

Site Characteristics and Issues Matrix

Site Name North Head

Terrestrial Biophysical Attributes		Extent and Condition			Level of Confidence	Potential for Significant Risk / Hazard and Impact of Development at this Site
Rainfall: 769 mm (Cape Leveque)		Extent 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	Key Coastal and Ecological Processes 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	Site Condition / Disturbance Factors Includes factors such as weed cover, apparent erosion (on ground or visible in aerial photography), excessive fire frequency	High: from site visit /survey, good map based knowledge, Medium: inferred from other good information sets, Low: limited information.	
Geological Province	Site Geology, Substrate Characteristics & Diversity	Extent in local area and region	Key Coastal / Ecological Processes	Site Condition / Disturbance Factors		Altered Drainage and Stormwater Management H: Site area or substrate restricts effective on site management of storm water, erosion, potential pollution issues M: Site size and / or substrate allows for some retention of stormwater L: Site size and substrate allows for retention and managed discharge of stormwater.
Canning Basin Sandplains	Emeriau Sandstone (Exposed/soil covered) / Broome Sandstone / Melligo Sandstone	Present exposed as cliffs and soil covered– type location Emeriau Sandstone. Emeriau Sandstone has very limited extent largely confined regionally to this hub location. But appears to be very similar to/same as Broome Sandstone and Melligo Sandstone which are somewhat more widely exposed in near coastal locations.	Erosion of coastal headlands cliff. Represent regionally rare sandstone cliff/rock face environments and rock shelter/cave environments.	Some localised disturbance from vehicle access tracks to vantage points.	H	L: Relatively stable coastline and small scale, so limited physical constraint on development site management
	Pindan Red Earths	Widespread and dominant surface on the Dampier Peninsula,	Limited coastal exposure on site, but coastal areas showing evidence of major episodic erosion from cyclonic waves, storm surge and extreme meteorological events.	Localised coastal erosion, Localised impact from vehicle roads and track assess, Frequent extensive fire, some weed invasion.	H	L: Site size and substrate and gentle slopes allows for detention and managed discharge of stormwater.
	Alluvial and Lacustrine deposits	Limited area east of potential hub site. Larger areas regionally associated with drainage lines to Pender Bay and Beagle Bay, north and south of the site	Impeded by small barrier dune. Stormwater runoff from the site likely to drain towards the drainage line. Stormwater, erosion management required.	Generally intact	H	L-M: Site size and substrate allows for some detention of stormwater
Coastal Deposits	Holocene coastal dunes	Present Middle Lagoon and other small embayments	Cyclonic wind, waves and storm surge.	Vehicle access tracks have localised impact.	M	M: Stormwater management should avoid impacts on drainage flows to the back of the dune environments supporting Monsoon Vine Thicket vegetation.
	Bossut Formation (Exposed/soil covered)	Present exposed as cliffs and soil covered	Regionally restricted calcareous surface occurs south of Middle Lagoon. Karst collapse features.	Generally intact.	H	M: Stormwater management should avoid impact on karst environment.
	Tidal Flat and mangrove swamp	Limited area Middle Lagoon	Small scale examples of these	Generally intact.	H	L:

	Supratidal flat	west of the Site Limited area Middle Lagoon west of the site.	environments in regional context Very limited scale examples of this environment type.	Localised impact from vehicle access tracks causing changes in drainage flows, erosion and compaction.	M-H	M: Stormwater management should avoid impact on supratidal flats and ephemeral freshwater wetland environments.
Site Diversity/ Extent	Seven geological substrates.	High diversity within the study area. Some limited in extent regionally. Hub site is on regionally widespread surface type.				L-M
Coastal Geomorphology, Geomorphological Processes & Landform Stability	Extent in local area and region	Key Coastal / Ecological Processes	Site Condition / Disturbance Factors	Level of Confidence	Potential for Coastal impacts from altered coastal wave / energy regime, or concentrated stormwater flows H: 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 M: Moderately elevated topography (to 10 m); Sandy & silty beaches limited longshore sand movement; Moderate to wide barrier dunes and wetlands; Erodable or eroding cliff. L: Elevated topography (>10m); rocky coast and landward landform with little evidence of recent erosion; low longshore sediment drift	
Coastal Geomorphology, Geomorphological Processes & Landform Stability	Extent in local area and region North Head is a small salient NW-SE trending promontory separating Beagle Bay and Tappers Inlet. The promontory is 2km wide. The 10m depth contour varies approximately from 2 to 5 km with distance seaward of the headland. The contour is angled to the shore and closest at its southern end.	Key Coastal / Ecological Processes This location is exposed to the key processes identified by NCCOE (2004), including 1. Mean Sea Level changes 2. Ocean Currents 3. Wind Climate 4. Wave Climate 5. Rainfall & Runoff	Site Condition / Disturbance Factors The geologic structure of the coast is the primary factor contributing to configuration of the coast. Secondary processes are significant at a local scale due to variation in aspect and exposure of the coast around the headland. These processes are potentially disturbance factors and include: 1. Local sea level 2. Local currents 3. Local winds 4. Groundwater 5. Coastal flooding 6. Sediment transport 7. Tidal creek hydraulics 8. Coastal water quality	Level of Confidence Medium: inferred from other good information sets such as aerial photography and satellite imagery	L: Elevated topography (>10m); rocky coast and landward landform with little evidence of recent erosion The major hazards relate to exposure of the location to strong winds and erosion along the cliff margin.	
Inshore features (a) Ebb-tide deltas	Located in Tappers Inlet, adjacent to the NE shore of the North Head promontory	Tide and extreme meteorological events, particularly tropical cyclones	The landform does not appear to be disturbed.		M: Storm water runoff and discharge would require management to ensure maintenance of water quality and potential impacts on the mangals in Tappers Inlet.	
Rocky shores						
(d) Unstable cliffs - sandstone	Major structural feature of the location.	Tropical cyclones and extreme meteorological events	Wave and storm surge Erosion in extreme storm events. Karst solution along boundary of limestone and sandstone		L: Elevated topography landwards of cliff margin. Cliff coastline unstable - development setback needed.	
(e) Unstable cliffs - limestone						
(f) Unstable cliffs - other (Pindan)	Moderate extent	Tropical cyclones, extreme monsoonal rainfall	Wave and storm surge, extreme rainfall events. Potential for significant episodic erosion/ retreat in extreme storm events		M: Uncontrolled stormwater runoff could lead to severe erosion along the cliff margin	
Rocky headlands						
Rocky headlands (a) Localised outcrops & reefs	Small scale feature locally	Tropical cyclone, local sea	Storm surge & wave action during extreme meteorological events		M	
(b) Localised outcrops – talus / Storm deposits	Small scale feature locally	Tropical cyclone	Onshore surge events		M	

	distributed along the actively eroding cliffs.				
Embayments					
Barrier dune ridge & vine thicket					
(b) Vegetated dunes	Small scale feature	Storm Surge	Tourism numbers/ access related impacts include a small community and tracks set back from the cliff edge; washover from cyclones.	H	L
Cheniers					
Cheniers (a) Lithified – perched beach	Local to North Head and extending into Tappers Inlet	Local fluctuation in sea level and the coastal wave regime, Local winds and foreshore stability	Storm surge washovers. Erosion associated with tidal currents as well as storm surge and wave action during extreme weather events	H	L
Mud Flats & Tidal Creeks					
(c) Tidal creek – vegetated tributaries	Small	Tides Tropical cycles	Storm surge	H	M:
Stream Mouths (b) Drains mangrove wetlands	Small but locally significant feature	Tropical cyclones	Tides, storm surge Potential contamination from spills, stormwater runoff	H	H:
(c) Drains bare mud flats & scalds	Small scale local	Tides and storm surge	Tropical cyclones, Potential contamination from spills, stormwater runoff	H	M:
Site Diversity Six coastal landforms in vicinity of site	Moderately diverse, landforms of varying stability and sensitivity to disturbance			H	L-M: Relatively stable. Stormwater runoff management and discharge across the coast. Cliff coastline unstable - development setback needed.
Diversity of Vegetation Communities - on site and regional context	Extent in local area and region	Key Coastal / Ecological Processes	Site Condition / Disturbance Factors	Level of Confidence	Potential for Significant Impacts from Site Clearing H: Conservation Significant communities, high physical / biological diversity, or restricted community/s. M: Moderate physical / biological diversity. L: Low diversity, communities widespread regionally
Coastal Vegetation Communities					
Foredune vegetation	Present but limited scale adjacent to the site, larger areas regionally	Dune stability, habitat	Localised disturbance associated with vehicle access.	M-H	L-M:
Supratidal Flats					
(a) Samphire (b) Saltwater couch (c) Bare surface-algal crust	Present at Tappers Inlet	Cyclonic winds and storm surge, tidal processes.	Localised disturbance associated with vehicle access.	M-H	M-H: Conservation significant communities with the potential for impact from contamination or site management.
Mangrove –					
(a) closed forest,	Present – as locally large more complex area Tappers Inlet	Habitat for a wide variety of taxa, nutrient cycling, provides substrate stability and coastal protection	Generally intact.	H	H: High conservation significant community, potential for marine contamination, spills.
Rocky coast community	Rocky shorelines and headland vegetation associated with Bossut formation present. Regionally restricted environment best represented at this site.	One of the most extensive representations of <i>Spinifex longifolius</i> dominated community associated with coastal sand over calcareous surfaces of the Bossut Formation. Karst solution and collapse evident.	Generally excellent condition with limited areas of severe localised disturbance associated with vehicle tracks.	H	L: Accentuated stormwater discharge from hardstand areas and coastal access /development and management will need to be managed to avoid/minimise impacts on karst coastal environments.
Wetland Vegetation Communities					
Ephemeral seep	Ephemeral wetland environment supporting narrow linear stands	Dependent of groundwater recharge and discharge.	Generally intact.	H	L-M: Restricted wetland environment potentially impacted by changes to groundwater recharge and stormwater discharge

	of <i>Melaleuca alsophila</i> associated with wet season seeps, where pindan soils adjoin the supratidal flats around Tappers Inlet.	Potentially impacted by cyclonic storm surge.			associated with hub development. Management required.
Upland Vegetation Communities					
(c) Upland on Pindan surfaces					
High rainfall Pindan Open Eucalyptus dominated woodland / forest	The dominant vegetation on site away from coastal communities	Fire management	Frequent fire, localised disturbance from vehicle access tracks.	H	L: Community is locally widespread though the relative regional extent is restricted by small area of Northern Dampier Peninsula.
Vine Thicket/Rainforest TEC in Dune Swale	Small patches in scattered locations behind coastal dunes and mangle	Essential habitat for a range of flora and fauna species confined to these vegetation communities.	Generally intact	M	H: if cleared for hub site or associated infrastructure. Soil moisture conditions need to be maintained to sustain the community.
Site Diversity	Moderate to high with seven vegetation communities present on or adjacent to the site.			H	L-M: Diverse site location with proximity of sensitive environments such as supratidal flats and mangrove forests, and small patches of Monsoonal Vine Thicket.
Threatened, Priority, Significant Flora (Population) (Species/status)	Extent in local area and region	Key Coastal / Ecological Processes	Site Condition / Disturbance Factors	Level of Confidence	Potential for Significant Impacts from Site Clearing H: Threatened species recorded, High quality/extensive suitable habitat for threatened species, high physical / biological diversity, or restricted community. M: Limited representation of restricted habitat type/s, or habitats suitable for priority/significant species, moderate physical / biological diversity. L: 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			L	L
Priority flora	None Recorded			L	L
Other significant flora. (eg Unnamed species, Range end/outlying populations)	<i>Crotalaria crispata</i> (Kimberley Horse Poison) and <i>Enneapogon polyphyllus</i> (Leafy Nineawn) are possible range extensions			M	M
Habitat specialist restricted taxa, restricted habits	No information			L	L
Threatened, Priority, Significant Fauna Population or Habitat (Species / status)	Extent in local area and region	Key Coastal / Ecological Processes	Site Condition / Disturbance Factors	Level of Confidence	Potential for Significant Impacts from Site Clearing H: Threatened (Rare) species recorded, High quality/extensive suitable habitat for Threatened species, high physical / biological diversity, or restricted community. M: Limited representation of restricted habitat type/s, or habitats suitable for threatened/priority species, moderate physical / biological diversity. L: 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)	Limited potential to impact on beaches with characteristics suitable for turtle nesting.			M	L
Priority listed sp / habitat	Area is poorly surveyed . <i>Numenius madagascariensis</i> (Eastern Curlew) P4 – wide ranging species, recorded for Perpendicular Head/North Head study area and likely to be present in some habitat.			L	M

Ramsar/JAMBA/CAMBA/ROKAMBA Migratory sp / habitat	Migratory species likely to occur on mudflats and ephemeral claypans on and around Tappers Inlet. 8 species recorded that are protected under international treaties. The 55 species of Migratory Birds listed under international treaty recorded at Perpendicular Head are also likely to occur at North Head.			M	M
Other significant fauna. (eg Unnamed species, Range end/outlying populations, species with declining range)				L	L-limited site diversity
Potential habitat for Short Range Endemic inc subterranean fauna	Extent in local area and region	Key Coastal / Ecological Processes	Site Condition / Disturbance Factors	Level of Confidence	Potential for Significant Impacts from Site Clearing H: 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 M: 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. L: Common substrates and communities regionally widespread, without substrate characteristics normally favourable for subterranean fauna
Site environment likely to support restricted habit specialist fauna, SRE fauna Substrate/habitat potential suitability for subterranean fauna, (ie fractured rock, karst environment, springs etc)	Some potential associated the calcareous coastal environment south of Tappers inlet, and in patches of Vine Thicket vegetation. Pindan substrates low risk.	Species diversity		L	M: associated with calcareous rock substrates and vine thickets.
Visual Landscape Significance	Visual Landscape Significance Assessment			Level of Confidence	Potential significance of Landscape impacts from development of the site Suitability Rating and Absorption Capacity
Landscape character of hub site and broader context	<p>Landscape Region: The Kimberley</p> <p>Character type: Dampier Tableland</p> <p>Landscape context: The North Head node is located within a broad-scale landscape with a landform of gently undulating sand plains, closely spaced linear dunes and dramatic coastal features. Vegetation cover is characterised by open woodland with pindan thickets and hummock grass understorey common to the Dampier Peninsula. Numerous creeks dissect the peninsula and mangroves, bays, mud-flats, swamps and sandy beaches occur along the coastline. Grazing has occurred on pastoral leases with evident signs of pastoral/residential infrastructure – roads, fences, out-camps and yards. There are residential communities, localised evidence of mining and exploration and public recreation use in this sub-type.</p> <p>View character of this development node: The landscape is characterised by dramatic coastal cliffs, high undulating dune ridges, rock outcroppings, a dramatic peninsula and diverse vegetation patterns in the coastal influence zone; inland plain horizontal character with largely uniform woodland without significant patterns.</p> <p>Landscape character significance rating: High coastal, moderate inland.</p> <p>Comments: The coastal zone of this node is a landscape of high significance due to a complex landform and complexity of vegetation pattern. There are landscapes of cultural significant within the node. The potential to retain a buffer reserve along the coastal dune and cliff zone within the node is excellent.</p>			H	<p>Suitability rating: Moderate</p> <p>Absorption Capability: Low</p> <p>Analysis (+ positive and - negative):</p> <ul style="list-style-type: none"> + few terrestrial travel routes or use areas - high level of visual landscape significance - proximity to marine tour boat routes - established user patterns and commercial camp - low to moderate visual absorption capability
	Degree of evident change from naturally established character: Low on the coast, moderate inland; tracks			H	

Degree of evident alteration or change from the 'naturally established' landscape character based on levels of 'naturalness'	and a campsite are the only evidence of human activity from some coastal observation positions; exploration roads on grids lines are present inland. Naturalness rating: High			
Degree and sensitivity of views and seen areas from travel routes and use areas (duration, frequency, position in landscape, number of viewers, distance)	Viewer positions: Marine based visitors on tour boats that travel close to the headland, some anchor in Tappers Inlet, visitors to Tappers Inlet camp and local access tracks. Distance zone: Foreground, middle ground and background from marine positions; foreground and middleground from middle lagoon access road and visitor facility; variable distance zones from minor access tracks. Duration of view: Variable but generally long duration views from both marine and terrestrial positions. Viewer position: Generally 'level', but can be below from marine locations close to the shoreline. Sensitivity Level: level 1 - high level of concern for visual landscape in the coastal zone; Level 2 - low to moderate concern level on the inland plain zone. Implications: Height and configuration of coastal dunes would provide a moderate degree of landform buffer screening of development on the inland plain from some marine viewer positions if retained in a coastal reserve. Development would be highly visible from all identified terrestrial viewer positions. Development in this landscape would become visually dominant as viewed from a number of established marine view points, but few terrestrial viewer positions. Height of coastal dune ridges and some minor variation in vegetation patterns on the terrestrial plain, could help reduce but not eliminate negative visual impacts resulting from development.		H	
Special features and focal points within view of the hub site	Cliff Point, North Head, Tappers Inlet, Emeriau Point , Sandy Point and Head, Ledge Point, Beagle Bay		H	
Remote Area - Quarantine Risks / Hazards from Construction / Operation of development Introducing new species	Site Context	Site Condition and Disturbance Factors	Level of Confidence	Quarantine - Potential Hazard from Introduction of New Species H: Island, or remote mainland area currently largely free of introduced species and distant from most human vectors M: Site has few weeds and limited vehicle access. L: Site some development / existing vehicle access / weeds are common and a stock grazing history
Relative quarantine risk from developing/operating Hub at the location	Site has scattered Aboriginal living areas and tourism infrastructure adjacent to it with vehicle access		H	L:
Remote area – potential for future development of Land-based transport or Infrastructure links.			Level of Confidence	Potential for major impacts from off site transport / infrastructure links H: Remote mainland area currently distant from most human vectors M: Mainland area currently not serviced by main road access. L: 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	Site has scattered Aboriginal living areas and tourism infrastructure adjacent to it with existing vehicle access			L:
Existing or proposed conservation reserve (inc marine) or Indigenous Protected Area			Level of Confidence	Conservation Reserve Status H: Existing reserve M: Recommended Reserve L: No reserve proposed
Existing / Proposed Conservation reserve	No terrestrial reserves proposed		H	L:
Existing / Proposed Marine Reserve	CALM 2004 Report Marine reserve proposed for Pender Bay		H	M:
Existing / Proposed Indigenous Protected Area	None proposed		H	L:

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