The event might occur at some time as there is a history of infrequent occurrence of similar issues with similar projects/activities.	41-60%
D	Unlikely	Less than once per five years	Not expected, but there's a slight possibility it may occur at some time.	11-40%

Rating	Likelihood	Frequency	Probability	Occurrence as Percentage
E	Rare	Unlikely to ever occur	Highly unlikely, but it may occur in exceptional circumstances.	0-10%

Table 3 Description of Risk Classification

Rating	Definition
Very High	Unacceptable risks primarily critical in nature in terms of consequences (e.g. extensive and long term environmental harm, permanent sacred site damage, fatality, massive economic impacts) that are considered a possibility through to almost certain to occur. Such risks significantly exceed the risk acceptance threshold and require comprehensive control measures, and additional urgent and immediate attention towards the identification and implementation of measures to reduce the level of risk.
High	Typically relate to significant to critical consequences (e.g. a major environmental or heritage damage, and considerable safety, social or economic impacts) that are inclined to cut across the possible to almost certain likelihood ratings. These are also likely to exceed the risk acceptance threshold and although proactive control measures have been planned or implemented, a very close monitoring regime and additional actions towards achieving further risk reduction is required
Moderate	As suggested by the classification, Moderate level risks span a group of risk combinations varying from relatively low consequence / high likelihood to mid-level consequences /mid-level likelihood, to relatively high consequence / low likelihood scenarios across environmental, social and economic areas. These risks are likely to require active monitoring as they are positioned on the risk acceptance threshold
Low	These risks are below the risk acceptance threshold and although they may require additional monitoring in certain cases are not considered to require active management. In general, such risks represent relatively low likelihood and low to mid-level consequence scenarios.

Table 4 describes the types of consequences that have been identified and assessed as part of the risk assessment process. These are grouped into the NT EPA environmental themes and factors, to demonstrate direct line-of-sight of the evaluation of risk with the key environmental factors as per the NT EPA objectives.

Table 4 Consequence Classification

NT EPA Themes and Factors		Consequence				
Theme	**Factors**	**(1) Insignificant**	**(2) Minor**	**(3) Moderate**	**(4) Major**	**(5) Significant**
LAND	**Landforms**	Negligible impact to existing landforms.	Contained low impact, not impacting on any large-scale landforms.	Moderate impact on small-scale landforms on the Project area.	Moderate impact on landforms at a large-scale on and off the Project area.	Major impacts on landforms on a large-scale on and off the Project area.
	Terrestrial Environmental Quality	Negligible impact to isolated area.	Contained low impact, not impacting on any environmental values of soil or land.	Uncontained impact, able to be rectified in short-term without causing pollution or contamination to soil or land.	Extensive hazardous impact on an environmental value requiring long-term remediation of soil or land.	Uncontained hazardous impact with residual effect, even with long term remediation of soil or land.
	Terrestrial Ecosystem	Alteration or disturbance to an isolated area that is unlikely to affect the habitat, species or ecosystem functioning.	Alteration or disturbance to less than 5% of a habitat, species or ecosystem functioning resulting in a minor, recoverable impact within 1 year.	Alteration or disturbance to 5-30% of a habitat, species or ecosystem functioning resulting in a moderate, recoverable impact within 1-2 years.	Alteration or disturbance to 30-70% of a habitat, species or ecosystem functioning result in a major, recoverable impact within 3-10 years.	Alteration of more than 70% of a habitat, species or ecosystem functioning resulting in an extinction or permanent change, or reduce threshold level below 30%. Recovery, if possible is greater than 10 years.
WATER	**Hydrological Processes**	Negligible impact to hydrological processes in Project area (surface or groundwater) and no consequence to the use of water.	Contained low impact to hydrological processes in Project area (surface or groundwater) with minor recoverable impact within 1 year.	Uncontained impact to hydrological processes that will affect the use of the water including outside the Project area but can be remediated in the short-term (1-2 years).	Extensive impact to hydrological processes that will affect the use of the water including outside the Project area and requires long-term remediation (3-10 years).	Uncontained hazardous impact to hydrological processes with residual effect, even with long- term remediation (greater than 10 years).
	Inland Water Environmental Quality	Negligible impact to water quality (surface or groundwater) in Project area and no consequence to the human or ecological uses of the water.	Contained low impact to water quality (surface or groundwater) in Project area with minor recoverable impact within 1 year.	Uncontained impact to water quality that will affect the human or ecological use of the water including outside the Project area but can be	Extensive impact to water quality that will affect the human or ecological use of the water including outside the Project area and requires long-term remediation (3-10 years).	Uncontained hazardous impact to water quality with residual effect, even with long-term remediation (greater than 10 years).

NT EPA Themes and Factors		Consequence				
				remediated in the short-term (1-2 years).		
	Aquatic Ecosystems	Negligible impact to aquatic ecosystems through quality or flow changes in Project area, but unlikely to affect the habitat, species or ecosystem functioning.	Contained low impact to aquatic ecosystems through quality or flow changes in Project area, with minor recoverable impact within 1 year.	Uncontained impact to aquatic ecosystems through quality or flow changes, with moderate consequence to habitat, species or ecosystem functioning including outside the Project area but can be remediated in the short-term (1-2 years).	Extensive impact to aquatic ecosystems that will affect the species or ecosystem functioning including outside the Project area and requires long-term remediation (3-10 years).	Uncontained impact to aquatic ecosystem with residual effect, even with long-term remediation (greater than 10 years).
SEA	**Coastal Processes**	Negligible impact to coastal processes through quality or vegetation removal in Project area, but unlikely to affect the habitat, species or ecosystem functioning.	Contained low impact to coastal processes through quality or vegetation removal in Project area, with minor recoverable impact within 1 year	Uncontained impact to coastal processes through quality or vegetation removal, with moderate consequence to habitat, species or ecosystem functioning including outside the Project area but can be remediated in the short-term (1-2 years).	Extensive impact to coastal processes that will affect the species or ecosystem functioning including outside the Project area and requires long-term remediation (3-10 years).	Uncontained impact to coastal processes with residual effect, even with long-term remediation (greater than 10 years).
	Marine Environmental Quality	Negligible impact to marine environmental quality through changes to water quality or vegetation removal in Project area, but unlikely to affect the habitat, species or ecosystem functioning.	Contained low impact to marine environmental quality through changes to water quality or vegetation removal in Project area, with minor recoverable impact within 1 year	Uncontained impact to marine environmental quality through changes to water quality or vegetation removal, with moderate consequence to habitat, species or ecosystem functioning including outside the Project area but can be remediated in the short-term (1-2 years).	Extensive impact to marine environmental quality that will affect the species or ecosystem functioning including outside the Project area and requires long-term remediation (3-10 years).	Uncontained impact to marine environmental quality with residual effect, even with long-term remediation (greater than 10 years).
	Marine Ecosystems	Negligible impact to marine ecosystems through changes to water quality or vegetation	Contained low impact to marine ecosystems through changes to water quality or vegetation	Uncontained impact to marine ecosystems through changes to water quality or vegetation	Extensive impact to marine ecosystems that will affect the species or ecosystem functioning	Uncontained impact to marine ecosystems with residual effect, even with

NT EPA Themes and Factors		Consequence				
		removal in Project area, but unlikely to affect the habitat, species or ecosystem functioning.	removal in Project area, with minor recoverable impact within 1 year	removal, with moderate consequence to habitat, species or ecosystem functioning including outside the Project area but can be remediated in the short-term (1-2 years).	including outside the Project area and requires long-term remediation (3-10 years).	long-term remediation (greater than 10 years).
AIR	**Air Quality**	Negligible impact to air quality through changes to train and vehicle movements in the Project area, but unlikely to affect the surrounding environment and population	Low impact to air quality through changes to train and vehicle movements in the Project area, with minor recoverable impact within 1 year	Uncontained impact to air quality through changes to train and vehicle movements in the Project area, with moderate consequence to the environment and population including outside the Project area but can be remediated in the short-term (1-2 years).	Extensive impact to air quality through changes to train and vehicle movements in the Project area, that will affect the environment and population including outside the Project area and requires long-term remediation (3-10 years).	Uncontained impact to air quality with residual effect, even with long-term remediation (greater than 10 years).
	Atmospheric Processes	Negligible impact to atmospheric processes through changes to train and vehicle movements in the Project area, but unlikely to affect the surrounding environment and population	Low impact to atmospheric processes through changes to train and vehicle movements in the Project area, with minor recoverable impact within 1 year	Uncontained impact to atmospheric processes through changes to train and vehicle movements in the Project area, with moderate consequence to the environment and population including outside the Project area but can be remediated in the short-term (1-2 years).	Extensive impact to atmospheric processes through changes to train and vehicle movements in the Project area, that will affect the environment and population including outside the Project area and requires long-term remediation (3-10 years).	Uncontained impact to atmospheric processes with residual effect, even with long-term remediation (greater than 10 years).

NT EPA Themes and Factors		Consequence				
PEOPLE	**Community and Economy** **Culture and Heritage** **Human Health**	Incident with or without minor injury. No impact on human health or very minor short term inconvenience or symptoms OR Adverse local social or economic implications that are brief or periodic.	Injuries requiring first aid treatment. Minor short term inconvenience or symptoms to human health OR Adverse local or regional, social or economic implications that last for 1 year.	Injury or illness requiring medical treatment. Short term or reversible disabling effect (impairment) to human health OR Adverse local or regional, social or economic implications that last for 1-2 years.	Injuries requiring hospitalisation. Serious long term or permanent disabling effects on human health Adverse local, regional or territory-wide, social or economic implications that last for 3-10 years.	Loss of life / fatality or long term or permanent disabling effects on human health Adverse local, regional territory-wide or national, social or economic implications that last for greater than years.

2.4 Risk Treatment

In accordance with the NT EPA Guidance on preparing an Environmental Impact Statement (NT EPA 2021[1]), when considering risk mitigation, the environmental decision-making hierarchy has been used to guide the identification and selection of appropriate controls. As per the guideline, proponents must demonstrate that the environmental decision- making hierarchy has been applied to avoid or mitigate potentially significant environmental impacts where practicable. Section 26 of the *Environment Protection Act 2019* states the environmental decision-making hierarchy is as follows:

a) "Ensure that actions are designed to avoid adverse impacts on the environment;

b) Identify management options to mitigate adverse impacts on the environment to the greatest extent practicable; and

c) If appropriate, provide for environmental offsets in accordance with the Act for residual adverse impacts on the environment that cannot be avoided or mitigated.

In making decisions in relation to actions that affect the environment, proponents must ensure that the potential for actions to enhance or restore environmental quality is identified and provided for to the extent practicable."

The hierarchy has been used in developing the risk assessment matrix to assist in applying appropriate mitigation measures where risks cannot be avoided. Generally, mitigation measures for significant environmental risks include adaptive management or ongoing monitoring. Each of the key environmental factor sections also provide an avoidance, mitigation and management sub-section that prioritises measures to avoid in accordance with the hierarchy.

2.5 Risk Evaluation and Assessment

The risk evaluation and assessment section provides a discussion of the key outcomes of the risk assessment. The risk assessment provides a good understanding of the Project risk profile and has enabled priority risks to be highlighted in order to minimise the likelihood of occurrence and / or the consequence severity. Risk assessments were based on the outcomes of planned mitigation and monitoring to detect incipient or actual failure of management systems.

It is important to note that the likelihood and consequence of risks vary across the Project stages. For example, the risk of impacts from vegetation clearing are highest during the construction stage, whereas stormwater runoff and GHG emissions may be greatest during operations. The risk assessment process has considered the applicable stages and based the assessment of residual risk on the stage for which the greatest risk is expected.

3.0 Risk Assessment Results

In total, 36 different sources of environmental, health, social and economic risks were identified and evaluated. Of these,10 of the risks applied to the land theme, 5 to the water theme, 9 to the sea theme and 8 to the people theme. The risk assessment was completed against each of the environmental factors and many of the risks apply to multiple factors. A summary of the identified risk and the applicable factors is provided in **Table 5**.

Table 5 Identified Risks and Relevant Factors

No	Stage	Risk/Potential Source of Impact	Relevant Factor					
			Terrestrial Environmental	Terrestrial Ecosystem	Water	Sea	Air	People
1	Clearing Construction	Exposure of contaminants during earthworks Disturbance of ASS	X					
2	Construction	Discharge of containments in the form of construction wastes	X					
3	Construction Operations	Loss of contaminants or spills of chemicals, hydrocarbons, and hazardous substances	X					
4	Clearing Construction	Clearing of existing vegetation	X					
5	Clearing Construction	Clearing of mangroves (sensitive vegetation)		X				
6	Clearing Construction	Clearing of potential fauna habitat for construction footprint and temporary work areas		X				
7	Clearing Construction	Removal of near- threatened fauna habitat		X				
8	Clearing Construction	Activity disturbs migratory bird activity		X				
9	Clearing Construction	Light spill impacting on nocturnal fauna activities.		X				
10	Clearing Construction	Spread of introduced weed species and pest species from movement of vehicles, machinery, materials and equipment.		X				
11	Construction Operations	Fire ignition due to construction activities		X				
12	Clearing Construction	Mobilisation of sediments in stormwater runoff Changes to drainage pathways due to stormwater runoff			X			
13	Construction Operations	Increased peak flow rate of stormwater discharge due to increase in impervious areas			X			
14	Construction	Discharge of sediments and contaminants from exposed soils			X			
15	Construction	Loss of containment or spills of chemicals, hydrocarbons and hazardous substances			X			
16	Operations	Contaminants present in stormwater runoff if not contained			X			
17	Clearing Construction	Earthworks - Discharge of sediment and associated contaminants from exposed soil during clearing and earthworks/construction phase				X		
18	Construction Operations	Spills of chemicals, hydrocarbons, and hazardous substances				X		

No	Stage	Risk/Potential Source of Impact	Relevant Factor					
			Terrestrial Environmental	Terrestrial Ecosystem	Water	Sea	Air	People
19	Operations	Contaminants present in stormwater runoff if not contained				X		
20	Construction	Disturbance of Acid sulfate soil (ASS)				X		
21	Construction Operations	Reportable spills (hydrocarbons, chemicals, metals, paints etc)				X		
22	Construction Operations	Light spill impacting on nocturnal fauna activities.				X		
23	Construction	Discharge of contaminants (sediments, stormwater)				X		
24	Operations	Discharge of contaminants (stormwater)				X		
25	Construction	Marine fauna and intertidal fauna				X		
26	Construction	Dust emission from activities, including land clearing, equipment movement, placement and stockpiles.					X	
27	Construction Operations	Emissions from railway station (trains, trucks, light vehicles, etc)					X	
28	Construction Operations	Greenhouse gas emissions from construction vehicles at the site and train movements at the site during operations.					X	
29	Operations	Increase in greenhouse gas emission resulting in global warming					X	
30	Construction	People: Accommodation						X
31	Construction	People: Workforce						X
32	Construction Operations	Economic Impacts: Local Benefits						X
33	Clearing Construction	Presence of items of WWII cultural heritage						X
34	Clearing Construction	Presence of items of Aboriginal cultural heritage						X
35	Construction	Presence of UXOs						X
36	Construction Operations	The Project area is located within and adjacent to mangroves and workers will be exposed to biting insects on a daily basis.						X
37	Construction	The increase of vehicle movement will impact the traffic flow and risks.						X

3.1 Risk Assessment Summary

Table 6 summarises the outcomes of the risk assessment process. The specific consequence and likelihood scenarios are detailed in **Table 7** along with the residual risk rating, based on a reasonable assumption of effective implementation of the control measures described. Ongoing monitoring and management will be required to validate the

effectiveness of these controls, audit their implementation and identify other measures or different approaches that may be required to achieve and maintain acceptable risk levels.

The results of the risk assessment have been used to inform an assessment of whether the Project achieves the NT EPA objectives for the relevant environmental factors.

Table 6 Summary of Risks

Theme	Risk Level				
	Low	Moderate	High	Very High	Total
Land					
Terrestrial Environmental Quality					
Inherent			3	1	4
Residual	3	1			4
Terrestrial Ecosystems					
Inherent	1	2	2	2	7
Residual	3	4			7
Water					
Hydrological Processes					
Inherent		2			2
Residual	2				2
Inland Water Environmental Quality					
Inherent			3		3
Residual	2	1			3
Sea					
Coastal Processes					
Inherent			3		3
Residual	3				3
Marine Environmental Quality					
Inherent			2		2
Residual	2				2
Marine Ecosystems					
Inherent	1		3		4
Residual	4				4
Air					
Air Quality					
Inherent			1		1
Residual	1				1
Atmospheric Processes					
Inherent		3			3
Residual	3				3
People					
Community and Economy					

Theme	Risk Level				
	Low	Moderate	High	Very High	Total
Inherent	3				3
Residual	3				3
Culture and Heritage					
Inherent		2			2
Residual	2				2
Human Health					
Inherent			2		2
Residual	2				2

Table 7 Risk Assessment Register

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
LAND											
Landforms Objective: Conserve the variety and integrity of distinctive physical landforms.											
There are no distinctive landforms within the Project area.											
Terrestrial environmental quality Objective: Protect the quality and integrity of land and soils so that environmental values are supported and maintained.											
1	Clearing Construction	• Exposure of contaminants during earthworks. • Disturbance of ASS. • ASS runoff mobilising metals within the soils which may enter terrestrial ecosystem. • Presence of UXO.	• Construction activities – disturbance, excavation of soils. • Exposure of potential Acid Sulfate Soils (ASS). • Exposure of potential metals or hydrocarbons. • Exposure of soil containing asbestos. • Exposure of UXO.	• Disturbance of ASS and subsequent contamination. • Potential to generate acidic and metal drainage/runoff. • Potential of uncontrolled dumping of industrial waste: o Impact to human health and surrounding terrestrial ecosystem. o Contaminated runoff discharging into marine ecosystem	Likely	Major	High	• Major earthworks occur predominantly in the Dry Season. • Implementation of an ASS Management Plan. • Implement an unexpected finds procedure to identify and manage contaminated materials if present during clearing. • Implement methodologies to minimise mud waving. • Implement an Erosion and sediment control plan (ESCP). • Stormwater and erosion and sediment controls to be implemented to control potentially contaminated water discharge to Darwin Harbour, incorporating: o Staging works and accounting for tidal inundation. o Protection of bare soil, slopes, topsoil stockpiles and stream lines from erosion by employing soil conservation techniques. o Management of stormwater flows to prevent erosion. o Use of temporary sediment traps and settling areas to trap sediment o Use of a monitoring and management plan to ensure water released to Darwin Harbour is of acceptable quality o Drains will be designed and constructed to produce non-scour velocities and to avoid erosion at inlet and outlet points o Laydown areas will be located in already disturbed areas and temporary fencing will be used to secure storage areas for fuels, materials and machinery in accordance with Australian Standards.	Unlikely	Minor	Low

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
								• The following actions will be incorporated into the Construction Environmental Management Plan (CEMP): o Assessment of areas for contaminants of potential concern (e.g. asbestos) o Areas identified with asbestos containing materials will be inspected by a licensed assessor to confirm the nature of any asbestos contamination present, and, where relevant, an Asbestos Management Plan will be adopted for excavation and construction works should significant amounts of Asbestos Containing Material be present. For minor quantities, an unexpected finds protocol will be adopted. o Identification and removal of known contaminants prior to clearing. o Stop works if suspected contaminated soils or material encountered and further investigate. o Limit the area of exposed earth and period of exposure during clearing.			
2	Construction	• Discharge of containments in the form of construction wastes.	• Contaminants entering terrestrial ecosystems.	• Contaminants adversely impacting invertebrate fauna in mangrove areas.	Likely	Major	High	• Engineering design to capture all hazardous waste and wastewater. • Sediment traps to be installed. • Waste management programs.	Unlikely	Minor	Low
3	Construction Operations	• Loss of contaminants or spills of chemicals, hydrocarbons, and hazardous substances.	• Spills/leaks of petrol, oils, lubricants, hazardous materials, paints, thinners and litter	• Adverse impact on soil quality within and adjacent to project footprint. • Contaminants adversely impacting invertebrate fauna in mangrove areas.	Possible	Major	High	• Chemical storage and handling procedures which includes minimising storage onsite. • Stormwater management system including sediment traps. • Spill response procedures including and availability of spill kits and training. • Contractor to develop a Hazardous Material Management Procedure including but not limited to the following: o Ensure stockpiles of bulk materials are well contained separated from exposed soils. o Training for personnel in implementation of safe work practices to minimise risks and impacts of spillage of fuels, chemicals and other contaminants.	Unlikely	Moderate	Low

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
								o Record and report all hydrocarbon, chemical and hazardous substance spills. o Ensure personnel have access to spill kits that contain an absorbent material and contaminated disposal sites.			
4	Construction	• Clearing of existing vegetation.	• Removal of vegetation and topsoil. • Leave area susceptible to erosion and infestation of weeds.	• Loss of topsoil during overland flows. • Eroded topsoil causing sedimentation in marine environment. • Increase in areas of declared weeds.	Almost Certain	Moderate	Very High	• All clearing to be staged and undertaken predominantly in the Dry Season and between tides. • All clearing to be undertaken in accordance with Land Clearing Guidelines (DEPWS, 2021c) and defined in CEMP. • Any cleared land outside of the direct footprint is to be rehabilitated using appropriate soils and vegetation. • Appropriate drainage design implemented to prevent ongoing erosion issues.	Possible	Minor	Moderate
Terrestrial Ecosystems Objective: Protect terrestrial habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.											
5	Clearing Construction	• Clearing of mangroves (sensitive and significant vegetation).	• Loss of habitat for vertebrate fauna	• Lack of habitat impacting on vertebrate fauna populations.	Almost certain	Moderate	Very High	• Report on the type of mangrove and regional context. • Limit the extent of the clearing footprint as much as practicable. • Control the extent of clearing (flagging, etc) to prevent the likelihood of over-clearing.	Possible	Minor	Moderate
6	Clearing Construction	• Clearing of potential fauna habitat for construction footprint and temporary work areas.	• Removal of fauna habitat	• Injury or death of fauna or destruction of habitat.	Almost Certain	Moderate	Very High	• Land clearing only to be undertaken in approved areas and as per NT land clearing guidelines. • Implementation of a pre-clearance procedure to identify fauna habitat. • Pre-clearance relocation of identified fauna.	Possible	Minor	Moderate
7	Clearing Construction	• Threatened species.	• Removal of fauna habitat	• Impact on threatened flora and fauna species through loss of habitat.	Almost Certain	Moderate	Very High	• Land clearing only to be undertaken in approved areas and as per NT land clearing guidelines. • Implementation of a pre-clearance procedure to identify fauna habitat. • Pre-clearance relocation of identified fauna.	Likely	Moderate	High
8	Construction	• Migratory species.	• Activity disturbs migratory bird activity	• Impacts on migratory bird foraging.	Likely	Moderate	Moderate	• Separation distance of at least 100m from significant habitat (ie saltpan) • Construction occurs in the Dry Season. • Adoption of suitable construction methodologies to minimise impacts from clearing. • Preparation and implementation of a Construction Noise and Vibration	Unlikely	Major	Low

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
								Management Plan (CNVMP) to support the CEMP.			
9	Construction Operations	• Lighting.	• Light spill impacting on nocturnal fauna activities.	• Potential for light spill to alter nocturnal activities of native and threatened species.	Possible	Minor	Moderate	• CEMP and OEMP will dictate that light spill be reduced to as low as reasonably possible.	Unlikely	Minor	Low
10	Construction & Operations	• Weeds.	• Spread of introduced weed species and pest species from movement of vehicles, machinery, materials and equipment.	• Potential impacts to adjacent vegetation from increased weeds • Increase in number and density of weed infestations	Likely	Major	High	• Development of a Weed Management Plan including but not limited to the following: o Review and relevant weed mapping and signpost areas of significant weed infestation o Vehicle washdown stations o Routine monitoring of infestations and controls. o Management practice to prevent the introduction and spread of weeds to be included in the CEMP and OEMP o Ongoing monitoring and weed controls.	Possible	Moderate	Moderate
11	Construction & Operations	• Fire ignition due to construction activities.	• Uncontrolled bushfire.	• Loss or damage to terrestrial ecosystems.	Unlikely	Moderate	Moderate	• Contractor to develop and implement a Fire Management Plan.	Unlikely	Minor	Low
WATER											
Hydrological processes Objective: 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.											
12	Clearing Construction	• Changes to drainage lines.	• Mobilisation of sediments in stormwater runoff. • Changes to drainage pathways due to stormwater runoff. • Scouring of drainage pathways due to stormwater runoff.	• Potential to increase sedimentation in the Harbour.	Likely	Moderate	Moderate	• All clearing to be staged and undertaken predominantly in the Dry Season and between tides. • Design of stormwater systems to consider existing natural drainage lines.	Unlikely	Minor	Low
13	Construction Operations	• Increased peak flow rate of stormwater discharge due to increase in impervious areas.	• Mobilisation of sediments in stormwater runoff. • Changes to drainage pathways due to stormwater runoff. • Scouring of drainage pathways due to stormwater runoff.	• Potential to increase sedimentation in the Harbour.	Likely	Moderate	Moderate	• All clearing to be staged and undertaken predominantly in the Dry Season and between tides. • Project design and drainage strategy to incorporate stormwater outfall structures with an appropriate energy dissipation measures. • Ongoing monitoring and maintenance of stormwater systems.	Unlikely	Minor	Low
Inland water environmental quality Objective: 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.											
14	Construction	• Discharge of sediments and contaminants from exposed soils.	• Mobilisation of sediments and contamination in stormwater runoff.	• Potential to increase sedimentation in the Harbour. • Potential for contaminants to enter Harbour.	Likely	Moderate	High	• All clearing to be staged and undertaken predominantly in the Dry Season and between tides. • Preparation of a CEMP containing an ESCP reflecting relevant Australian Standards including the use of silt curtains.	Possible	Minor	Moderate

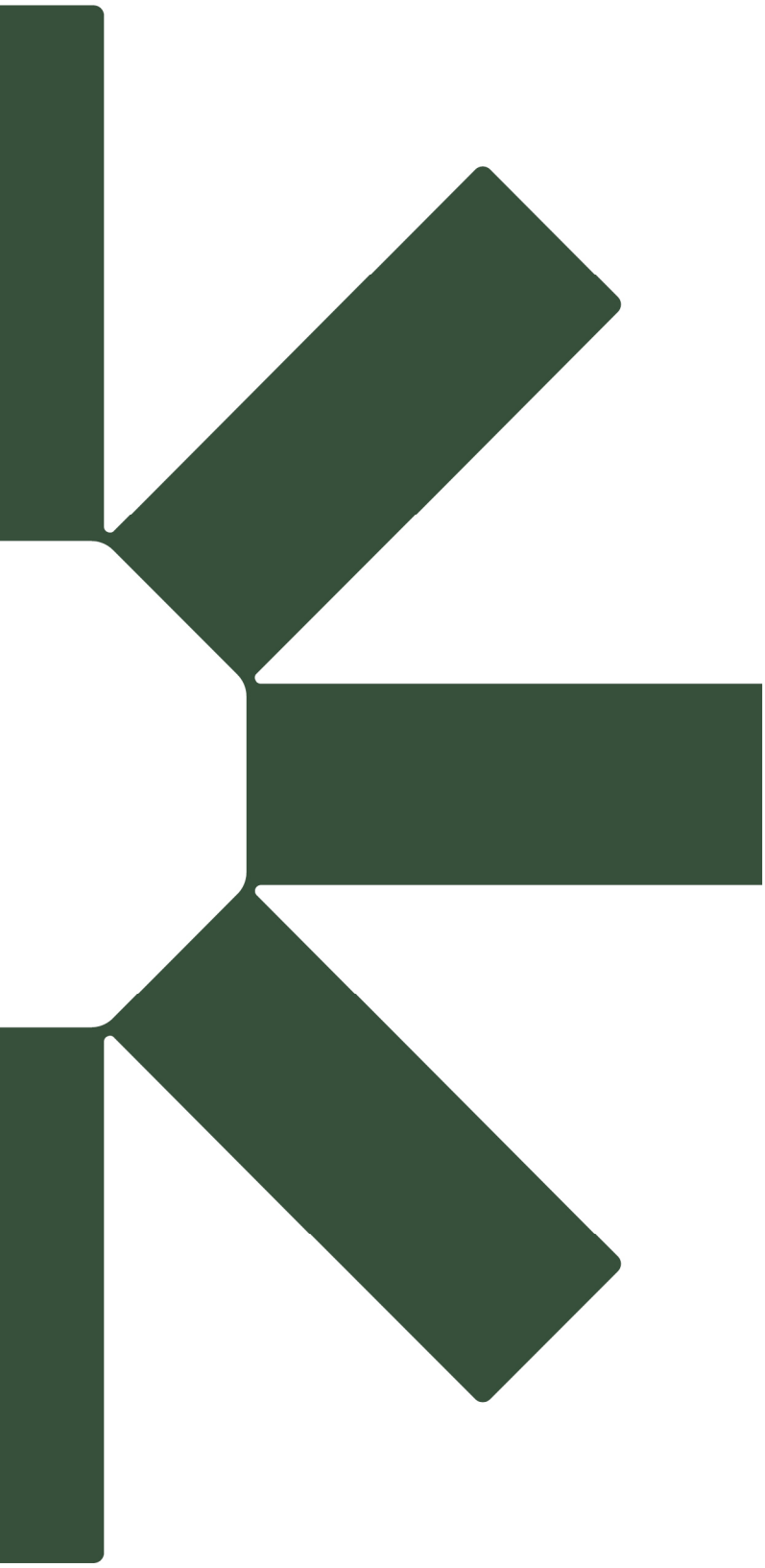
Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
								• Stormwater management system.			
15	Construction	• Loss of containment or spills of chemicals, hydrocarbons and hazardous substances.	• Contaminants present in stormwater runoff if not contained.	• Potential for contaminants to enter Harbour if not contained and managed.	Possible	Moderate	High	• Compliance with AS1940-2004 (Storage and handling of flammable and combustible liquids). • Chemical storage and handling procedures which includes minimising storage onsite. • Hazardous Substances Management Plan. • Stormwater management system. • Spill response procedures including availability of spill kits and training.	Unlikely	Minor	Low
16	Operations	• Loss of containment or spills of chemicals, hydrocarbons and hazardous substances.	• Contaminants present in stormwater runoff if not contained.	• Potential for contaminants to enter Harbour if not contained and managed.	Possible	Moderate	High	• Ongoing monitoring and maintenance of wastewater treatment system and stormwater management system. • Chemical storage and handling procedures including minimising hazardous materials stored on site. • Spill response procedure including marine spill response plan and availability of spill kits and training.	Unlikely	Minor	Low
Aquatic Ecosystems Objective: Protect aquatic habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning.											
No freshwater aquatic ecosystems are present on site.											
SEA											
Coastal processes Objective: Protect the geophysical and hydrological processes that shape coastal morphology so that the environmental values of the coast are maintained											
17	Clearing Construction	• Earthworks - Discharge of sediment and associated contaminants from exposed soil during clearing and earthworks/construction phase. • Disturbance of ASS.	• Increased sediment levels in stormwater caused by erosion during construction flowing to Darwin Harbour. • Mobilisation of soil or water contaminants to Darwin Harbour. • Construction activities – disturbance, excavation of soils • Exposure of potential ASS.	• Potential to increase sedimentation in the Harbour. • Potential for contaminants to enter Harbour and impact on intertidal zone. • Potential to generate acidic conditions and subsequent metal mobilisation in drainage/runoff.	Likely	Moderate	High	• All clearing to be staged and undertaken predominantly in the Dry Season and between tides. • Soil contamination investigations baseline. • A CEMP which includes: o ASS Management Plan. o Unexpected finds protocol. o ESCP. o Use of silts curtains during reclamation activities if required. • Suitable methodologies to minimise mud waving	Unlikely	Minor	Low
18	Construction Operations	• Spills of chemicals, hydrocarbons, and hazardous substances	• Contaminants present in stormwater runoff if not contained	• Potential for contaminants to enter Harbour if not contained and managed.	Possible	Moderate	High	• Compliance with AS1940-2004 (Storage and handling of flammable and combustible liquids). • Hazardous Substances Management Plan.	Unlikely	Minor	Low

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
								• Spill kits located on site and appropriate personnel trained in their use.			
19	Operations	• Discharge of contaminants (stormwater).	• Contaminants present in stormwater runoff if not contained.	• Potential for contaminants to enter Harbour if not contained and managed.	Possible	Moderate	High	• Stormwater and wastewater system maintenance. • OEMP to include mitigation to reduce build-up of contaminants on hardstand areas.	Unlikely	Minor	Low
Marine environmental quality Objective: Protect the quality and productivity of water, sediment and biota so that environmental values are maintained											
20	Construction	• Disturbance of ASS.	• Construction activities – disturbance, excavation of soils • Exposure of potential ASS.	• Potential to generate acidic conditions and subsequent metal mobilisation in drainage/runoff.	Likely	Moderate	High	• All clearing to be staged and undertaken predominantly in the Dry Season and between tides. • A Construction Environmental Management Plan (CEMP) which includes: o ASS Management Plan. o Erosion Sediment Control Plan (ESCP).	Unlikely	Minor	Low
21	Construction and Operations	• Reportable spills (hydrocarbons, chemicals, metals, paints etc).	• Contaminants present in stormwater runoff if not contained	• Potential for contaminants to enter Harbour if not contained and managed.	Possible	Moderate	High	• All clearing to be staged and undertaken predominantly in the Dry Season and between tides. • Spill kits located on site and appropriate personnel trained in their use.	Unlikely	Minor	Low
Marine ecosystems Objective: Protect marine habitats to maintain environmental values including biodiversity, ecological integrity and ecological functioning											
22	Construction Operations	• Lighting.	• Light spill impacting on nocturnal fauna activities.	• Potential for light spill to alter nocturnal activities of native species.	Unlikely	Minor	Low	• CEMP and OEMP will dictate that light spill be reduced to as low as reasonably possible.	Unlikely	Minor	Low
23	Construction	• Discharge of contaminants (sediments, stormwater).	• Contaminants present in stormwater runoff if not contained.	• Discharge of sediment and associated contaminants from exposed soil during earthworks/construction phase.	Likely	Moderate	High	• ESCP. • Stormwater Management Plan. • Compliance with AS1940-2004 (Storage and handling of flammable and combustible liquids). • Stormwater retention and treatment systems incorporated into Project design.	Unlikely	Minor	Low
24	Operations	• Discharge of contaminants (stormwater).	• Contaminants present in stormwater runoff if not contained.	• Potential for contaminants to enter Harbour if not contained and managed.	Possible	Moderate	High	• Stormwater and wastewater system maintenance. • OEMP to include mitigation to reduce build-up of contaminants on hardstand areas.	Unlikely	Minor	Low
25	Construction	• Marine fauna and intertidal fauna.	• Increased sediment levels in stormwater caused by erosion during construction flowing to Darwin Harbour. • Mobilisation of soil or water contaminants to Darwin Harbour.	• Impacts on fauna from decreased water quality in Darwin harbour due to sediment in stormwater flowing to Darwin Harbour. • Impacts on fauna from decreased water quality in Darwin harbour due to	Possible	Moderate	High	• Stormwater and erosion and sediment controls to be implemented to control potentially contaminated or sediment bearing water discharge to Darwin Harbour, incorporating: o General measures for erosion and sedimentation control including:	Unlikely	Minor	Low

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
				mobilisation of soil or water contaminants to Darwin Harbour.				o Protection of bare soil, slopes, topsoil stockpiles and stream lines from erosion by employing soil conservation techniques. o Management of stormwater flows to prevent erosion. o Use of temporary sediment traps and settling areas to trap sediment. o Use of a management plan to ensure water released to Darwin Harbour is of acceptable quality. o Drains will be designed and constructed to produce non-scour velocities and to avoid erosion at inlet and outlet points.			
AIR											
Air quality Objective: Protect air quality and minimise emissions and their impact so that environmental values are maintained											
26	Construction	• Dust.	• Dust emission from activities, including land clearing, equipment movement, placement and stockpiles.	• Construction activities may impact the local environment and humans though increased dust, odours and gaseous emissions, as well as release of dust from soil stockpiles. Impacts are expected to be localised. • Marginal increase in existing levels of key pollutants at local and regional scale.	Likely	Moderate	High	• Incorporation of a Construction Air Quality Management Plan (CAQMP) into the CEMP. • Inform adjoining neighbours of construction activities. • Dust management controls including limiting movement of dusty materials when bushfire smoke levels are high, eliminating dust production at the source, use of water trucks for dust suppression and covering materials during transport.	Unlikely	Minor	Low
Atmospheric Processes Objective: Minimise greenhouse gas emissions so as to contribute to the NT Government's goal of achieving net zero greenhouse gas emissions by 2050.											
27	Construction Operations	• Emissions from railway station (trains, trucks, light vehicles, etc).	• Greenhouse gas emissions from construction vehicles at the site and train movements at the site during operations.	• Construction activities may impact the local environment and humans though increased GHG emissions. Impacts are expected to be localised. • Marginal increase in existing levels of key GHGs at local and regional scale. • Potential for cumulative impacts in the area.	Likely	Minor	Moderate	• Incorporation of a Construction Air Quality Management Plan (CAQMP) into the CEMP. • Limit vehicle speed on site. • Seal permanent roads and areas planned to be sealed as soon as practicable. • Efficient operation of machinery, equipment and vehicles to minimise exhaust emissions. • Maintain equipment and vehicles to ensure engine and fuel efficiency.	Unlikely	Minor	Low
28	Construction Operations	• Increase in greenhouse gas emission resulting in global warming.	• Greenhouse gas emissions from construction vehicles at the site and train movements at the site during operations.	• Construction activities may impact the local environment and humans though increased GHG emissions. Impacts are expected to be localised.	Possible	Minor	Moderate	• Maintain equipment and vehicles to ensure engine and fuel efficiency. • Reduce travel distances both on-site and off-site.	Unlikely	Minor	Low

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
				• Marginal increase in existing levels of key GHGs at local and regional scale • Potential for cumulative impacts in the area.				• Minimise idling time of plant and equipment and switch engines off when not in use. • Minimise the extent of vegetation cleared during construction. • Recycle any waste produced where feasible.			
29	Operations	• Increase in greenhouse gas emission resulting in global warming.	• Greenhouse gas emissions from vehicles and plant at the site and train movements at the site during operations.	• Construction activities may impact the local environment and humans though increased GHG emissions. Impacts are expected to be localised. • Marginal increase in existing levels of key GHGs at local and regional scale. • Potential for cumulative impacts in the area.	Possible	Minor	Moderate	• Consider NTG's towards 2050 policy. • Procure power from renewable energy suppliers wherever possible. • Prioritise the selection and use of electric vehicles and equipment if possible. • Maintain equipment and vehicles to ensure engine and fuel efficiency.	Unlikely	Minor	Low
PEOPLE											
Communities and economy Objective: Enhance communities and the economy for the welfare, amenity and benefit of current and future generations of Territorians.											
30	Construction	• People: Accommodation.	• Aurizon will utilise local contractors to conduct the clearing and construction.	• A local workforce will be used therefore no additional accommodation is required.	Rare	Insignificant	Low	• There is no requirement for workforce accommodation management.	Rare	Insignificant	Low
31	Construction	• People: Workforce.	• Aurizon will utilise local contractors to conduct the clearing and construction. • Aurizon will utilise their own personnel during operations. Local contractors will be utilised if required for specific tasks.	• Local suppliers and contractors will be utilised for clearing and construction.	Rare	Insignificant	Low	• Where possible local suppliers and contractors will be used. The overall impact of the project will be positive.	Rare	Insignificant	Low
32	Construction & Operations	• Economic Impacts: Local Benefits	• Aurizon will utilise local contractors to conduct the clearing and construction. • Aurizon will utilise their own personnel during operations. Local contractors will be utilised if required for specific tasks.	• It is anticipated that there will be an overall positive impact to the region and the NT as a result of the proposed Project by providing infrastructure to support broader use of the Darwin Port. • The Project may slightly increase local demands on current service infrastructure (e.g. transportation, power and utilities).	Rare	Insignificant	Low	• Where possible local suppliers and contractors will be used. The overall impact of the project will be positive.	Rare	Insignificant	Low
33	Construction	• Road safety and traffic flow.	• Traffic increase from vehicle movements.	• Vehicle movement for imported fill materials will increase the traffic impacting the road users and the traffic flow with the existing Tiger Brennan bypass project	Almost certain	Moderate	High	• Implement a Traffic Management Plan.	Possible	Minor	Moderate
Culture and heritage Objective: Protect sacred sites, culture and heritage											
34	Clearing Construction	• WWII cultural heritage.	• Presence of items of WWII cultural heritage.	• Identification of, damage to, or loss of, significant tangible and intangible heritage value.	Rare	Moderate	Moderate	• Implement an unexpected finds procedure with correct steps for reporting to authorities.	Rare	Minor	Low

Number	Phase	Aspect	Risk Pathway	Issues / Impacts	Pre-mitigation			Mitigations	Residual Risk		
					Likelihood	Consequence	Rating		Likelihood	Consequence	Rating
								• Any WWII artefacts identified will be analysed, with subsequent findings reported to the NT Heritage Branch of the Department of Tourism & Culture, who will provide further direction.			
35	Clearing Construction	• Aboriginal cultural heritage.	• Presence of items of Aboriginal cultural heritage.	• Damage to, or loss of, significant tangible and intangible heritage value.	Rare	Moderate	Moderate	• Implement an unexpected finds procedure with correct steps for reporting to authorities. • Any Aboriginal artefacts identified will be analysed, with subsequent findings reported to the NT Heritage Branch of the Department of Tourism & Culture, who will provide further direction. • In the event that any skeletal remains are unearthed, works in that area will cease and reported immediately to the NT Police, and to the Director Heritage Branch, Department of Lands, Planning and the Environment (if there is reason to believe they are remains of an Aboriginal burial).	Rare	Minor	Low
Human health Objective: Protect the health of the Northern Territory population.											
36	Construction	• UXO risk.	• UXO detonation disturbance or detonation.	• Potential impacts on construction workers.	Rare	Major	High	• Heritage assessment including liaison with Heritage Branch regarding historical activities and surveys for UXO. • UXO to be incorporated into unexpected finds procedures. • UXO risk assessment to be undertaken prior to construction works.	Rare	Minor	Low
37	Construction Operations	• Biting Insects.	• The Project area is located within and adjacent to mangroves and workers will be exposed to biting insects on a daily basis.	• Increase in biting insect populations and associated health risks to workers and community. • Potential increase in localised breeding of mosquitoes and other biting insects that may carry disease.	Likely	Moderate	High	• Designs and Stormwater Management Plans to include a drainage strategy. • A Biting Insect Management Plan compliant with NT Medical Entomology guidelines is required. • Ponding will be minimised through appropriate site levelling and drainage design. • Appropriate personal protective equipment will be worn by construction personnel. • If required, an insecticide mosquito control program would be implemented.	Possible	Minor	Low



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