

**Site Characteristics and Issues Matrix**

**Site Name Koolan Island**

<b>Terrestrial Biophysical Attributes</b>		<b>Extent and Condition</b>			<b>Level of Confidence</b>	<b>Potential for Significant Risk / Hazard and Impact of Development at this Site</b>
<b>Rainfall:</b> 833 mm (Koolan Island)		<b>Extent</b> Extent in the local area and regional context. Coastal area extent may be described as either alongshore and cross-shore length. Non-coastal extent could include; highly restricted to landform or habitat, locally common but regionally restricted, or widespread	<b>Key Coastal and Ecological Processes</b> Key coastal processes are defined by NCCOE (2004) and should be interpreted in the context of coastal landform description. Ecological processes relate to terrestrial ecology	<b>Site Condition / Disturbance Factors</b> Includes factors such as weed cover, apparent erosion (on ground or visible in aerial photography), excessive fire frequency	<b>High:</b> from site visit /survey, good map based knowledge, <b>Medium:</b> inferred from other good information sets, <b>Low:</b> limited information.	
<b>Geological Province</b>	<b>Site Geology, Substrate Characteristics &amp; Diversity</b>	<b>Extent in local area and region</b>	<b>Key Coastal / Ecological Processes</b>	<b>Site Condition / Disturbance Factors</b>		<b>Altered Drainage and Stormwater Management</b> <b>H:</b> Site area or substrate restricts effective on site management of storm water, erosion, potential pollution issues <b>M:</b> Site size and / or substrate allows for some retention of stormwater <b>L:</b> Site size and substrate allows for retention and managed discharge of stormwater.
Kimberley Plateau	Massive joint-controlled Sandstones (King Leopold, Warton) (Exposed/soil covered)	Warton sandstone is present along the south eastern margin of the island only. Common feature of adjacent mainland	Stable surface	Mining impacts along western extent	<b>H</b>	<b>H:</b> Limited capacity to manage stormwater, sediment given site size and terrain constraints
	Yampi Member (Exposed/soil covered)	Dominant formation. Confined to the coastal margins of Collier Bay on the mainland and is also the dominant surface of Cockatoo, Irvine and Bathurst Islands	Stable surface	More than 10% of current extent has been disturbed through mining, and future development proposals could account for at least another 10% being disturbed	<b>H</b>	<b>H:</b> Limited capacity to manage stormwater, sediment given site size and terrain constraints
	Elgee Siltstone	Elgee Siltstone occurs as a narrow band running approximately east-west through the centre of the Island. Overall extent on the mainland is predominantly to the east of Koolan and adjacent to the coastal margin of Collier Bay		Mining impacts (current and proposed) will effect a considerable proportion of the Elgee Siltstone extent.	<b>H</b>	<b>H:</b> Limited capacity to manage stormwater, sediment given site size and terrain constraints
Coastal Deposits	Holocene coastal dunes	Small storm ridge dunes located at the end of deep embayments on the island	Formed as a result of Cyclonic wave and storm surge. Heavy monsoonal rains.	Generally undisturbed condition, except where impacted by mining related changes to drainage flows or sediment.	<b>H</b>	<b>H:</b> Potential changes to stormwater flows and sediment characteristics. Restricted land availability, steep terrain and significant elevation would contribute to management constraints.
<b>Site Diversity/ Extent</b>	<b>Total:</b> Four geological substrate types	Low Diversity of geological substrate types, restricted regionally. Hub site existing disturbed environment.				
<b>Coastal Geomorphology, Geomorphological Processes &amp; Landform Stability</b>		<b>Extent in local area and region</b>	<b>Key Coastal / Ecological Processes</b>	<b>Site Condition / Disturbance Factors</b>	<b>Level of Confidence</b>	<b>Potential for Coastal impacts from altered coastal wave / energy regime, or concentrated stormwater flows</b> <b>H:</b> Low lying topography; proximity to tidal creeks; cheniers, narrow barrier dunes & associated extensive wetlands; extensive mudflats; considerable longshore sand drift regime with significant

					potential for impact <b>M:</b> Moderately elevated topography (to 10 m); Sandy & silty beaches limited longshore sand movement; Moderate to wide barrier dunes and wetlands; Erodeable or eroding cliff. <b>L:</b> Elevated topography (>10m); rocky coast and landward landform with little evidence of recent erosion; low longshore sediment drift
<b>Rocky shores</b>					
(a) Stable cliffs - sandstone	Yampi Member sandstone major structural unit on Koolan Island	Extreme winds, waves storm surge, extreme tidal amplitude and strong tidal currents remove unconsolidated sediments from exposed coastal shores	Generally stable in good condition except where impacted by mining or associated activity including spoil dumps.	<b>H</b>	<b>L:</b> Widespread and dominant coastal form in much of the Yampi Peninsula
(c) Stable cliffs - Other (eg. ironstone)	Yampi Member Haematitic Quarts Sandstone	Mining impacts dominant over coastal and ecological processes	Extensively mined and being mined	<b>H</b>	<b>L:</b> Impacted in part by past and ongoing mining – limited scope for further impact.
<b>Rocky headlands</b>					
(d) Localised outcrops – coral reef	Extensive fringing coral reef development in embayments around the island particularly on the eastern and south-east shores of the island.	Reef building, episodic damage and recovery from cyclonic waves and storm surge.	Some smothering from iron dust / sediment in proximity to mining related disturbance. Otherwise intact	<b>H</b>	<b>H:</b> Coral reef is sensitive to potential impacts from hydrocarbon contamination, and smothering from mining impacts
<b>Embayments</b>					
Storm ridge (bar)					
(a) Mobile sand sheet	Limited pocket beach development at the head of narrow embayments	Cyclonic waves and storm surge	Intact, cyclonic storm surge and waves may episodically remove vegetation and reshape the storm ridge bars	<b>H</b>	<b>L-M:</b> Potential for modification as a result of modified stormwater discharge regime.
(b) Vegetated ridge					
<b>Site Diversity</b> Six coastal landforms on site.	Moderate coastal diversity. Generally widespread landform types			<b>L</b>	
<b>Diversity of Vegetation Communities - on site and regional context</b> Limited diversity coastal geomorphological diversity, steep sided island rapidly shelving into deeper water except where coral reef development has occurred. Lacks mangrove and tidal flat, creek environments that are represented in the region	<b>Extent in local area and region</b>	<b>Key Coastal / Ecological Processes</b>	<b>Site Condition / Disturbance Factors</b>	<b>Level of Confidence</b>	<b>Potential for Significant Impacts from Site Clearing</b> <b>H:</b> Conservation Significant communities, high physical / biological diversity, or restricted community/s. <b>M:</b> Moderate physical / biological diversity. <b>L:</b> Low diversity, communities widespread regionally
<b>Coastal Vegetation Communities</b>					
Foredune vegetation	Distinct pocket beach communities occur on mobile sands in protected bays.	Cyclonic wave and storm surge actions. Sand stability, habitat value as restricted environment locally.	Generally undisturbed unless impacted by mining	<b>H</b>	<b>L</b>
Mangrove –					
(a) closed forest,	Mangrove communities in two bays to the south of the settlement. These are small and species poor in comparison to adjacent mainland sites.	Habitat, substrate stability, nutrient cycling, coastal protection.	Generally undisturbed, unless impacted by mining, sediment runoff	<b>H</b>	<b>M-H:</b> Small species poor mangrove communities
(b) scattered plants	Narrow mangrove fringe around much of the island.	Habitat, substrate stability, nutrient cycling,	Generally undisturbed	<b>H</b>	<b>L</b>
<b>(b) Upland on Sandstone</b>					
Eucalyptus woodland/open forest	Dominant community (80% of the non-disturbed area of the island) made up of <i>E. miniata</i> and <i>E. confertiflora</i> over <i>Triodia</i> hummock grassland and	Stable coastline. Widespread community locally on the Island and on Yampi Peninsula	Severe disturbance to parts of the island through mining, spoil dumps, mining infrastructure and settlement. Weed invasion particularly in areas near disturbance.	<b>H</b>	<b>L</b>

	is a common vegetation type on adjacent mainland. A sparse Eucalyptus woodland community comprising similar species is confined to the Warton Sandstones. A <i>Callitris intratropica</i> overstorey community is restricted to deeply incised gullies where it occurs in small stands. This community has also been recorded on Cockatoo, Irvine, Bathurst and Kingfisher Islands				
Communities on Cliff / outcrop, or exposed rock surfaces, inc ephemeral pools Vine Thicket/Rainforest TEC (2 types)	Present as small scale mosaic				
(a) Sandstone,	Small patches in steep creek lines on eastern end and in the south west of the island ranging in size from a few trees to several hectares.	Provides essential habitat for a range of flora and fauna- particularly land snails, among other invertebrates.	Potential disturbance factors include mining operations, weed invasion and fire	<b>H</b>	<b>H</b>
<b>Site Diversity</b>	Moderate diversity, six vegetation communities on or in vicinity of potential hub site			<b>M-H</b>	<b>H:</b> Moderate diversity, small vine thicket TEC's, mangals, and <i>Callitris</i> communities which are at risk.
<b>Threatened, Priority, Significant Flora (Population) (Species/status)</b>	<b>Extent in local area and region</b>	<b>Key Coastal / Ecological Processes</b>	<b>Site Condition / Disturbance Factors</b>	<b>Level of Confidence</b>	<b>Potential for Significant Impacts from Site Clearing</b> <b>H:</b> Threatened species recorded, High quality/extensive suitable habitat for threatened species, high physical / biological diversity, or restricted community. <b>M:</b> Limited representation of restricted habitat type/s, or habitats suitable for priority/significant species, moderate physical / biological diversity. <b>L:</b> Low habitat diversity, Habitats widespread regionally, limited potential to support threatened/priority or other significant species.
DRF (Wildlife Conservation Act) / Endangered (EN)/Vulnerable (VU) EPBC Act Species/Habitat	None recorded.			<b>H:</b> Well surveyed	<b>L</b>
Priority flora	3 species- <i>Phyllanthus aridus</i> P3- Occurs on Sandstone, gravel, red sand across the Kimberley Region, <i>Gymnanthera cunninghamii</i> P3 Sandy soils primarily in the Pilbara, <i>Brachychiton xanthophyllus</i> P4- Soils over granite, limestone or basalt. Upper slopes, crests & rock outcrops in far North Kimberley			<b>H:</b>	<b>M-H</b>
Other significant flora. (eg Unnamed species, Range end/outlying populations)	1 species identified - <i>Corymbia aff. Cadophera</i> which is thought to be a Koolan Island endemic.			<b>M</b>	<b>M-H</b>
Habitat specialist restricted taxa, restricted habits	None recorded			<b>L</b>	<b>M</b>
<b>Threatened, Priority, Significant Fauna Population or Habitat</b>	<b>Extent in local area and region</b>	<b>Key Coastal / Ecological Processes</b>	<b>Site Condition / Disturbance Factors</b>	<b>Level of Confidence</b>	<b>Potential for Significant Impacts from Site Clearing</b> <b>H:</b> Threatened (Rare) species recorded, High quality/extensive

(Species / status)					suitable habitat for Threatened species, high physical / biological diversity, or restricted community. <b>M:</b> Limited representation of restricted habitat type/s, or habitats suitable for threatened/priority species, moderate physical / biological diversity. <b>L:</b> Low habitat diversity, Habitats widespread regionally, limited value as habitat for threatened/priority or other significant species.
Threatened (Rare) Wildlife Conservation Act / Endangered (EN), or Vulnerable (VU) EPBC Act Species / Habitat (ie Turtle nesting beach)	<i>Dasyurus hallucatus</i> (Northern Quoll) EN-wide ranging, <i>Erythrura gouldiae</i> (Gouldian Finch) EN - widely distributed in savannah woodlands with suitable habitat, <i>Rhinonicterus aurantius</i> (Orange Leaf-nosed Bat) VU – rare knowledge of species habitat preferences limited, <i>Erythrotriorchis radiatus</i> (Red Goshawk) VU – very sparse and discontinuous distribution over a wide area from the Kimberley across northern Australia, down the east coast and south to northern NSW. <i>Amplirhagada astute</i> (Land snail) – potential island endemic	There is a highly diverse faunal assemblage documented from Koolan Island.	Mining, settlement and associated infrastructure, weed and pest invasion	<b>H:</b> Considerable survey effort over many years.	<b>H:</b> Loss of significant habitat area for listed fauna species, on an island with limited total area.
Priority listed sp / habitat	3 priority listed species – 1 snake and 2 bats- <i>Ramphotyphlops yampiensis</i> (Blind snake) P2, – potential island endemic <i>Hipposideros stenotis</i> (Northern Leaf-nosed Bat) P2- few records rare and scattered distribution and <i>Macroderma gigas</i> (Ghost Bat) P4 – widespread but patchy distribution across northern Australia.		Mining, settlement and associated infrastructure, weed and pest invasion	<b>M</b>	<b>M- H:</b> Potential for island endemic. Although the two bat species are under surveyed in the region they are wide ranging.
Ramsar/JAMBA/CAMBA/ROKAMBA Migratory sp / habitat	18 Migratory bird species are known from and around the Island	Koolan island provides very limited intertidal wader bird habitat.		<b>M</b>	<b>L</b>
Other significant fauna. (eg Unnamed species, Range end/outlying populations, species with declining range)	Specially protected fauna. <i>Falco peregrinus</i> (Peregrine Falcon) Schedule 4 is a wide ranging species. Schedule 4 species <i>Crocodylus porosus</i> (Saltwater Crocodile) - there is limited habitat in study area species is wide ranging.	Regionally insignificant habitat		<b>H</b>	<b>L</b>
<b>Potential habitat for Short Range Endemic inc subterranean fauna</b>	<b>Extent in local area and region</b>	<b>Key Coastal / Ecological Processes</b>	<b>Site Condition / Disturbance Factors</b>	<b>Level of Confidence</b>	<b>Potential for Significant Impacts from Site Clearing</b> <b>H:</b> Restricted habitat with high potential for short range endemic species, or restricted community/s or restricted environment with substrate characteristics (high porosity, connectivity and high humidity/moisture) favourable for subterranean fauna

					<p><b>M:</b> Moderately restricted habitat with some potential for short range endemic species, or environment with substrate characteristics (high porosity, connectivity and high humidity/moisture) potentially favourable for subterranean fauna.</p> <p><b>L:</b> Common substrates and communities regionally widespread, without substrate characteristics normally favourable for subterranean fauna</p>
<p>Site environment likely to support restricted habit specialist fauna, SRE fauna</p> <p>Substrate/habitat potential suitability for subterranean fauna, (ie fractured rock, karst environment, springs etc)</p>	<p>Short range endemics known for Koolan Island includes land snails, earthworms and a blind snake with vine thicket representing the most important habitat for SRE's. Fractured rock geology has potential to support subterranean fauna.</p>	<p>Inputs in to overall biological diversity</p>	<p>Habitat loss from mining related activities</p>	<b>H</b>	<p><b>H-M:</b> Potential for further habitat loss.</p>
<b>Visual Landscape Significance</b>	<b>Visual Landscape Significance Assessment</b>			<b>Level of Confidence</b>	<b>Potential significance of Landscape impacts from development of the site</b>
<p>Landscape character of hub site and broader context</p>	<p><b>Landscape Region:</b> The Kimberley</p> <p><b>Character type:</b> Yampi Peninsula</p> <p><b>Landscape context:</b> The Koolan Island node is located within a broad-scale landscape characterised by rugged terrain features with parallel ridges and extremely eroded slopes with irregular escarpments and occasional flat topped plateaux. Land cover is a mosaic of grasslands, scattered trees, shrub-land and thickets with extraordinary patterns depending on soil, geology and terrain steepness. The coastal fringes are rugged with the occasional low-lying sand-plains or river mouth, small beaches and pockets of sheltered mangrove. Only minor watercourses are present in this sub-type. Mining is prominent on Koolan Island with localised loss of naturalness.</p> <p><b>View character of this development node:</b> This landscape is characterised by extremely rugged rocky interior and diverse coastline with tidal flats, inlets and bays, some with mangrove communities. An open cut mine with established service and recreational infrastructure including roads, dock, pipelines, tanks, structures and an airstrip is currently active. Alterations to the established natural landscape are highly visible from some marine viewer positions.</p> <p><b>Landscape Character Rating:</b> High</p> <p><b>Comments:</b> The industrial infrastructure visible from the established marine travel routes, while locally dominant is relatively low in negative visual impact due to the scale and form of structures and diversity of island landform. The proposed hub would be much more dramatic in scale, vertical element and density of built form with a much greater potential impact.</p>			<b>Moderate</b>	<p><b>Suitability rating:</b> Moderate</p> <p><b>Absorption Capability:</b> Low to Moderate</p> <p><b>Analysis (+ positive and - negative):</b></p> <ul style="list-style-type: none"> <li>+ built infrastructure evident; some highly evident changes to landscape character</li> <li>+ moderate visual absorption capability</li> <li>+ established user patterns</li> <li>- high levels of visual landscape significance</li> <li>- proximity to marine tour boat routes</li> </ul>
<p>Degree of evident alteration or change from the 'naturally established' landscape character based on levels of 'naturalness'</p>	<p><b>Degree of evident change from naturally established character:</b> Moderate to High depending on viewer position. Evidence of human activity as viewed from some observation positions, is visually dominant.</p> <p><b>Naturalness rating:</b> Moderate to High depending on position in the landscape.</p>				
<p>Degree and sensitivity of views and seen areas from travel routes and use areas (duration, frequency, position in landscape, number of viewers, distance)</p>	<p><b>Viewer positions:</b> Visitors on tour and cruise boats pass close to the western flank of the Island to and from Talbot Bay feature attractions - often with a special focus on scenic assets and expert interpretation of bio-physical and landscape values and features.</p> <p><b>Distance zone:</b> Foreground, middleground and background.</p> <p><b>Duration of view:</b> Variable but long duration views provided by some operators while in transit around the island.</p> <p><b>Viewer position:</b> Generally level, but can be below as one approaches the shoreline of the Island.</p> <p><b>Sensitivity Level:</b> Level 1 – seasonally variable depending on tour operations.</p> <p><b>Implications:</b> The established industrial complex has imposed a dramatic change in the landscape character that may be perceived as acceptable, even sculpturally desirable, by some visitors. An expansion of that altered landscape character may be possible, but this should not be supported without visitor/community perception studies and impact assessment once a development concept is prepared. Talbot Bay with a pearl farm and the Horizontal Waterfall is a feature destination. The marine travel route is located close to Koolan Island.</p>				

Special features and focal points within view of the hub site	Koolan Island, Cookatoo Island, and many nearby bays, points, canals and islands.			
<b>Remote Area - Quarantine Risks / Hazards from Construction / Operation of development Introducing new species</b>	<b>Site Context</b>	<b>Site Condition and Disturbance Factors</b>	<b>Level of Confidence</b>	<b>Quarantine - Potential Hazard from Introduction of New Species</b> <b>H:</b> Island, or remote mainland area currently largely free of introduced species and distant from most human vectors <b>M:</b> Site has few weeds and limited vehicle access. <b>L:</b> Site some development / existing vehicle access / weeds are common and a stock grazing history
Relative quarantine risk from developing/operating Hub at the location	Impacted by previous and current mining and settlement.	Low quarantine measures in mining history have resulted in introduction of numerous weed species.	<b>H</b>	<b>L:</b>
<b>Remote area – potential for future development of Land-based transport or Infrastructure links.</b>			<b>Level of Confidence</b>	<b>Potential for major impacts from off site transport / infrastructure links</b> <b>H:</b> Remote mainland area currently distant from most human vectors <b>M:</b> Mainland area currently not serviced by main road access. <b>L:</b> Island with no potential for off site impacts, or mainland location close to major roads with existing vehicle access.
Degree of impact from potential future land-based transport or infrastructure links	Island			<b>L:</b> Not applicable
<b>Existing or proposed conservation reserve (inc marine) or Indigenous Protected Area</b>			<b>Level of Confidence</b>	<b>Conservation Reserve Status</b> <b>H:</b> Existing reserve <b>M:</b> Recommended Reserve <b>L:</b> No reserve proposed
Existing / Proposed Conservation reserve	No reserve proposed			<b>L:</b>
Existing / Proposed Marine Reserve	Marine environments around Yampi Sound are recommended for conservation in CALM 1994 Report			<b>M:</b>
Existing / Proposed Indigenous Protected Area	No reserve recommended			<b>L:</b>

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