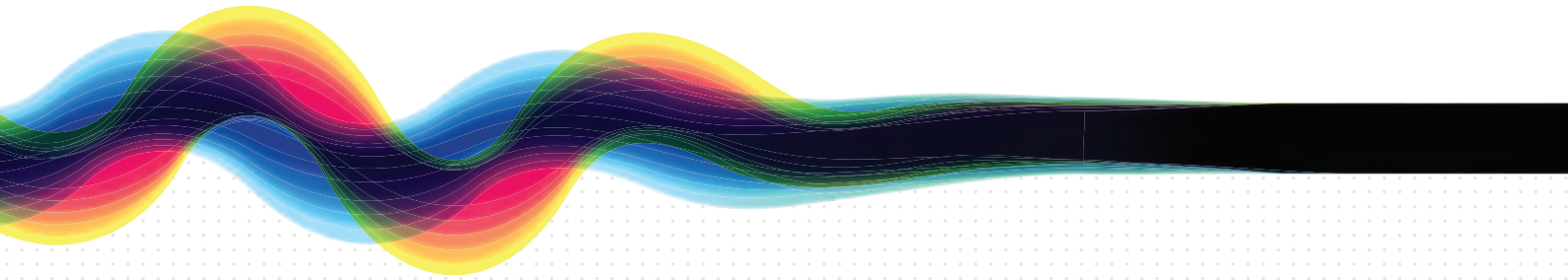
Athol Street
Structure Plan

December 2020 | 20-143



element.
the art and science of place

We would like to acknowledge the Kariyarra, Ngarla, and Nyamal people as the Traditional Custodians of the Town of Port Hedland lands.

We recognise their strength and resilience and pay our respects to their Elders past and present

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Issue	Date	Status	Prepared by	Approved by
1	15.07.20	Draft	Justin Page	Matt Raymond
2	23.07.20	Draft	Justin Page	Matt Raymond
3	24.07.20	Final	Justin Page	Matt Raymond
4	14.12.20	Final V2	Justin Page	Matt Raymond

CERTIFICATION OF APPROVED STRUCTURE PLAN

This Structure Plan is prepared under the provisions of the Town of Port Hedland Town Planning Scheme No. 5 and in accordance with the Planning and Development (Local Planning Schemes) Regulations 2015

IT IS CERTIFIED THAT THIS STRUCTURE PLAN
WAS APPROVED BY RESOLUTION OF
THE WESTERN AUSTRALIAN PLANNING COMMISSION ON:

20/1/2021 Date

Signed for and on behalf of the Western Australian Planning Commission

An officer of the Commission duly authorised by the Commission pursuant to section 16 of the Planning and Development Act 2005 for that purpose, in the presence of:

Witness

20/1/2021 Date

20/1/2031 Date of Expiry of this Structure Plan

Table of Amendments to Structure Plan

Amendment No.	Description of Amendment	Amendment Type	Date Endorsed by WAPC

Executive Summary

This structure plan has been prepared for the 'Athol Street' future urban development site within the East End of Port Hedland. The site comprises various Crown Land allotments (totalling approximately 48.89 hectares) with management under the Town of Port Hedland, Water Corporation or is unallocated Crown Land. The structure plan is intended to guide the future use, subdivision and development of land within the site area.

There is an emerging need to ensure an adequate supply of housing in Port Hedland, triggered by anticipated population growth and the need to reduce residential land use in West End, due to concerns over dust and public health. The local planning framework has identified Port Hedland's East End as a suitable area to accommodate future population growth and the potential relocation of residential use from West End. The Athol Street site is one of the identified areas for potential future residential development.

Previous structure planning was undertaken and considered for the Athol Street site in 2014 - 2015, however at the time, this was determined as being premature. The Town of Port Hedland had not completed a Coastal Hazard Risk Mapping and Adaption Plan (CHRMAP) to address the policy measures in State Planning Policy 2.6. A CHRMAP informs the viability (including any adaptation measures) for consideration of locating future residential areas in areas potentially subject to coastal hazard risk (i.e. flood inundation). In April 2019 the Town had completed and adopted a CHRMAP. The CHRMAP findings indicated urban development could be considered on the Athol Street site, subject to the provision of appropriate coastal protection works and further planning investigations.

The Athol Street Structure Plan considers the groundwork laid by the former 2015 Athol Street Structure Plan. Following discussions with key stakeholders and a review of the knowledge and understanding of the site's significance and environmental context, in the Pretty Pool Creek area, the structure plan proposes modifications to the original 2015 structure plan. The new structure plan has sought to more appropriately balance planning, heritage and environmental aspects.

Key considerations adopted under the proposed structure plan include:

- CHRMAP management of coastal hazard risks including provision of adequate coastal protection works;
- Appropriate residential densities, building form and height to restrict urban light spill impacts to turtle nesting sites at Cemetery Beach and Pretty Pool Beach,
- Protection of significant cultural heritage sites (i.e. Merv's Lookout)
- Protection of existing street trees in Athol Street
- Appropriate land uses for a future coastal node,
- Creation of a foreshore reserve to adequately buffer the Pretty Pool Creek mangrove habitat from urban development
- Provision of adequate public open space
- Appropriate interface of urban development with foreshore reserve
- Management of stormwater drainage, and
- Continued use of intertidal mudflats for recreation and wildlife habitat.

The following table is a summary of the proposed structure plan.

Item	Data	Section number referenced within the Structure Plan Report
Total area covered by the Structure Plan	41.89 hectares	1.2.2
Area of each land use proposed • Residential • Roads • Coastal Node • Public Open Space and Drainage • Public Purpose • Coastal Protection Infrastructure • Foreshore Reserve	 12.37 hectares 2.72 hectares 2.00 hectares 2.06 hectares 1.31 hectares 2.10 hectares 19.33 hectares	5.2, 5.7
Total estimated lot yield	232 lots	5.2
Estimated number of dwellings	232 single/grouped dwellings 70 multiple dwellings	5.2
Estimated residential density • Per site hectare	 18 dwellings per site hectare	5.2
Estimated Population (average 2.8 people/household)	650 - 800 people	5.2
Estimated area and percentage of public open space given over to: • Local Parks • Foreshore • Drainage	 1.23 ha (6.8% POS) 19.33 ha (No credit as POS) 0.83 ha (No credit as POS)	5.7

Contents

PART ONE
IMPLEMENTATION

Part One – Implementation

1. Structure Plan Area

The structure plan is identified as the Athol Street Structure Plan (plan reference 20-143 ST-1). This structure plan shall apply to the land contained within the inner edge of the line denoting the structure plan boundary on the Structure Plan Map.

2. Operation

The date the structure plan comes into effect is the date the structure plan is approved by the Western Australian Planning Commission as set out in the Structure Plan - Certification Page.

3. Staging

Development in the structure plan is likely to be delivered in at least two stages, due to the size of the development, market forces, the need to source adequate fill and costs associated with fill and coastal protection works. There are no specific triggers for staging of development, except that the initial Stage 1 will likely commence in the eastern half of the structure plan area.

The boundary and extent for Stage 1 would likely be up to the eastern side of the central drainage corridor near Wyndham Street. Permanent coastal protection works (i.e. rock revetment) would be constructed interfacing with the foreshore reserve, with the extent to the determined as part of subdivision approval.

The initial Stage 1 boundary would require the build-up of temporary 'soft edge' (battered) coastal protection works on its western edge behind the permanent coastal protection works. Provision of the temporary coastal protection works would be to the satisfaction of the Town of Port Hedland. The existing pumping station and servicing infrastructure west of the drainage corridor would remain until further staging. Contribution of public open space will be determined at the first stage of subdivision.

Stage 2 would likely cover the remaining balance western area of the structure plan. This would include the construction of the public open space and completion of the permanent coastal protection works edge extending up to the wastewater pumping station. The timeframe for undertaking Stage 2 is unlikely to be delayed for any long period of time, as the temporary 'soft edge' coastal protection works would require continual on-going monitoring and maintenance by the developer, under an agreed foreshore management plan with the Town. As soon as the next stage is ready to commence, it is envisaged it will be undertaken as quickly as possible, so that permanent coastal protection works can be installed.

A Foreshore Management Plan would be prepared to reflect the intended staging and identify works and responsibilities for management of the foreshore area. For the coastal node, development of this site could occur at any time. The coastal node site is separate to the main urban development area, is less constrained and can be developed independently. Market demand would determine the timing for development of the coastal node. The tenure of the coastal node is to be determined by the Town of Port Hedland and state government. This would inform whether the coastal node needs to be created on a separate title, or whether the land is leased and managed by the Town of Port Hedland.

4. Subdivision and Development Requirements

4.1 Land Use and Permissibility

The structure plan outlines the Zones and Reserves applicable within the structure plan area and these will guide future subdivision and development of the land. Land use permissibility within the structure plan area shall generally be in accordance with the corresponding Zone and/or Reserve under the Town of Port Hedland Local Planning Scheme.

4.2 Residential Density

i) The structure plan defines the areas for low and medium density residential codes that apply to the structure plan. Residential densities for lots are to be assigned in accordance with a Residential Code Plan developed in consultation with the local authority approved by the Western Australian Planning Commission.

ii) A Residential Code Plan is to be submitted at the time of subdivision to the Western Australian Planning Commission following consultation with the local authority and shall indicate the R-Code applicable to each lot within the subdivision and shall be consistent with the structure plan locational criteria herein provided.

iii) Approval of the Residential Code Plan shall be undertaken at the time of the determination of the subdivision application by the Western Australian Planning Commission. The approved Residential Code Plan shall then form part of the structure plan and shall be used for the determination of future development applications.

iv) Variations to the Residential Code Plan will require further approval of the Western Australian Planning Commission, with a revised Residential Code Plan submitted generally consistent with the approved plan of subdivision issued by the Western Australian Planning Commission. The revised Residential Code Plan shall be consistent with the structure plan locational criteria.

v) A revised Residential Code Plan, consistent with (v) above will replace, wholly or partially, the previously approved residential density code plan, and shall then form part of the structure plan as outlined in (iv) above.

vi) Residential Code Plans are not required if the Western Australian Planning Commission considers that the subdivision is for one or more of the following:

- the amalgamation of lots;
- consolidation of land for “superlot” purposes to facilitate land assembly for future development;
- the purposes for facilitating the provision of access, services or infrastructure; or
- land which by virtue of its zoning or reservation under the structure plan cannot be developed for residential purposes.

Locational Criteria

The allocation of residential densities on the Residential Code Plan shall be in accordance with the following criteria:

Residential Low Density

1) The R20 code applies as the base code to areas identified as Residential Low Density on the structure plan map.

Residential Medium Density

2) The R25 code applies as the base code to areas identified as Residential Medium Density on the structure plan map.

3) The R40 code may be applied to lots within Residential Medium Density areas (only) where there is a desire to provide for diverse housing accommodation and the lots are within a 200m ped-shed walking distance of public open space.

Residential High Density

4) Higher density for single, grouped and/or multiple dwellings, up to an R60 code, may be applied at the locations specified on the structure plan map, provided no R60 development is located within areas designated as Residential Low Density on the structure plan map.

4.3 Public Open Space

Public open space is to be provided in accordance with the requirements of the Western Australian Planning Commission's Liveable Neighbourhoods framework (as amended) and generally situated as shown in the Structure Plan Map. An updated Public Open Space Schedule is to accompany application(s) for subdivision approval in respect of the first stage of development.

4.4 Local Development Plans

A Local Development Plan(s) is required to be prepared and implemented pursuant to the provisions of TPS 5 and the Planning & Development (Local Planning Schemes) Regulations 2015, for lots with the following site attributes:

(i) Lots abutting public open space and/or land required for drainage infrastructure.

(ii) Lots accessed via a laneway (if required).

(iii) Lots to be developed for High Density Residential or multiple dwellings.

(iv) Lot/s that is part of or wholly within the Coastal Node.

(v) All lots fronting or abutting Athol Street to ensure location of garages/carports and crossovers address the retention of existing street trees in Athol Street.

4.5 Artificial light impact on wildlife

a) Prior to subdivision and/or development approval, the developer shall prepare a detailed **Artificial Light Management Plan**, in accordance with and to the specifications of the Commonwealth National Light Pollution Guidelines for Wildlife and the Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (Environmental Protection Authority 2010) - or as updated. The recommendations of the Artificial Light Management Plan shall inform subdivision design and urban built form to mitigate light spill impacts on wildlife, including turtle nesting sites at Pretty Pool Beach and Cemetery Beach. The plan shall be provided to all prospective purchasers.

b) All landowners within the structure plan shall comply with the recommendations of the Artificial Light Management Plan.

c) The maximum building height for single and/or grouped dwellings is two storeys.

d) The maximum building height for multiple dwellings is three storeys.

4.6 Notifications on Title

In respect of applications for the subdivision of land the Town of Port Hedland may recommend to the Western Australian Planning Commission that a condition be imposed on the grant of subdivision approval for a notification to be placed on the Certificate(s) of Title(s) to advise of the following:

(i) Land or lots deemed to be affected by a Bush Fire Hazard

(ii) Building setbacks and construction standards required to achieve a Bushfire Attack Level 29 or lower in accordance with Australian Standards (AS3959-2009): Construction of buildings in bushfire prone areas

(iii) Recommendations of the estate Mosquito Management Plan in relation to the structure plan proximity toPretty Pool Creek, which is a known breeding area for mosquitos.

(iv) Vulnerable Coastal Area – area likely to be subject to coastal erosion and/or inundation over the next 100 years.

4.7 Coastal Planning Flooding Finished Development Level

(i) All residential and commercial development shall have a minimum finished habitable development level of 6.7m AHD.

(ii) The following are to be completed prior to the Western Australian Planning Commission granting subdivision conditional approval:

- The developer is to submit to the Commission a detailed design and modelling of the coastal protection works to satisfy the requirements of SPP 2.6;
- The developer is to submit to the Commission a suitable Statement/s of Undertaking from both the developer and the Town of Port Hedland, whereby these parties agree to satisfy the requirements of SPP 2.6 Policy Measure 5.7(iii)(b), through the collaborative preparation of a Foreshore Management

Plan, which amongst other matters, sets the specific funding arrangements for the construction and ongoing care, control and maintenance of coastal protection works; and

- The developer is to consult with the Town of Port Hedland and Department of Planning, Lands and Heritage and agree upon the scope and content required for the preparation of a Foreshore Management Plan, which is to address the requirements of SPP 2.6 and of which is to form the basis for the preparation and approval of a detailed Foreshore Management Plan as a condition of subdivision approval.

4.8 Retention of Existing Trees – Athol Street

Prior to commencement of subdivision and/or development, the developer shall provide a feature survey which identifies the location of existing street trees within Athol Street road reserve. The developer is to locate any future lot boundaries and/or development so as to address the retention of existing trees in the Athol Street road reserve, to the satisfaction of the Town of Port Hedland.

4.9 Wastewater pumping station odour buffers

No development of sensitive land uses are to occur within the wastewater pumping station odour buffer/s to the satisfaction of the Town of Port Hedland.

4.10 Coastal Node

The objective of the coastal node is to provide for land uses which are limited to hospitality and/or tourism uses which can take advantage of the site's attributes and vista overlooking Pretty Pool Creek. Proposed development is to be of high quality given the site's strategic location and prominence in the urban and natural landscape.

(i) A local development plan is required to be prepared and approved for the coastal node site, as a condition of subdivision approval, or prior to the Town of Port Hedland granting development approval.

The local development plan shall address the following planning matters:

- Orientation of development
- Plot ratio and retail floor space
- Site access and location for parking
- Retention of existing street trees in Athol Street
- Access and interface with the foreshore
- Site landscaping
- Boundary setbacks
- Building height
- Building external design including materials, colours and finishes
- Bushfire management.

(ii) Permitted uses are restricted to the following, with all other uses being prohibited ('X') uses:

- Restaurant (includes café)
- Tourist Resort
- Tourism Development

5. Additional Information

To facilitate subdivision of the land, the following documentation and management plans are to be prepared, as applicable, to the satisfaction of the relevant authority as outlined in Table 1:

Documentation	Stage of development	Relevant authority
Cultural Heritage Management Plan	Subdivision application stage	Department of Planning, Lands and Heritage
Bushfire Management Plan	Subdivision application stage	Department of Fire and Emergency Services
Artificial Light Management Plan	Subdivision application stage	Department of Biodiversity, Conservation and Attractions
Mosquito and Midge Management Plan	Subdivision application stage	Town of Port Hedland
Marine Turtle Management Plan	As a condition of subdivision approval	Department of Biodiversity, Conservation and Attractions
Foreshore Management Plan	As a condition of subdivision approval	Western Australian Planning Commission
Mangrove Management Plan	As a condition of subdivision approval	Department of Biodiversity, Conservation and Attractions
Acid Sulfate Soil Management Plan	As a condition of subdivision approval	Town of Port Hedland
Urban Water Management Plan	As a condition of subdivision approval	Western Australian Planning Commission Department of Water and Environmental Regulation.
Nutrient and Irrigation Management Plan	As a condition of subdivision approval	Department of Water and Environmental Regulation.
Construction Management Plan	Prior to commencement of subdivision or development site works	Town of Port Hedland

To provide greater clarification of the information to be provided to support later stages of subdivision and development.

Legend

Local Scheme Reserves

- Public Open Space
- Environmental Conservation
- Public Purposes
- Local Road

Local Scheme Zones

- Residential (Low Density)
- Residential (Medium Density)

Other

- Structure Plan Boundary
- Existing Lot Boundaries
- Residential (High Density Indicative Locations)
- Coastal Node
- Future lots to avoid the removal of existing street trees (Athol Street)
- Local Road
- Full Movement Intersection
- Restricted Movement Intersection
- Roundabout
- No Vehicle Access
- Drainage

Athol Street Structure Plan

0 40 80m

Date: 19 Jan 2021 Scale: 1:4000 @ A3 1:2000 @ A1 File: **20-143 ST-1** Staff: JP GW Checked: JP

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PART TWO
EXPLANATORY

1. Introduction

The Athol Street site is government owned land, comprises of various Crown Land lots. Most of the lots are managed by the Town of Port Hedland, with one lot being managed by Water Corporation for a wastewater pumping station and others being unallocated Crown Land. With the exception of two wastewater pumping stations, the site is vacant land comprising of mostly coastal dune scrub/grasses and tidal flats.

The overall area of the development site is approximately 41.89 hectares and is currently zoned 'Urban Development' under the Town of Port Hedland Town Planning Scheme No. 5 (TPS 5). The urban development zone was established under TPS 5 Scheme Amendment No. 58, which was gazetted on 10 January 2014. The urban development zone establishes a broad footprint for which further planning investigations can occur as to use of the land for urban development. In general, planning investigations are to consider what land uses are appropriate, what areas to be set aside for open space/conservation, what should be the future built form for development, provision of adequate coastal protection works and future on-going management requirements for desired uses in the structure plan area.

The former Athol Street Structure Plan 2015 originally proposed the maximum use of the structure plan footprint for urban development. This included residential lots backing onto the Pretty Pool Creek natural area. At its Council Meeting held 27 April 2016, the Town of Port Hedland did not support the structure plan. Similarly, at its meeting held 8 November 2016, the Western Australian Planning Commission resolved to refuse the structure plan.

Subsequently, the Athol Street Structure Plan 2015 was not approved nor progressed. One of the primary reasons for refusal of the structure plan related to outstanding planning issues, centred on provisions within the State Planning Policy 2.6 'State Coastal Planning Policy' - coastal and flooding hazards. These matters have now been resolved with the adoption of the Town's Coastal Hazard Risk Mapping and Adaptation Plan in April 2019.

In terms of the Athol Street site potential for urban development use, the site is identified in the Town of Port Hedland Port City Growth Strategy (and Draft Local Planning Strategy 2020) for future residential development. Based on planning investigations, the proposed new Athol Street Structure Plan balances both planning, heritage, coastal, community and environmental expectations.

With a planned reduction of residential use in Port Hedland's West-End, the East-End offers opportunities to open up land for new residential development - the Athol Street site is one of those areas.

Image 1. The East End coastal area of Pretty Pool is unique and offers an attractive place for people to live. (Source: discoveryparks.com.au)

The Athol Street Structure Plan envisages a new place for people to live, one where residents can share an intimacy with the site's history and natural environment. Development will overlook the historical rifle range where World War II Australian servicemen stationed in Port Hedland trained. Merv's lookout will remain as a memorial to those who were stationed in Port Hedland and served in WWII.

The tidal flats at Pretty Pool Creek are familiar to many residents. The tidal flats form part of Port Hedland's unique landscape and scenery, adding to a sense of place and identity. The Athol Street development will have a strong visual and physical connection with this iconic landscape.

The tidal flats also have significant heritage value for Aboriginal people as a place. The Athol Street Structure Plan development will therefore have a strong sense of place and identity. It's proximity and outlook to Pretty Pool Creek will make it an appealing place to live.

1.1 Project Background

Port Hedland's growth since the 1960's has largely been driven by the iron ore industry. Today Port Hedland is the largest bulk export port in the world for iron ore, with an export output of 247 million tonnes during 2012 and 513 million tonnes in 2019. Future export volume is forecast by the Port Hedland Industries Council to be 700 million tonnes by 2027. As a result of a significant increase in port operations and export movements in the last decade, concerns have been raised as to the public health risk of iron ore dust in the West End of Port Hedland.

The WA Department of Health undertook investigations into the issue of dust in West End and published the report *Port Hedland Air Quality Health Risk Assessment for Particulate Matter* (February 2016). The report concluded that there is sufficient evidence suggesting the possible negative effects on human health from dust in West End. The Department recommended improved dust management, monitoring controls and land use planning measures to reduce community exposure to dust.

In October 2018 the WA State Government adopted a whole of government approach to dealing with the management of dust in Port Hedland. This includes a proposed Improvement Plan and Scheme (IP50) that seeks to reduce the number of residential land use in the West End of Port Hedland.

As part of the Town of Port Hedland new Local Planning Strategy, future residential growth areas have been identified in the east-end of Port Hedland that fall outside of IP50. The Athol Street site is one of those identified areas for potential future residential development.

The Athol Street Structure Plan considers the former 2015 Athol Street Structure Plan and proposes modifications to the original design. Based on discussions with key stakeholders and a review of the knowledge and understanding of the site's significance and environmental context in the Pretty Pool Creek area, the proposed structure plan has sought to more appropriately balance planning, heritage and environmental aspects.

The original Athol Street Structure Plan 2015 was refused by the WA Planning Commission on 8 November 2016, primarily on the basis of an inconsistency with State Planning Policy 2.6 – State Coastal Planning Policy (SPP2.6). That inconsistency being the Town of Port Hedland had not (at that time) completed its Coastal Hazard Risk Mapping and Adaption Plan (CHRMAP). A CHRMAP informs the viability (including any adaptation measures) for locating future residential areas in the context of coastal processes and flood inundation, arising from climate change and forecast sea level rise.

In April 2019 the Town of Port Hedland adopted a CHRMAP for Port Hedland that identifies and assesses coast hazard risks, culminating in a recommended adaptation pathway to address the identified short-term and long-term risks to the area. The findings of the adopted CHRMAP provide a framework to guide future development of the Port Hedland town site. The CHRMAP informs proposed finished development levels and mitigation measures and strategies that will be necessary for development on land which is subject to coastal and tidal impacts.

The Town's adopted CHRMAP and subsequent technical erosion and flood modelling undertaken for the site supports the development of the Athol Street site for residential use.

The structure plan provides the statutory framework for determining future land uses, design and implementation of the desirable planning, environmental and heritage outcomes. These will inform the planning decision making for future subdivision and development approvals for the Athol Street site.

1.2 Site Description

1.2.1 Site Location

The subject site comprises a portion of land in the east-end (Cooke Point) part of Port Hedland, approximately 5 kilometres east of the Port Hedland Town Centre. The site is generally bound by Pretty Pool Creek to the south, Athol Street to the north and east and Cooke Point Road to the west.

Refer to Figure 1 – Location Plan

1.2.2 Site Tenure

The subject site comprises a number of Crown Land parcels, totalling 41.89 hectares. This includes both Unallocated Crown Land and Crown Reserves vested in the Town and the Water Corporation.

Refer to Figure 2 – Aerial and Cadastral Plan

A detailed description of the land in the subject site is provided in Table 1.

Table 1 – Land Description

Lot	Volume/Folio	Crown Reserve	Management Order	Area
Pt 555	LR3162/598	R51251 public purpose	Water Corporation	1.313 ha
Pt 340	N/A	N/A	State of WA	4.513 ha
Pt 511	LR3162/317	R30768 for 'Recreation'	Town of Port Hedland	1.220 ha
512	LR3019/718	N/A	State of WA	0.066 ha
Pt 556	LR3162/598	R30768 for 'Recreation'	Town of Port Hedland	34.05 ha
1732	LR3013/629	R30220 for 'Recreation'	State of WA	0.188 ha
1444	LR3060/303	R30768 for 'Recreation'	Town of Port Hedland	0.531 ha
Total				**41.89 ha**

1.2.3 Existing Use

The subject site is mostly vacant land comprising of coastal dune low scrub and tidal flats. Some limited development has occurred, which includes:

- A large wastewater pumping station on Lot 555 adjacent to Cooke Point Road. This wastewater pumping station receives all effluent in Port Hedland and pumps it to the South Hedland Wastewater Treatment Plant.
- A small wastewater pumping station within Lot 1732 adjacent Athol Street, which receives effluent from the Cooke Point residential area and pumps via pressure main southwards to the larger pump station on Lot 555.
- Merv's Lookout developed on Lot 512 adjacent Athol Street as a memorial with a planted garden.

The site is used by the public for recreation including walking, dog exercise, bird watching and informal vehicular access, with a number of 4WD tracks criss-crossing the site.

Image 2. View from Athol Street looking south at the smaller pumping station on Lot 1732. (Source: Google maps street view, 2020)

Image 3. View from Cooke Point Road looking north-east at wastewater pumping station (Source: Google maps street view, 2020)

Figure 1. Location Plan (**element**, 2020)

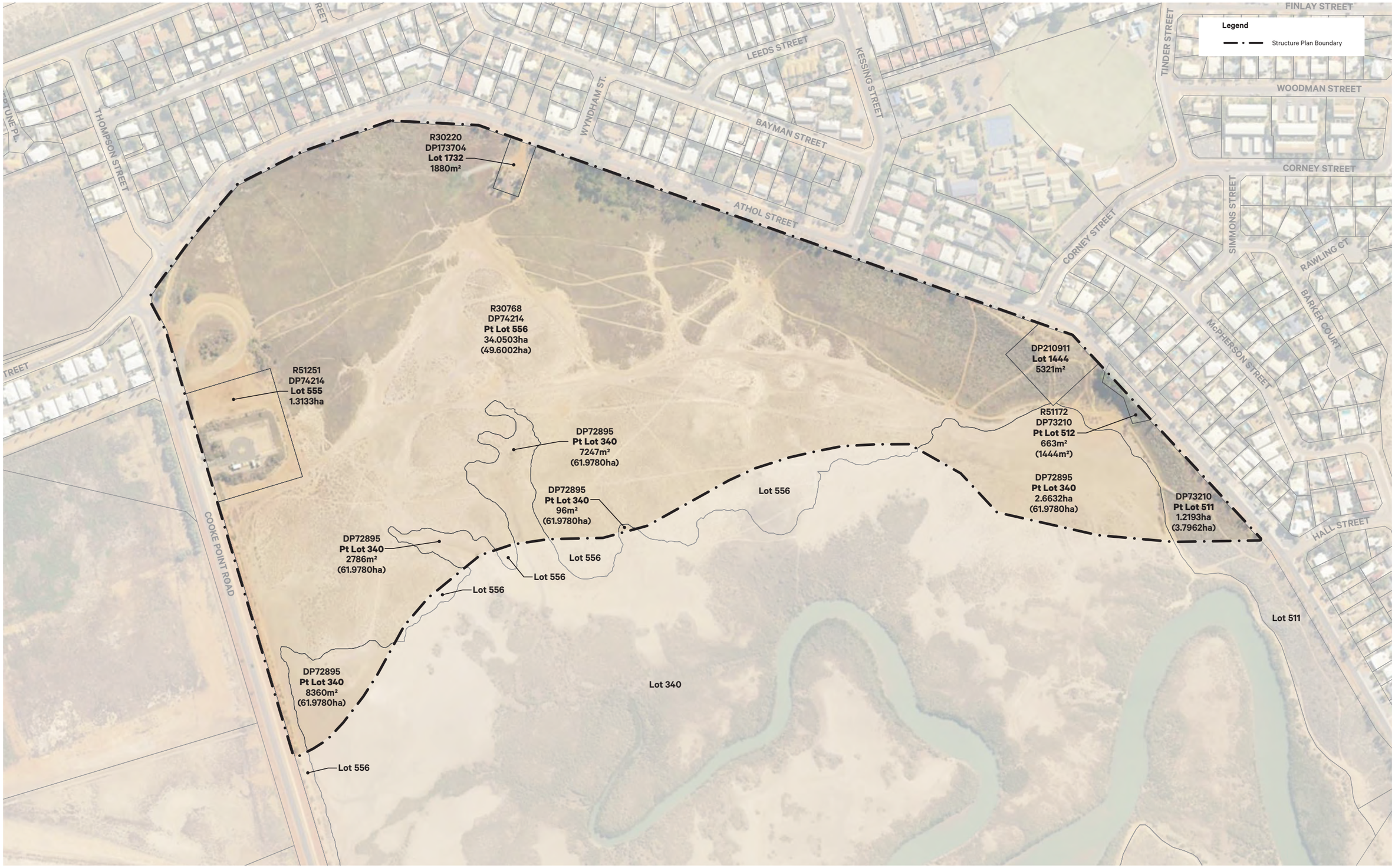


Figure 2. Aerial and Cadastral Plan (**element**, 2020)

1.2.4 Surrounding Context

Within the context of the Town of Port Hedland, the subject site is identified as potential future residential land. At present the site is mostly undeveloped and predominantly used as informal recreational open space (and the two wastewater pumping stations).

The subject site is influenced by the high and low tide fluctuations within Pretty Pool Creek, which connects with the ocean. Pretty Pool Creek just south of the site is a natural surface waterway forming a narrow winding low velocity creek spanned by mangroves on either side. The adjacent mud tidal flats on either side of the creek are often inundated by the daily tidal movement. Tidal inundation is generally not greater than 0.5m water depth.

Presently the furthest extent of the high tide water mark extends generally to the edge of where the coastal scrub/grass vegetation begins at the base of the secondary dune system. Based on aerial imagery from 1995, the line of vegetation separating the mud tidal flats from the secondary dune formation has remained relatively consistent.

However, during large storms or cyclonic events, flooding inundation can temporarily extend into the site's secondary dune formation beyond the daily tidal extent. As an example, when Cyclone Veronica hit Port Hedland in March 2019, flooding was observed above 4.0m AHD, which resulted in floodwaters crossing the top of the pavement level of Cooke Point Road.

To the north and east of the site is established low density residential with community facilities nearby, as detailed below:

- Port Hedland Primary School is within 100m
- Port Hedland YMCA and Early Learning Centre and Andrew McLaughlin Community Centre is within 200m
- Colin Matheson Oval (co-shared with the primary school) is within 250m
- The coastal beach is within 320m via Thompson Street from the north-west area of the site
- Port Hedland shopping centre is the nearest major commercial centre with supermarkets and specialty stores, located in McGregor Street approximately 1.8km west of the site.

The former Port Hedland Wastewater Treatment Plant to the west on the opposite side of Cooke Point Road is now decommissioned. The site is earmarked for future residential use.

South of Pretty Pool Creek is the Stables site where the Port Hedland Pony Club and Port Hedland Turf Club are located. The Stable site is also earmarked for future residential development in the Town's planning framework.

Refer to Figure 3 – Surrounding Context

Image 4. Colin Matheson Oval is the major sporting and recreational facility for the east-end of Port Hedland within 250m of the site. (Source: Google maps street view, 2020)

Image 5. View looking south near intersection of Athol Street and Keesing Street showing secondary dune system vegetation in foreground and tidal flats in background with informal 4WD tracks. (Source: Google maps street view, 2020)

Figure 3. Surrounding Context (**element**, 2020)

2. Subject Site

The following section is a general description of the site characteristics of the subject land. This section demonstrates that there are no significant constraints to urban development which cannot be adequately addressed. A broad opportunities and constraints analysis is provided in Figure 4.

Refer to Figure 4 – Opportunities and Constraints Plan

2.1 Landforms and topography

There are two distinguishable landforms found within the subject site, being the bare tidal salt flats (mudflats) and secondary dune system, which comprises dunal sand deposits and limestone.

The southern portion of the site forms the lower lying intertidal samphire mudflats that surround Pretty Pool Creek and fringing mangrove habitat. The northern portion of the site predominantly consists of a higher elevated secondary dune system.

The natural level of the tidal flats is approximately 2.0m – 2.8m AHD, which is subject to daily tidal inundation. This is confirmed during recent site inspections, particularly during a super full moon period when the high tide water level was observed to not extend beyond the 3.0m AHD topographical contour. The existing line of scrub vegetation is at a level of approximately 3.0m – 3.5m AHD.

The secondary dune system topography varies, but generally rises up from the edge of the mudflats (i.e. approximately 3.0m AHD) sloping upwards towards Athol Street, to a maximum height varying 6.0m AHD at Athol Street to 16.0m AHD in the north-eastern portion on top of the mound near Corney Street. The majority of the subject site above the mudflats is at a level ranging 3.5m – 5.0m AHD.

The structure plan design has considered the natural landforms and topography and proposes urban development primarily limited on the secondary dune system. The original Athol Street Structure Plan 2015 proposed urban development within the intertidal mudflats and this approach has been abandoned. The vast majority of the tidal mudflats is proposed to be retained in its natural form as an environmental and recreational asset.

2.2 Geology and soils

The soils found within the site have been assessed and categorised as follows:

- *Secondary dune system:* coastal beach deposits, older shelly sands medium grained, red brown or loose to medium density with traces of silt and clay with some limestone.
- *Tidal flats:* coastal mud and silty clay with some fine to medium grained sand.

In reviewing the geology of the site, urban (residential) development is feasible within the secondary dune system sand, but the mud tidal flats pose more significant constraints. The mudflats would not be suitable for conventional residential foundation without amending the geology to improve the ground. Preliminary geotechnical investigations indicate that pre-loading would need to be carried out to consolidate the intertidal estuarine deposit material. Consolidation would be in the order of 300mm - 500mm as a result of the final filling of the site.

Upon review of the geological formations and soils, the structure plan limits urban development to the secondary dune system, which can better support residential development.

The requirements to amend the geology of the mudflats to support urban development would be challenging and costly. The tidal mudflats will therefore be retained in its natural state and left undeveloped. Coastal protection infrastructure would generally commence at the base of the secondary dune system and rise up to the finished levels of development. Thus development will be limited extending onto the tidal flats.

Refer to Appendix 1 – Environmental Assessment Report (Geological Report part of the appendices)

Refer to Figure 5 – Geological Formations

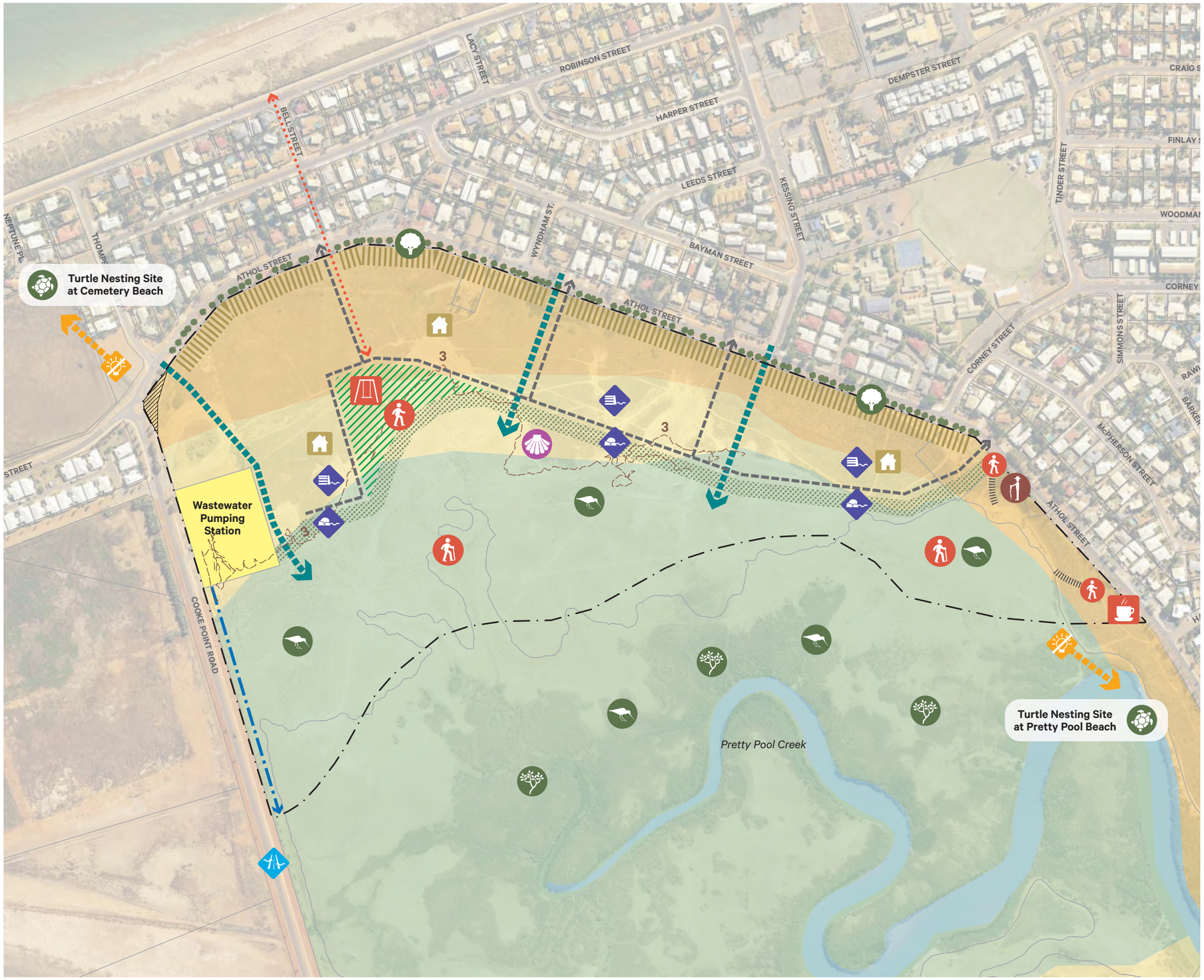


Figure 4. Opportunities and Constraints (**element**, 2020)

Legend

Structure Plan Boundary

Residential Development

Residential low density interface with existing residential area and to retain street trees

Residential high density indicative locations around areas of natural amenity and for views of Pretty Pool Creek

Environmental

Coastal dunes, sand and limestone

Coastal dunes, sand

Intertidal Mudflats

Ocean

Provision of adequate buffer to existing mangrove habitat fringing Pretty Pool Creek

Future low density lots along Athol Street to avoid removal of existing street trees by carefully selecting location of lot boundaries and future driveway crossovers

Foreshore area continued use for wildlife habitat

Consideration of existing turtle nesting sites at Cemetery Beach and Pretty Pool Beach concerning light spill

Residential building height restrictions (three storey maximum) to ensure no adverse light spill impacts turtle nesting sites at Cemetery Beach and Pretty Pool Beach

Leisure and Recreation

Continued access to foreshore

Foreshore area continued use for recreation

Possible future location for cafe and / or tourist use with outlook over Pretty Pool Creek

Possible location of park for active and passive recreation

Pedestrian connection between coast and Pretty Pool Creek

Culture and Heritage

World War II historical memorial (Merv's Lookout) retained

Indigenous cultural heritage site (midden)

Infrastructure

Public Purposes: Wastewater Pumping Station
(Odour buffer is contained within pumping station site)

Wastewate pumping station overland flow path

Drainage corridors required to provide for upstream overland flow paths

Road Widening

Possible connection points for future roads with Athol Street and provide a hard edge road interface with foreshore

Existing flood hazard over Cooke Point Road

CHRMAP Considerations

Existing 3m AHD Contour Level which is generally the extent of the intertidal mudflats at normal high tide

Existing geological and topographical attributes used as demarcation for coastal works between intertidal mudflats and potential future urban development on higher ground secondary dunal system

Coastal protection works (rock revetment) against storm surge erosion and flooding

Establishment of a minimum 6.7m AHD (Australian Height Datum), to raise ground level by up to approx. 3.5 metres, to finished habitable development level as part of the planned coastal protection works for CHRMAP adaptation measures to address flood inundation coastal hazard

element.

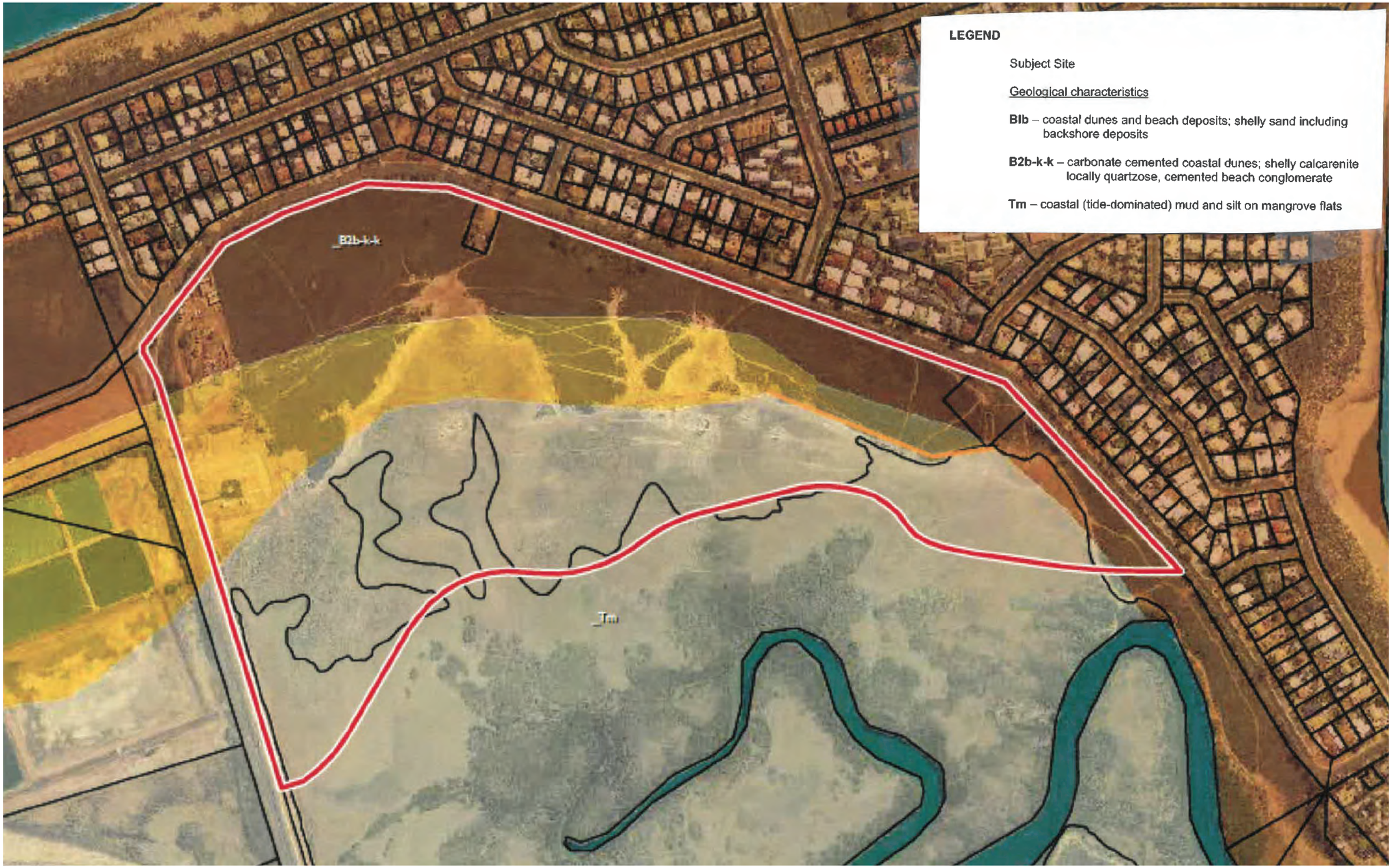


Figure 5. Geological Formations

Image 6. View from Cooke Point Road looking east over tidal mudflat dry and exposed at low tide. (Source: Google maps street view, 2020)

Image 7. View from north-west area looking east over secondary dune system containing coastal scrub and grasses. (Source: Google maps street view, 2020)

2.3 Acid Sulfate Soils

A desktop review of acid sulfate soils mapping provided by Department of Water and Environmental Regulation indicates a 'Moderate to Low Risk' within 3 metres of the natural soil surface for the northern half of the site including the secondary dune system. A 'High to Moderate Risk' is identified for the southern half within the tidal mudflats.

Image 8. Acid sulfate soils mapping. (Source: RPS, 2020)

Where required for the limited urban development being proposed on estuarine deposits, further acid sulfate soils investigation would be required, to identify whether there is a need for specific management measures to be implemented during construction and dewatering activities. This would require preparation and approval of an Acid Sulfate Soils Management Plan. Overall the proposed area of the structure plan to be developed for residential use is not significantly constrained by acid sulphate soils and can be adequately managed, particularly as the site will be substantially filled.

2.4 Flora and Vegetation

The Environmental Assessment Report provides a description of the flora and vegetation found within the subject site.

Refer to Appendix 1 – Environmental Assessment Report

Conservation of significant vegetation

There were no known occurrences of Threatened Ecological Communities (TECs) protected under the EPBC Act within or adjacent to the subject site. This has also been confirmed by other external studies that have been undertaken in the *Pilbara 4 Bioregion*.

Vegetation types

The coastal secondary dune system within the subject site typically comprises of low shrub (*Acacia stellaticeps* over hummock grassland of *Triodia epactia*) with open herbland of *Euphobia tannensis*.

The intertidal mudflats are typically bare, with salt tolerate species of dwarf shrubland of *Tecticornia halocnemoides, Hemichro adiandra* and *Frankenia pauciflora,* with patches of grassland *Sporobolus virginicus*.

The secondary dune system vegetation found on the subject site is relatively common in Port Hedland and does not have any significant environmental value. The structure plan proposes all of the vegetation within the secondary dune system to be removed (with the land predominantly filled) to accommodate urban development.

The structure plan does not propose any development on the tidal mudflats, with coastal protection infrastructure being accommodated at and beyond generally the 3.0m AHD topographical contour. Subsequently there would be limited removal or impact of existing vegetation on the mudflats.

Image 9. View from central south looking north over tidal mudflat vegetation (within hours after high tide) with secondary dune system in background. (Source: DevelopmentWA, 2020)

Image 10. View of the northern portion of site looking south across typical secondary dune coastal scrub vegetation. (Source: DevelopmentWA, 2020)

Conservation significant flora

There are no known occurrences of Threatened flora species recorded within or immediately surrounding the subject site.

Benthic communities and habitat – Pretty Pool Creek mangroves

The site is situated to the north of the Pretty Pool Creek intertidal zone mangrove habitat. The mangroves potentially support a variety of fauna, including crustaceans, birds and bats. The structure plan proposes urban development to be well setback from the mangroves, for instance the setback ranges 120m – 300m. The proposed coastal node site is closer to within 40 metres of the edge of the mangrove habitat. However, the coastal node site is substantially elevated (by 8 - 9 metres) above the ground level of the mangroves. This height difference will result in a low impact to the mangrove habitat.

The structure plan proposes filling of the secondary dune system area to accommodate urban development to a finished level of 6.7m AHD, as required to address the coastal hazard risk of flood inundation. Flood modelling undertaken confirms that the filling of the structure plan area will not have any adverse impact upon the long-term sustainability of the mangrove community. This detailed analysis is contained in the Environmental Assessment Report.

2.5 Fauna

A desktop review of likely fauna to inhabit the secondary dune system and tidal flats can be found in the Environmental Assessment Report. Within the secondary dune the types of fauna that could potentially be found include reptiles, such as snakes (woma, Pilbara olive python) and skinks (Airlie Island skink).

The most noticeable fauna found on the intertidal mudflats are the various species of foraging shorebirds.

Image 11. A common shorebird species, the Bar-tailed Godwit is shown foraging on intertidal flats during a falling tide. (Source: parks.dpaw.wa.gov.ua, 2020)

Marine Turtles

Pretty Pool Beach (approximately 1km east of the site) and Cemetery Beach (approximately 1.3km north-west of the site) are known nesting sites for the *Flatback* turtle. These turtles are listed as 'Vulnerable' under *Environmental Protection and Biodiversity Conservation Act* and 'Threatened' under the *Wildlife Conservation (WC) Act*.

Female Flatback turtles come ashore onto beaches to nest and lay their eggs. Turtle hatchlings have an innate instinct that leads them towards the brightest direction which, at the time of hatching on a dark beach, is usually moonlight reflecting off the ocean.

Excess artificial light generated from human activities (such as from the urban environment) can cause hatchlings to become disorientated and wander inland towards the artificial light. The excess lighting from the nearshore buildings and streets can thus draw hatchlings towards land, where they perish from dehydration or predation. It is critical therefore that light spill from the structure plan is not direct nor excessive to have an adverse impact on the Flatback turtle nesting sites.

The natural height of the coastal primary dunes running along Pretty Pool Beach and Cemetery Beach provide shielding from direct impacts of urban light spill. If building and urban infrastructure height is appropriately controlled and managed, artificial light impacts to turtle nesting sites from the structure plan would be restricted to *sky glow*.

The Commonwealth *National Light Pollution Guidelines for Wildlife including marine turtles, seabirds and migratory shorebirds* (2019) indicates that there is no one source of sky glow. Management of sky glow (and measures to mitigate and minimise artificial light) needs to be undertaken on a regional and collaborative basis, addressed by the community, regulators, councils and industry. The guidelines recommend that where appropriate, an **Artificial Light Management Plan** should be developed in collaboration with all relevant light owners and managers to mitigate impacts on wildlife.

The Environmental Assessment Report contains a Line of Sight assessment (which informed Scheme Amendment No. 58) indicating that direct light spill from built infrastructure within the structure plan area can be suitably managed through building height controls. The results of the Line of Sight assessment showed the following outcomes.

Table 2 – Line of Sight assessment

Location	Line of Sight Assessment Outcome
Pretty Pool Beach	Buildings start to become visible at the turtle nesting site between 18m - 21m AHD. With site filling to 6.7m AHD, this would equate to a maximum building height limit of three storeys, to avoid direct light spill pollution to the turtle nesting site.
Cemetery Beach	Buildings at 36m AHD would not be visible from the turtle nesting site. With site filling to 6.7m AHD, the maximum three storey height limit would not create any direct light spill pollution to the Cemetery Beach turtle nesting site.

It is recommended that a maximum building height of three storey be set for development within the structure plan area and this will adequately address any potential adverse light spill pollution impacting the turtle nesting sites at Pretty Pool Beach and Cemetery Beach.

Image 12. Flatback turtles frequent Pretty Pool Beach and Cemetery Beach during nesting season. (Source: seeturtles.org, 2020)

2.6 Biodiversity Value

The portion of the site between Athol Street and the tidal flats (i.e. secondary dune system) comprises land disturbed by human activities and non-significant vegetation types. The area proposed for urban development is therefore on land which has limited biodiversity value.

2.7 Hydrology and Coastal Flooding

Groundwater

There is limited historical groundwater data for the subject site. However, groundwater data from the coastal plain aquifers in the Pretty Pool area indicates the general groundwater to be highly saline to brackish.

The geotechnical investigations for the subject site provide a general overview of the localised groundwater. The results from test pits show groundwater encountered at depths of approximately 0.4m – 0.6m under the natural surface on the tidal flats, with groundwater at 1.8m – 2.8m in the more elevated secondary coastal dune area just beyond the tidal flats.

The depth of groundwater found on the tidal flats poses challenges for urban development along with the requirement for an amended geology solution to support residential use. However, the depth of groundwater encountered within the secondary dune system poses less challenges in terms of distance between groundwater and sub-soil urban infrastructure. With the minimum 6.7m AHD fill requirement, which will provide an adequate finished habitable level to address the coastal flooding constraint, the separation to groundwater from urban infrastructure can be adequately managed.

Surface water

No natural surface watercourses exist within the site, however the southern half of the site is located within the marine intertidal zone of Pretty Pool Creek. The creek itself is a natural watercourse which meanders south of the site, flowing to and joining with the coast. Surface water run-off within the Pretty Pool Creek catchment moves as overland flow towards the intertidal zone and fringing mangroves and into the creek.

Freshwater flows from the surrounding catchment to the north enters the subject site from existing pit/pipe outlets on the southern side of Athol Street (refer to *Opportunities and Constraints Plan*). The current overland flow route from these outlets to Pretty Pool Creek has been created by storm events over the years.

There are no natural surface watercourses or wetlands that constrain the structure plan area. Consideration is given to the existing hydrology of the intertidal flats, Pretty Pool Creek and urban upstream flows, which currently discharge into the site.

Image 13. Drone image of Athol Street intertidal mudflats seen at high tide, during a super full moon phase on 26 April 2020. (Source: Town of Port Hedland, 2020)

Coastal flooding

Port Hedland is often impacted by large storms and seasonal cyclonic events, resulting in coastal storm surge and potential flooding. The Town's CHRMAP has identified the site as being affected by coastal flood inundation. Accordingly, a minimum finished development habitable level of 6.7m AHD has been determined to adequately address the coastal flood hazard. This will be further discussed in this report under 'State Planning Policy 2.6 – State Coastal Planning'.

2.8 Contamination

Site contamination

A search of the Department of Water and Environment Regulation indicates that there are no recorded contaminated site(s) for the subject land.

Pumping station - wastewater contamination

The large effluent pumping station on Lot 555 (Reserve 51251) Cooke Point Road will be retained within a proposed Public Purpose reservation, which includes the full 50m odour buffer. The other smaller pumping station on Lot 1732 (Reserve 30220) Athol Street is proposed to be temporary. It will eventually be removed once duplicated pipework infrastructure is installed as part of staging of development. As part of its removal, any potential decontamination within Lot 1732 will be required to accommodate the intended future urban use of Lot 1732 under the structure plan.

WWII rifle range - Unexploded ordinance

During World War II, thousands of Australian and Allied personnel trained in the north-west part of Western Australia where they were stationed, including Port Hedland. Firing ranges were established for live firing and bombing practices. Within those historic firing ranges, there is potential for discarded and/or unexploded ordnance.

Unexploded ordnance (UXO) is any sort of military ammunition or explosive ordnance which has failed to properly detonate. It generally includes shells, mortars, rockets, missiles and hand grenades. UXO may or may not be dangerous, but if disturbed UXO can explode without warning.

The firing range established in WWII at Athol Street was primarily used for rifle training. The Australian Department of Defence does not classify personnel small arms ammunition (i.e. bullets) under its Land Service Ammunition UXO category. The former rifle range at Athol Street therefore does not require a formal UXO search. However, as part of any subdivision construction works, care should be observed given the historical military use of the site for weapons training.

Wastewater pumping station odour buffer

There are two existing wastewater pump stations developed on the site. The large effluent pumping station on Lot 555 (Reserve 51251) Cooke Point Road will be retained within a proposed Public Purpose reservation, including its 50m odour buffer. As the odour buffer is fully contained within the public purpose use, no residential development will be located within the buffer. The large pump station pumps effluent generated in Port Hedland to the upgraded South Hedland Wastewater Treatment Plant.

The smaller pumping station exists on Lot 1732 (Reserve 30220) Athol Street and is proposed to be removed as part of staging of development. This smaller pumping station (23 litre per second) requires a buffer of 10m under EPA Guidance Statement No. 3 : *Separation Distances between Industrial and Sensitive Land Uses.* While the pumping station is in operation, no residential development will be proposed within its buffer.

2.9 Transport Noise (Road and Rail)

The Athol Street site is located 1.1km from the railway line to the south used by the mining industry. Therefore the site is not significantly impacted by rail noise. Athol Street, which is an urban road, is not used by heavy trucks. The section of Cooke Point Road abutting the site on the eastern boundary between the wastewater pumping station and the roundabout at McGregor Street requires vehicles to slow down upon approach to the urban environment, thus reducing transport noise.

A preliminary noise assessment was undertaken for the Athol Street Structure Plan 2015, which considered potential noise impacts from vehicles, railway and salt harvesters. The assessment confirmed that transport and industry noise would not exceed SPP 5.4 compliance standards. Therefore transport noise impact is minimal and is not a constraint to urban development.

2.10 Cultural Heritage Significance

Aboriginal heritage

Aboriginal people have continually occupied the coastal lands of the Pilbara for many thousands of years. The marine resources of the coastal lands have provided sustenance for the Aboriginal people, along with a cultural connection.

Lot 340 within the structure plan area is subject to a native title claim of the *Kariyarra* people. The *Marapikurrinya* people also have a connection with the site.

Currently there are no recorded aboriginal sites under the Department of Aboriginal Affairs database.

The Report of an Aboriginal Heritage Survey of the East Port Hedland Redevelopment (Anthropos Australis, June 2012) provides a survey of the Athol Street site. The survey results found one midden at the base of the secondary dune system, recorded as Site LAN22-11-22 shell midden/scatter as shown in Image 14.

Refer to Appendix 2 - Report of an Aboriginal Heritage Survey of the East Port Hedland Redevelopment

The extended midden at LAN22-11-22 is generally located at the base of the sand dune extending onto the tidal mudflats. Some disturbance to the site has occurred through human activities. No artefacts were noted at the site.

Image 14. Athol Street Site LAN22-11-22 shell midden/scatter. (Source: Anthropos Australia, 2012)

A shell midden is distinguished from a natural accumulation of shells (which can naturally occur through local geomorphological processes), in that the shells are generally intact (not fragmented), usually of one or two species of local edible shellfish and may contain some shells burnt by fire.

Image 15. Midden at site LAN22-11-22 showing disturbance from 4WD activity. (Source: Anthropos Australis, 2012)

Image 16. Scattered shells within midden site LAN22-11-22. (Source: Anthropos Australis, 2012)

It is important that continual land and water access to the Pretty Pool Creek system be provided for the aboriginal people, to maintain their cultural connection with the area.

The protection of Aboriginal heritage will be an important ongoing consideration during later stages of planning for the future development of the subject site. This is likely to involve ongoing engagement with the *Kariyarra* and *Marapikurrinya* people.

The protection of identified heritage assets will be ensured via the preparation of a **Cultural Heritage Management Plan** to support the future development of the area, which will include consideration of:

- Establishing a set of work procedures for the subject site that align with Department of Planning, Lands and Heritage (DPLH) Guidelines and the aspirations of the Traditional Owners;
- Ensuring that construction is undertaken in a manner that is sensitive to and/or protects Aboriginal heritage assets;
- Liaising with Kariyarra Aboriginal Corporation, as the representatives of the Traditional Owners, regarding Aboriginal heritage management during the pre-construction, construction, post construction and post-development stages of the project;
- Ensuring that discoveries of previously unidentified Aboriginal sites or objects are dealt with in accordance with the requirements of the *Aboriginal Heritage Act 1972*, including the implementation of appropriate Stop Work Procedures; and
- Creating opportunities for the enhancement of identified Aboriginal cultural assets, with the active engagement and participation of the *Kariyarra* and *Marapikurrinya* people at all times.

European heritage

The Heritage Council of the WA State Heritage Office identifies the World War II rifle range and Merv's Lookout as Place No. 18427. The Town's Municipal Heritage Inventory identifies the rifle range and Merv's Lookout as Place No. 54 'World War Two Rifle Range/Merv's Lookout'.

In early 1942, the Australian Army 29th Garrison Battalion, North West detachment was stationed in Port Hedland in response to improving the security of the WA's north-west coast against the threat of a Japanese invasion. For military training, a rifle range with a 500 yard firing line was established at Athol Street for target practice.

The remains of the rifle range can be seen from Merv's Lookout, along with a row of sandstone rocks to the right which contain remnants of .303 bullets lodged in the sandstone. Local resident Mr Merv Stanton, arrived in Port Hedland in 1942, with the Guerrilla Warfare section of the army. As a tribute in memory of his former battalion, Mr Stanton planted a commemorative garden which includes gum trees. He had been a local resident in Port Hedland for around 50 years.

The lookout memorial is contained within Lot 512 and is proposed to be retained and continue as a *place interpretation*. The existing memorial garden, interpretive signage and bench seat which overlooks the former rifle range, are located outside of the planned structure plan area.

Image 17. A view of Merv's Lookout overlooking the former WWII rifle range. (Source: Town of Port Hedland, 2017)

2.11 Bushfire management

The Athol Street site is within the Department of Fire and Emergency Services Bushfire Prone Mapping and is subject to the planning considerations in the state bushfire planning framework. A Bushfire Management Plan has been prepared for the structure plan, which details the fire management methods and requirements to provide for fire protection and fire management.

The main threat of fire is from grassland within the secondary dune system. The majority of this grassland will be cleared for urban development as proposed by the structure plan. The threat of fire from the vegetation within the intertidal mudflats is low.

The main threat of fire will be from areas of existing vegetation retained in-between staging of development. Management of vegetated areas adjacent to staged development is addressed in the Bushfire Management Plan, including the need for interim asset protection zone/s. Overall the risk of fire is not a significant constraint to urban development and can be adequately managed at later stages of planning.

2.12 Mosquitos

Mosquito surveillance of Pretty Pool Creek undertaken by the Town indicates the high presence of mosquitos as a potential breeding area. Mosquitos captured in traps during surveillance monitoring include the mosquito species *Culex annulirostis*, which is a known carrier of the Ross River virus, which can affect humans. Mosquito activity and the recorded cases of Ross River virus in Port Hedland is a public health concern, particularly under certain environmental conditions.

The subject site is within the mosquito dispersal distance from the low-lying areas around Pretty Pool Creek, which when become inundated by wet season flooding, can provide for mosquito breeding habitat. It is noted that mosquitos that breed in the Pretty Pool Creek area have capable dispersal of up to several kilometres from Pretty Pool, so mosquito health risks are an on-going impact that affects the wider Port Hedland community.

For the proposed development, a Mosquito Management Plan is recommended to be prepared and approved in consultation with the Town of Port Hedland as part of later stages of planning. A detailed Mosquito Management Plan can assist in protecting the amenity and health of future residents by addressing mitigation measures, including but not limited to:

- Design of stormwater infrastructure to reduce potential mosquito breeding habitat
- Mosquito monitoring to inform the location and timing of controlled measures (i.e. spraying)
- Provision of advice, notifications on title and building design recommendations for future residents, to assist in protecting residents from being bitten (i.e. insect screening and ways to reduce exposure to biting insects).

3. Pre-lodgement Consultations

This structure plan follows on from the former Athol Street Structure Plan 2015. Extensive consultation with key stakeholders was undertaken for the previous structure plan. There was an understanding from the key stakeholders that the Athol Street site is earmarked for future urban development, but that more detailed planning investigations would consider the most appropriate form of development.

Pre-lodgement consultations for the current proposed structure plan have been undertaken with key stakeholders, along with a community consultation event, which involved a pop-up display booth at the Port Hedland shopping centre on Saturday 18 July 2020. Community feedback on the Athol Street site was also obtained from the Town's Draft Local Planning Strategy community engagement and consultations.

3.1 Town of Port Hedland Draft Local Planning Strategy

During the recent **Shaping Hedland's Future** engagement campaign, the Town asked the community their priorities and insights regarding future housing growth within Port Hedland. The results from this engagement were used to inform the preparation of the Draft Local Planning Strategy for the Town.

The draft strategy identifies up to six potential residential growth areas in East End, being the Telstra tower site, the former recreation centre and detention centre sites, the remediated wastewater treatment plant site, Athol Street site, the Stables site and a portion of the McGregor Street sporting precinct.

Refer to Figure 6 – East End potential future urban sites

Community and stakeholders were asked to consider what was their preferred staging for future housing in Port Hedland and why. In relation to the Athol Street site, those people who engaged in the conversation at meetings, events or through the online community survey:

- Acknowledged that only a portion of the Athol Street site would likely be suitable for staged housing, when considering storm surge inundation and the need to conserve the natural environmental assets.
- Protection of trees in Athol Street.
- Reinforced the significance of Aboriginal heritage, and the priority to maintain access to and protect significant cultural assets.

While there was general support for a staged development across suitable portions of the Athol Street site, more investigation was seen to be required to understand the constraints or opportunities within this broadly defined area.

Figure 6. East End potential future urban sites

Recent pre-lodgement consultations with key stakeholders

The following Table 3 is a list of key stakeholders that were consulted during the preparation of the Amendment.

Table 3 – Key Stakeholder Consultations in May/June 2020

Stakeholder	Comments	Actions
Department of Planning, Lands and Heritage **Land Use Planning - Regional North**	**First Pre-Lodgement Meeting** Reviewed background and planning reasons for refusal for previous structure plan. Updated structure plan needs to address the Town's CHRMAP considerations and potential for provision of an adequate foreshore for coastal protection infrastructure.	Noted. Technical reports to be updated to reflect CHRMAP.
Department of Water and Environment Regulation	DWER raised no objections at this preliminary stage. A formal review and assessment will be undertaken once the amendment is referred to DWER for comment.	Noted.
Kariyarra Aboriginal Corporation	Scheduled meeting with the Kariyarra Board on 24 June 2020. Initial consultation undertaken with Elder Diana Brown. Diana commented on maintaining an adequate buffer from high environmental and heritage values of Pretty Pool Creek. Meeting on 23 June 2020 with Kerry Robinson (Kariyarra Elder who also speaks for the Marapikurrinya area however is not on the Kariyarra Aboriginal Corporation Board) where East end projects were discussed, including Athol and Stables sites. Raised no objections however any works on these sites (particularly excavation) will require a Heritage monitor to be present in case any skeletal remains, artefacts or the like are uncovered.	Noted and project team to consider in structure plan design. Archaeological monitoring would be covered in the Cultural Heritage Management Plan.
Care for Hedland	Formal letter dated 30 June 2020 provided to the Town outlining environmental expectations for both Athol Street and Stables sites. Expectations were outlined concerning flooding impacts/CHRMAP considerations, sediment, runoff and site drainage, Merv's Lookout, retaining existing eucalypts, use of native species for landscaping, litter/waste management, fill import to be suitable/complimentary for use, waterwise landscaping and careful species selection, protection of fauna (i.e. birds, bats, etc), indigenous heritage, light impacts on Flatback turtle nesting sites and best practice development.	Noted and considered by the project team.
Department of Planning, Lands and Heritage **Land Use Planning - Regional North** **Coastal Team**	**Second Pre-Lodgement Meeting** Discussions focused on coastal planning, specifically coastal modelling, coastal protection infrastructure and maintenance requirements and agreement with the Town, coastal hazard risk management and adaptation planning requirements of adjoining landholdings, management at sediment cell level, local water management strategy considerations, provision of an adequate foreshore reserve and planning application timeframes. At the meeting it was agreed that balance land between the proposed development and Pretty Pool Creek would fall within a future foreshore reserve, which would be covered by a Foreshore Management Plan.	Applicant noted guidance by DPLH officers in addressing DPLH expectations in relation to coastal planning and CHRMAP considerations.

Stakeholder	Comments	Actions
Town of Port Hedland	**POS, drainage and Recreation** Consideration of the relocation of the Cooke Point stand-pipe and decommissioning through development staging. Currently a non-potable irrigation main services Colin Matheson Oval and runs up the tidal creek side of Athol Street. Consideration should be given to this irrigation infrastructure. The non-potable irrigation line that supplies Colin Matheson Oval may be accessed to supply water for the proposed POS areas (subject to supply). **Movement network** The Town supports restricting crossovers closer to the roundabout of Cooke Point Road, McGregor Street and Athol Street. Consideration of a footpath on the southern side of Athol Street to accommodate pedestrians / school users as the primary school is in close proximity and may require this connection. **Built Form/Zoning** Use the model zones and reserves colouring for the structure plan, specifically, 'Public Open Space' for the POS and drainage areas and 'Environmental Conservation' for the remainder of Pretty Pool Creek and mudflats. The Town supports lots backing onto drainage swales to have dwelling design to orientate to POS and consider fencing which balances privacy and passive surveillance. The Town supports design principles which encourage dwellings of battle-axe lots to orientate to Athol Street. Crossover restrictions for the residential zone areas closest to Athol Street, McGregor Street and Cooke Point Road roundabout.	Noted and considered by the project team.

3.2 Athol Street and the Stables Street Precincts East Port Hedland Engagement Outcomes

An engagement consultant was appointed by the proponent to assist with obtaining and collating information/preliminary feedback from key stakeholders and the community. These would inform the preparation of structure plans for the Athol Street site and Stables site, as well as Scheme Amendment No. 84. The report entitled 'Athol Street and the Stables Street Precincts East Port Hedland – Engagement Outcomes Report' (Element, July 2020) provides a summary of related community and stakeholder engagements, outcomes, and recommendations that were considered by the project team in the preparation of the structure plans. Overall, the structure plan addresses and provides for the community and stakeholder major considerations, including protection of marine turtles and Pretty Pool Creek mangrove environment, coastal protection works, cultural and heritage considerations and protection of existing street trees in Athol Street.

Refer to Appendix 3 - Athol Street and the Stables Precincts East Port Hedland - Engagement Outcomes Report

4. Key Planning Framework

4.1 State Planning Framework

4.1.1 State Planning Strategy 2050

Included in the diverse range of initiatives, the strategy seeks to encourage the population growth of regional towns. In particular, the strategy recognises the role of the Pilbara Cities initiative in developing Port Hedland into a stronger regional centre with growing appeal as a place to live.

Opening up new areas within Port Hedland that have high residential amenity is a key to attracting permanent population growth that choose Port Hedland as a desirable place to live.

The Athol Street site is one example of a high amenity residential living location, adjacent to Port Hedland's iconic Pretty Pool coastal environment.

4.1.2 Pilbara Planning and Infrastructure Framework

A key part of the framework is its role in supporting the implementation of the Pilbara Cities vision, which encourages the growth of Port Hedland to support a residential population of 50,000 by 2035. This is part of a broader initiative to consolidate population growth in the region's main urban centres.

This includes a desire to deliver nearly 15,000 new dwellings in Port Hedland by 2035, with a focus on:

- Achieving an efficient supply of land for future urban growth;
- Providing areas of high amenity for residential living;
- Facilitating private sector involvement in urban land development;
- Accelerating land releases for the development of new housing; and
- Providing residential land in identified growth areas to meet the needs of the labour market.

The proposed structure plan is consistent with the framework, as it is a potential residential greenfield site with high amenity, that can positively contribute towards accommodating population growth.

4.1.3 State Planning Policy 2.0 – Environmental and Natural Resources Policy

State Planning Policy 2 – Environmental and Natural Resources Policy (SPP2.0) defines the key principles and considerations that inform good and responsible planning outcomes with respect to issues relating to the environment and natural resources. An assessment against the relevant provisions of SPP2.0 is provided below.

General Measures

Various technical environmental, geotechnical, noise and engineering studies have been undertaken to consider the suitability of the site for future residential use. These form the appendices of this report.

Collectively, these technical studies confirm that the site can be developed for residential use, in a manner that is consistent with the general measures outlined under SPP2.0. These include:

- Providing for the implementation of effective environmental management measures to ensure quality environmental outcomes for the Pretty Pool Creek system and associated mangrove habitat.
- Providing for the protection of identified cultural heritage assets, as identified through engagement with the Traditional Owners, the Marapikurrinya and Kariyarra people, including:
  - Protecting the sensitive Pretty Pool Creek environment to prevent any adverse impact, whilst maintaining public access; and
  - Providing for the ongoing protection of the four identified heritage sites within the boundary of the subject site, consistent with the recommendations of the accompanying Cultural Heritage Assessment Report.

- Considering the impact of changing climatic conditions and associated coastal processes, in accordance with the adopted Port Hedland Townsite Coastal Hazard Risk Management Plan (CHRMAP), and the accompanying site specific Coastal Hazard Assessment.

Other specific matters dealt with under SPP2.0 are generally discussed below.

Water Resources

This report is accompanied by a Local Water Management Strategy (refer to appendices within Appendix 1 – Environmental Assessment Report). The LWMS demonstrates that urban stormwater will be managed in accordance with the WAPC's Better Urban Water Management Guidelines. The strategy outlines that any potential impacts can be readily managed so as not to have any significant impact on the natural water resources.

Air Quality

The *Port Hedland Air Quality and Noise Management Plan* seeks to consolidate future residential development in the East End of Port Hedland, in response to dust and air quality concerns in the established West End residential areas. The proposed structure plan will assist in providing a supply of suitable land for residential development in the East End, where land use conflict and associated air quality impacts are within acceptable levels.

Soil and Land Quality

The suitability of the land for future residential development has been addressed in detail through the various geotechnical, environmental and engineering servicing investigations. These assessments conclude that:

- Development on the estuarine deposits poses earthworks and servicing challenges for urban development. In the context of the Town's CHRMAP and in considering the constraints of developing on the estuarine deposits, the structure plan limits the extent of proposed urban development within intertidal mudflat areas.
- The subject site does not contain any registered contaminated sites, nor has it been used in the past for any use which may have resulted in contamination, thereby ensuring its suitability for future residential use.

Biodiversity

The structure plan is accompanied by a detailed Environmental Assessment Report, which includes a Mangrove and Erosion Impact Assessment. The findings of the environmental report confirm there are no significant impacts on the environment.

In addition, it is noted that the environmental studies undertaken to date will be supported by further detailed investigations and management plans to be prepared at later stages of planning, which are outlined in the Part One section. This will ensure the implementation of appropriate environmental management measures as part of the future subdivision and development of the subject site.

Landscape

The ecological, aesthetic and social value of Pretty Pool Creek and the associated mangrove system is acknowledged, and the proposed structure plan seeks to facilitate development that complements and does not detract from established landscape character of the area. In this regard, it is noted that:

- The development of the subject site will not adversely affect the landscape value of Pretty Pool Creek;
- Due consideration has been given to retaining the biodiversity values of the surrounding area, as detailed above; and
- Public access to Pretty Pool Creek from the subject site is provided for in the structure plan, to be delivered as part of the future subdivision and development of the site. This is in recognition of the recreational value and level of amenity the Pretty Pool Creek area offers to existing and future residents.

4.1.4 State Planning Policy 2.6 – State Coastal Planning

State Planning Policy 2.6 – State Coastal Planning (SPP2.6) sets out a range of policy measures to ensure that development in coastal locations appropriately takes into account the potential impact of coastal hazards. This includes considerations relating to coastal hazard risk management and the sustainable use of the Western Australian coastline that are relevant in the context of this proposed structure plan.

SPP2.6 places particular emphasis on the need for adequate coastal hazard risk management and adaptation planning, which has been addressed through the preparation of the Port Hedland Townsite Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) – reference *Port Hedland Townsite Coastal Hazard Risk Management and Adaptation Plan (GHD 2019; File Ref: 6136239 - April 2019. Version: Rev 0 - 29/03/2019).*

Essentially the adopted CHRMAP supports further development in the East End of Port Hedland, including urbanisation of the subject site. Urbanisation can be accommodated by adaptation measures, specifically filling to a minimum finished development level of 6.7m AHD and provision of adequate coastal protection works to ensure the sustained longevity of the finished development level. Compliance with the SPP2.6 objectives and provisions and planning considerations relative to the Town's CHRMAP are discussed below in Table 4 and policy measure sub-headings.

Table 4 – Compliance with policy objectives.

SPP 2.6 Policy Objectives	Structure Plan Compliance
1. Ensure that development and the location of coastal facilities takes into account coastal processes, landform stability, coastal hazards, climate change and biophysical criteria.	The structure plan minimum finished development level of 6.7m AHD provides adequate separation from coastal hazards and processes (i.e. flooding) identified from the Town's CHRMAP. The intertidal mudflats present a less stable landform to accommodate urban development, however with geotechnical amendment, the mudflats can support development. Notwithstanding, the structure plan is predominantly located on the more stable secondary dune system, where the sand deposit soil type is more stable and does not require geotechnical amendment. Only limited development on the northern peripheral edge of the intertidal mudflats is proposed, in order to achieve design efficiency and desired planning outcomes (i.e. location of a hard edge road interface and sizeable area of POS adjacent to the foreshore).
2. Ensure the identification of appropriate areas for the sustainable use of the coast for housing, tourism, recreation, ocean access, maritime industry, commercial and other activities.	Within the urban development zone footprint, the structure plan ensures a good balance of the proposed land uses of housing (urban development) and foreshore reserve (recreational and environmental values). The outcome provides for a sustainable use of the land in proximity to the coast consistent with the planning framework. The extent of the urban development footprint acknowledges the continued use of the intertidal mudflats for recreation and wildlife habitat. Implementation of an approved Foreshore Management Plan will ensure the appropriate use (and opportunities for environmental enhancement) of the foreshore reserve. The management plans required for urban development (as a condition of subdivision and development approval) will ensure long term sustainable use of the land for residential.
3. Provide for public coastal foreshore reserves and access to them on the coast.	A considerable area of the structure plan is set aside as foreshore reserve, where the intertidal zone can continue to be used as a unique area for public recreation . The structure plan 'hard edge' road provides a suitable interface and access to the foreshore. The location of public open space adjacent to the foreshore reserve strategically provides for public interaction between both recreational spaces. Access is to be provided from public open space adjacent to the foreshore reserve (i.e. via stairs) and this is detailed in the Foreshore Management Plan.
4. Protect, conserve and enhance coastal zone values, particularly in areas of landscape biodiversity and ecosystem integrity, indigenous and cultural significance.	The intertidal mudflat areas around Pretty Pool Creek form part of the Port Hedland iconic landscape. The large foreshore area set aside in the structure plan ensures the continued protection and conservation of this landscape. Implementation of the Foreshore Management Plan will provide opportunities to enhance the foreshore area in terms of maintaining biodiversity and ecosystem integrity. Provision of the large foreshore reserve also recognises the indigenous and cultural values of the Athol Street site (i.e. WWII rifle range/Merv's Lookout and access to Pretty Pool Creek for indigenous traditions).

During DPLH pre-lodgement consultations, there were certain specific matters in SPP 2.6 that were particularly important planning considerations for the Athol Street site, which included:

- Policy Measure 5.7 – Coastal protection works
- Policy Measure 5.9 – Coastal foreshore reserve
- Policy Measure 5.10 – Coastal strategies and management plans
- Local Water Management Strategy – Coastal modelling and cumulative impacts considerations

The above matters will be discussed under the various sub-headings.

Policy Measure 5.5 – Coastal hazard risk management and adaptation planning

The Town's CHRMAP and local planning framework identifies the Athol Street site as potential land for future urban use, to meet the on-going demand for residential land to accommodate Port Hedland's growing population. Demand for new residential land within the east end of Port Hedland will also be driven from the recently announced Port Hedland Voluntary Buy-Back Scheme - associated with the planned gradual relocation of residents out of the west end of Port Hedland, due to dust and public health concerns.

In considering the site's constraints and the high environmental/recreational/community values placed on the intertidal mudflats, the proposed structure plan generally avoids residential development on the mudflats. As the balance of the site beyond the mudflats is subject to coastal hazard (i.e. flood inundation), protective measures are provided that suitably address the identified risks. These are further outlined in this report.

Although the site is proposed as greenfield development on land affected by coastal hazards, the Town's CHRMAP and structure plan investigations confirm that the level of coastal hazard risk is acceptable and can be adequately managed.

Policy Measure 5.5 provides a basis for hierarchy or risk management and encourages avoiding new greenfield development in areas where coastal hazards exist, particularly where such development would require a substantial 'protection works' solution. With this in mind, the Athol Street site is considered acceptable as a greenfield development site, in that:

- Greenfield urban expansion in Port Hedland is already extensively constrained by coastal hazards (i.e. storm surge inundation), as identified by the Town's CHRMAP.
- Policy Measure 5.5 does not preclude new greenfield development within coastal-hazard affected areas.
- The Town's CHRMAP has given proper consideration of coastal hazards and it is concluded that appropriate coastal protection measures can be provided, that will facilitate an appropriate urban development outcome for the Athol Street site.
- The Town's draft Local Planning Strategy and local planning framework identifies Athol Street site as a potential greenfield urban expansion site, subject to the required further planning and technical investigations. These have been fundamentally addressed through the structure planning process. Further detailed work will be undertaken at the subdivision and development approval stage.
- As shown in Figure 6, the Athol Street site is one of a number of potential urban development sites in the east end of Port Hedland. Selection of preferred residential development sites, with a focus on prioritisation in the short-term, is a separate decision making process, outside of structure plan approval.
- A preliminary memorandum of understanding will be undertaken between the developer and the Town to reduce any uncertainty over coastal protection works capital upfront and maintenance funding post-development.

A strategic spatial plan for long-term coastal adaption in Port Hedland is provided in the Town's CHRMAP Figure 5-1 Long Term Settlement Planning Opportunities (at page 65). This plan is achieved by focusing growth, urban expansion and increased development potential in the eastern part of the existing townsite.

The long-term settlement plan for Port Hedland is to avoid growth and expansion in the West End (which is subject to dust and inundation), avoid new development in the coastal strip (which is affected by coastal processes erosion) and ultimately focus on a managed retreat from these areas. This enables long-term investment into feasible protection of inundation in the East End, which is unconstrainted by dust. This will enable the full suite of urban uses that could not otherwise be supported in the West End (CHRMAP, GHD 2019).

Due to the coastal hazards identified in the Town's CHRMAP, much of Port Hedland's coastal interface over time will take on the form of an **engineered coastline**. The adaptation measures envisaged for East End (and for many other areas of Port Hedland) will require engineered coastal protection works. This is the nature and requirement for continued settlement in Port Hedland over the planning 100 year timeframe.

The structure plan provides for an implementable adaptation plan that is technically sound, viable and that outlines the key tenure and management responsibilities for the future coastal adaptation and protection measures.

Policy Measure 5.7 – Coastal protection works

The Town's CHRMAP identifies the need for new coastal protection works to be adapted for the Athol Street site. Currently there is limited existing coastal protection works for the site to address CHRMAP considerations. The only portion of the site which contains coastal protection works is the Water Corporation wastewater pumping station development, located on Lot 555 abutting Cooke Point Road.

The pumping station finished level is raised to approximately 6.4m AHD (calculated at the time of development prior to the Town's CHRMAP), to address coastal flooding. Coastal protection works have been installed along the boundaries with the intertidal mudflats. These works mainly comprise of sand bund overlaid with geo-textile landscape matting, some landscaping and a 1.5m high rock base scour protection.

Cook Point Road also has some coastal protection works along its eastern boundary facing the intertidal area. The works are limited to a similar geotextile matting over a sand bund within the road reserve, which is outside of the structure plan boundary.

The Town of Port Hedland and Water Corporation are responsible for and manage the coastal protection works necessary for Cooke Point Road and the wastewater pumping station respectively.

The developer of the Athol Street structure plan will not be responsible for the implementation and on-going future management of coastal protection works for these public infrastructure items and associated land.

Type of coastal protection work

There are various types of coastal protection works, which can perform the same function, yet have contrasting appearance and levels of maintenance. For instance, there is a vast difference between providing coastal protection 'soft edge', compared with an engineered 'hard edge'.

A 'soft edge' coastal protection work can include creating an artificial landscaped 'sand dune'. The dune or sand bund would typically slope down from the finished development level towards the lower lying coastal area. The sand bund can be overlaid with vegetation brushing, landscaping and geotextile matting to encourage stabilisation and vegetation growth. The base would typically have scour protection, where rocks are commonly used.

A soft edge type coastal protection work presents as a more natural look. Geotextile sandbags can also be used to reinforce the soft edge, which in the short term are relatively hardy, but in the longer term are susceptible to wear and damage, requiring replacement and on-going maintenance.

Although in the short term a soft edge coastal protection work is less costly to deliver, over time it attracts higher maintenance costs, to counter weather impacts and erosion. In a large major storm event, damage to soft edge protection works can be catastrophic, requiring a re-construction.

Image 18. View of wastewater pumping station eastern boundary showing an example of 'soft edge' coastal protection using geotextile matting over sand bund with rock scour protection at the base.

In contrast, 'hard edge' coastal protection works can take on a more engineered form with a higher upfront construction cost. This includes masonry or concrete seawall or rock revetment. Rock revetment appears less artificial than a man-made vertical seawall. A rock revetment is considered better suited to the Athol Street site, given rock revetments are more familiar in Port Hedland – for instance, used in the port areas and protection of mining infrastructure. The engineered coast appearance of the rock revetment necessary to accommodate the Athol Street site will therefore not be too unfamiliar to within the Port Hedland landscape.

Image 19. Example of rock revetment coastal protection works.

The strong permanent nature of a rock revetment coastal protection works ensures the upfront delivery of a standard of infrastructure that satisfies 'future proofing'. This would reduce the Town's financial risk and uncertainty for the on-going future maintenance, by establishing at the beginning a type of coastal protection works which is more durable in the longer term. This would bring a certain level of comfort for future Athol Street residents and for the Town, concerning long-term coastal protection from flooding and financial management.

Site filling cumulative impacts on adjacent lands

The structure plan proposes substantial fill of the land to achieve the required minimum finished habitable floor level of 6.7m AHD. This will require approximately 491,000 cubic metres of imported fill. A level of 6.7m AHD (compared with the rare inundation level of 6.6m AHD in the Town's CHRMAP) has been adopted for the structure plan as the required minimum habitable finished development level. This is based on a recent review and estimate of the 500 year ARI for the year 2120 at the site, in accordance with SPP 2.6 and after review of the Town's CHRMAP and Port Hedland Coastal Vulnerability Study (Cardno, 2011).

The proposed coastal protection works (i.e. filling and rock revetment) for the Athol Street development will have some impact on the adjacent environment within the sediment cell. This is demonstrated by the modelling undertaken for the structure plan as set out in the Coastal Hydrodynamic Modelling report (Cardno, 2020) contained as an appendix in the Local Water Management Strategy.

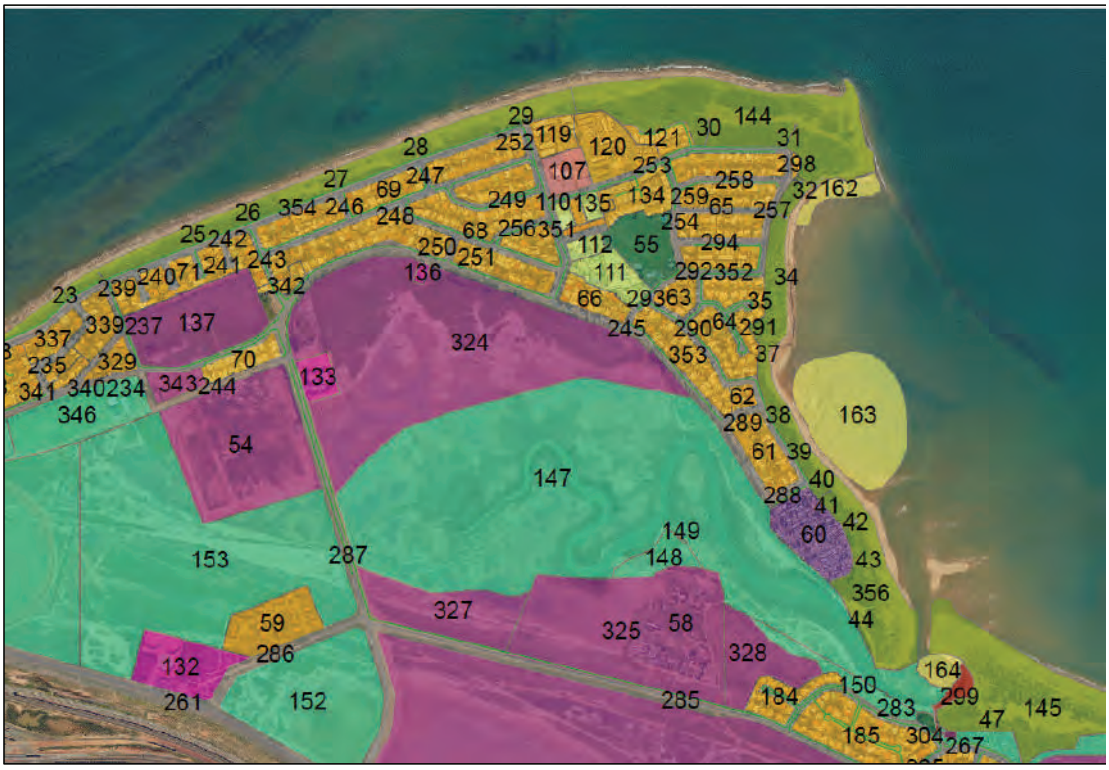
Refer to Appendix 1 – Environmental Assessment Report (Local Water Management Strategy part of the appendices)

Whilst the filling of the Athol Street site on its own will not have a significant impact on adjacent lands, the cumulative filling of the Athol Street site, Stables site and former Port Hedland wastewater treatment plant site (PHWWTP) could alter the flood flow pattern in Pretty Pool Creek and could potentially increase the inundation depth (in the order of 0.1m) to land between the PHWWTP site and Wilson Street. However, the modelled pre-development inundation depth in this area is in the order of 2 – 3 metres under the 500yr storm tide event. The pre-development inundation depth already poses significant risk of inundation to the land between PHWWTP and Wilson Street. So the adding of an additional 0.1m to the inundation depth does not change the already significant inundation risk in this area. Furthermore, the 0.1m change in inundation depth, as a result of the cumulative filling of the above urban development sites, is also a relatively minor change.

Land between the PHWWTP and Wilson Street (i.e. Residential Area '59' in the CHRMAP – refer to Figure 6a in this report), will need to protect against the risk of inundation for any redevelopment of the land. This includes raising land levels to address the pre-development inundation depth of 2 – 3m for the 500yr event. This is consistent with the Town's CHRMAP, which adopts a 'Protect' pathway as the preferred risk management and adaptation strategy, for the strategic development of urban sites in the Pretty Pool Creek area as shown in Figure 6a. Thus, for future urban expansion areas affected by inundation, the CHRMAP adopts the risk management measure of raising land level, in addition to investigating the feasibility of accommodating the possible and/or rare event hazards. For existing developed areas (e.g. Residential Area '59'), the CHRMAP adopts the risk management approach of accommodating or raising land levels in redevelopment. Accordingly the structure plan (and cumulative impacts of urban development in the Pretty Pool area) will not have any significant adverse impacts on adjacent lands, which are already subject to the inundation risks identified in the Town's CHRMAP.

Refer to Figure 6a - Town CHRMAP Coastal Assets and Land Users

Refer to Appendix 7 - Site Specific CHRMAP for Athol and Stables



Legend

- Foot Path
- Carpark,
- Commercial and Shops,
- Community,
- Environmental,
- Gravel Road/Path,
- Marine Infrastructure,
- Ocean Access,
- Parks and Recs, Active
- Parks and Recs, Passive
- Parks and Recs, Passive - Turtle Habitation
- Residential,
- Roads,
- Tourism,
- Urban Development,
- Utilities,

Figure 6a. CHRMAP Coastal Assets and Land Uses (Source: Town of Port Hedland, Port Hedland Town Site CHRMAP Coastal Hazard Risk Management and Adaption Plan, GHD April 2019)

Impact on Pretty Pool Creek mangroves

Filling of the subject site has the potential to alter the natural patterns of water movement in adjacent areas. This may impact the existing Pretty Pool Creek mangrove habitat. The findings of the Local Water Management Strategy, which contains the modelling of the impacts of filling of the subject site, demonstrates that the subject site (in conjunction with the development of other future urban sites in East End) will not have a significant adverse impact on the mangrove habitat.

Cooke Point Road – emergency access

Cooke Point Road is an important piece of public transport infrastructure that provides direct access to the East End from Wilson Street. The section of Cooke Point Road extending south of the wastewater pumping station (Lot 555) is relatively low lying (around 4.0m AHD – 5.0m AHD). Cooke Point Road is already identified in the Town's CHRMAP as being vulnerable to coastal inundation for the 500 ARI event.

During Cyclone Veronica in March 2019, storm surge swept over this section of road essentially flooding the road inhibiting transport movement. As a result of flooding due to the cyclone, traffic accessing/egressing East End had to be diverted along McGregor Street to Wilson Street, until the section of Cooke Point Road was re-open to traffic.

The proposed development does not impact the current vulnerability of Cooke Point Road. Based on the Town's CHRMAP, future works will be required to upgrade Cooke Point Road to address coastal inundation from storm surge and flooding. The modelling demonstrates that the impacts of the proposed development (and cumulative development of Athol, Stables and PHWWTP sites) on Cooke Point Road are negligible and that the need to upgrade Cooke Point Road to manage flooding risk is not the result of the filling of the structure plan site for urban development. The upgrading of Cooke Point Road will be the responsibility of the Town of Port Hedland.

Delivering upfront adequate coastal protection and its management

The main adaptive coastal management measures and considerations to facilitate urban development of the Athol Street site include:

- Establishing a minimum finished development level of 6.7m AHD by filling the site.
- Establishing coastal protection works which can withstand the impacts of weathering and erosion to maintain an acceptable freeboard development level above the forecast flood level.
- Management of adjoining lands, as a result of implementing the filling and coastal protection works for the site, will not be required due to the minimal impact on adjoining lands.

It is envisaged that the delivery of the above will occur indicative as follows:

- Developer to source locally suitable fill material (i.e. sand) to achieve a minimum 6.7m AHD finished development level. One possible source option for local fill could be from dredging material (i.e. port channel or spoil bank marina) with the agreement of the port authority.
- For any staging of development, there will be a provision of temporary coastal protection works on the side edges of staging boundary/s, generally behind the main coastal protection work front.
- The cost of delivering the coastal protection works (i.e. rock revetment) upfront would be borne by the developer and once satisfactorily constructed, would then be handed over to the Town of Port Hedland (i.e. after an agreed developer maintenance period) for future monitoring and maintenance, at the Town's cost, within a Crown Land reserve with management order to the Town.

Staging and temporary coastal protection works

If the development is undertaken in a single stage, the entire adaptive coastal management measures would be implemented upfront, including the filling of the site to a minimum of 6.7m AHD and construction of the coastal protection works along the entire southern interface with the intertidal area.

Where development is staged, it is envisaged that filling would be localised to the staging area only. Construction of the permanent coastal protection works would be designed and built along the alignment of the staging boundary consistent with the southern extent of urban development as shown on the structure plan. The permanent coastal protection works might extend slightly further than the staging area, as deemed necessary to provide for adequate coastal flooding protection. The extent of the construction of permanent coastal protection works would be determined to the satisfaction of the Town at subdivision approval stage.

At the internal staging boundary, temporary coastal protection works would likely take on the form of a 'soft edge' treatment. This may comprise of a sand/geotextile bund, which could withstand to some degree the

impacts of weathering and erosion. However, importantly these soft edge temporary coastal protection works would need to be monitored continually and maintained as necessary by the developer, until further staging is undertaken and so on. These temporary coastal protection works would be located within the developer's land. Therefore the management of the temporary coastal protection works would therefore be at the liability, cost and responsibility of the developer.

Coastal protection works tenure and responsibilities

The foreshore reserve provided within the southern half of the structure plan area is identified in the structure plan as 'Environmental Conservation' reservation - reflecting its current and future intended use for conservation and restricted recreational use. The coastal protection works will be solely contained within this reservation, so that the management of the coastal protection works can be included in the Foreshore Management Plan.

As shown on the Concept Plan, the coastal protection works is indicatively shown within an approximate 20m wide strip of land extending along the southern edge of the urban development area up to the wastewater pumping station site. This ensures that the coastal protection works will be retained in perpetuity within public land (designated foreshore reserve).

Refer to Figure 7 – Concept Plan

Public access to foreshore

The intertidal mudflats currently fall within public land which is controlled and managed by the Town for public recreation. Adequate public access to the foreshore from the development and existing streets is considered important and identified in the structure plan, to provide on-going use of the foreshore area for local recreational opportunities.

The coastal protection works will therefore be designed to provide for legible, safe and accessible public pedestrian connectivity, between the foreshore reserve and the proposed urban development. A Foreshore Management Plan will be prepared and approved by the Town of Port Hedland that addresses public access, use and management of the foreshore area. This will occur at later stages of planning.

Policy Measure 5.9 – Coastal foreshore reserve

The establishment of the proposed publicly-owned foreshore reserve is based on the biophysical characteristics associated with the site's coastal environmental context. This approach is adopted, rather than using a nominal setback requirement. It is noted that the Athol Street site is located inland, away from the direct influences of coastal processes and as such, is not affected by planning for a coastal processes setback. The setting of the foreshore reserve is primarily influenced by the biophysicial characteristics and the community and recreational foreshore values.

Image 20. Example of a road hard edge along a foreshore reserve which provides for a pathway and street parallel parking bays. (Source: Google maps street view, 2020)

Figure 7. Concept Plan (**element**, 2020)

The location of the structure plan foreshore reserve boundary preserves the physical, biological and ecological attributes of the Pretty Pool Creek intertidal mudflats. A main relevant consideration for the structure plan is whether the foreshore reserve makes adequate allowance for the provision of coastal protection works (i.e. flood management) over the 100 year planning timeframe. It has been determined through preliminary engineering investigations that the proposed foreshore reserve area is sufficiently large enough, to provide adequate area to accommodate the necessary coastal protection works.

Most of the foreshore reserve will be used for environmental conservation and recreation. The Athol Street site is not an area of regional or district significance. The site is mostly frequented by Port Hedland residents for local recreation. There is no foreshore classification in the relevant strategic planning framework for the Athol Street site – whereby the site is identified for future urban development. Pretty Pool Creek is identified as a significant conservation and recreational area. The Town's Trails Masterplan identifies a future trail through the Pretty Pool Creek area. Accordingly, only limited facilities and infrastructure is required for the foreshore reserve, given the restricted, low scale and intensity of use. The foreshore reserve for the structure plan is considered appropriate.

The proposed public open space located adjacent to the foreshore reserve will be developed to provide for active and passive recreational use, along with the necessary amenities to enjoy the foreshore area. The public open space park is situated behind the coastal protection works, where it will be protected during the planning timeframe and not be impacted by coastal inundation.

Similarly, the hard edge road located adjacent to the foreshore area is also located behind the coastal protection works, where it will be protected. The road provides a public realm where a pathway and street parallel parking bays can be provided. These enhance the accessibility of the foreshore area when considered in conjunction with strategically located stair access points.

The detailed design of the public open space park, shared pathways, street parking bays and stair access points connected with the foreshore area would be determined at later stages of planning. These elements are sufficient for the provision of adequate public amenities in Pretty Pool (for the Athol Street side of Pretty Pool Creek) for the values, functions and use of the Pretty Pool Creek coastal area over the planning 100 year timeframe.

Policy Measure 5.10 – Coastal strategies and management plans

Foreshore Management Plan

The preparation of a Foreshore Management Plan (FMP) is an appropriate approach to addressing the SPP 2.6 Policy Measure 5.7 requirements. These include the assignment of management and responsibilities for the delivery and maintenance of the coastal protection works.

As well as establishing the funding arrangements for the construction and ongoing care, control and maintenance of the proposed coastal protections works, a FMP would also detail the managed use and any landscape opportunities for the foreshore reserve. The appropriate level of recreational amenity would also be determined in view of the environmental values of the foreshore area.

Policy Measure 5.10 encourages a FMP to be prepared as part of the early stages of planning for development within areas affected by coastal hazards. For the Athol Street site, a FMP would be more logical at subdivision stage – as the final subdivision design, depicting the foreshore boundaries and its area, including the details of engineering coastal protection works to be used, will be determined at the subdivision stage.

In addition, sufficient time is required post structure plan approval, to allow for the undertaking of consultation with the broader community, indigenous people and relevant public authorities, in the preparation of the FMP. The structure plan should however set the scope for the future FMP for the site, which should include but not be limited to the following considerations.

Table 5 – Scope for future Foreshore Management Plan

Foreshore Management Plan Considerations	Scope and matters to be included
Environmental Considerations	Ecological values, water quality, climate change, protection of existing vegetation and environmental values, marine turtles, mangrove protection, rehabilitation opportunities.
Cultural and Heritage Considerations	Indigenous (i.e. middens, archaeological monitoring etc) and European heritage (i.e. Merv's Lookout) interpretations, educational and site protection.
Planning Considerations	Coastal hazards, landform and stability, natural vulnerability, coastal node tenure, uses and form of development, identify types of recreational use, public access and any restricted areas, landscape and visual values, extent of foreshore reserve/boundaries, landscaping opportunities.
Administrative Considerations	Foreshore tenure and management authority, staging of development and interim coastal protection works required and management thereof and financial responsibilities for ongoing maintenance and management of foreshore area including coastal protection works.

The above scope can be the basis for future discussions with the relevant stakeholders and the developer, as required in Part One Clause 4.7 preliminary considerations for the preparation of a Foreshore Management Plan.

Preliminary undertakings to address Policy Measure 5.10

Consistent with the approach taken for other similar coastal development sites in Western Australia, the following are to be completed prior to Department of Planning, Lands and Heritage (DPLH) recommending the WA Planning Commission supports the proposed structure plan:

- The developer is to submit to DPLH a detailed design and modelling of the coastal protection works to satisfy Policy Measure 5.7(iii)(a) of SPP 2.6; and
- The developer is to submit to DPLH a suitable Statements of Undertaking from both the developer and the Town of Port Hedland whereby these parties agree to satisfy Policy Measure 5.7(iii)(b) of SPP 2.6 through the collaborative preparation of a FMP which sets the specific funding arrangements for the construction and ongoing care, control and maintenance of coastal protection works.

The developer and the Town should then partner with DPLH to scope and prepare the FMP, which could then form the basis for formal FMP approval at subdivision and development approval stage.

Local Water Management Strategy – Coastal modelling and cumulative impacts considerations

The Town's CHRMAP notes that a risk with areas affected by inundation is that with rising sea levels, the ability to drain inundated areas with drainage infrastructure will also reduce as tail water levels will be higher in the future. The impacts of the combination of high rainfall events with coastal inundation and high tail waters is likely to increase, although the CHRMAP focuses only on flooding from the marine environment and not rainfall. The LWMS provides for stormwater management to address the 1:100yr event, but does not provide for this with a combined 1:500yr coastal inundation event. Such an event would be highly unlikely, but could be further considered at the subdivision stage, to determine whether additional filling may be required to demonstrate adequate drainage for such a rare event.

The impact of the proposed structure plan, in the context of other sites being developed for East End (refer to Figure 6), on surrounding hydrological characteristics is not significant. The hydrological modelling confirms that ocean inundation from Pretty Pool, once the Athol Street site, Stables site and the former WWTP site are fully developed, will not have any significant adverse impact on the Pretty Pool Creek mangroves and adjacent lands.

4.1.5 State Planning Policy 2.9 – Water Resources

State Planning Policy 2.9 – Water Resources provides guidance to planning decision-makers in relation to managing impacts on water resources at various stages in the planning process, including local structure planning. This includes a focus on mitigating potential adverse impacts to water resources and promoting total water cycle management, to ensure best practice for the sustainable use of urban water resources.

The LWMS demonstrates that urban stormwater will be managed in accordance with the WAPC's Better Urban Water Management Guidelines. The strategy outlines that any potential impacts can be readily managed so as not to have any significant impact on the natural water resources.

4.1.6 State Planning Policy 3.4 – Natural Hazards and Disasters

State Planning Policy 3.4 – Natural Hazards and Disasters (SPP3.4) seeks to implement a systematic approach to the consideration of natural hazards and disasters in the planning process, including in the assessment of structure plans. In response to the provisions of SPP3.4 the proposed structure plan acknowledges the findings of the Town's adopted CHRMAP and makes provision for compliance with the policy measures under SPP 2.6 coastal planning.

4.1.7 State Planning Policy 3.7 – Planning in Bushfire Prone Areas

State Planning Policy 3.7 – Planning in Bushfire Prone Areas (SPP3.7) sets out the policy measures that apply to development in identified bushfire prone areas under the Department of Fire and Emergency Services State Map of Bush Fire Prone Areas.

As the subject site is located within an identified bushfire prone area, this application is supported by a Bushfire Management Plan (BMP). The BMP demonstrates that the relevant requirements under SPP3.7 can be appropriately addressed to comply with the policy.

Refer to Appendix 4 – Bushfire Management Plan

4.1.8 Liveable Neighbourhoods

Liveable Neighbourhoods (LN) has been prepared to guide the sustainable development of communities. It addresses both strategic and operational aspects of structure planning and subdivision for both 'greenfield' and larger urban infill sites.

The structure plan has been designed in accordance with the principles of LN, in particular the layout of roads, lots and public open space (POS). Consistent with LN, the structure plan provides a high level of connectivity with good external linkages to existing and planned road, cycle and pedestrian transport networks. The Figure 7 – Concept Plan demonstrates (along with the supporting technical reports) how the structure plan can be subdivided at later stages of planning.

The road design in the structure plan is legible and reduces car travel distances by creating alternative routes. These aspects are further addressed in the report.

LN encourages walkable access to local parks within POS. All future lots within the structure plan are within 400 metres walking distance from existing or planned POS areas. This provides residents with opportunities for active lifestyle and recreation within five minutes walking distance from residences. The structure plan provides for a relatively large functional active POS area for existing and future residents adjacent the foreshore reserve. This park will have a high level of amenity, being close to the foreshore and having views overlooking Pretty Pool Creek. The park will contribute towards achieving a sense of identity and place for the local residents.

Consistent with LN, it is important for the structure plan design to respond to site characteristics and site context. The structure plan design has taken into consideration the natural topography, the geological formations (i.e. estuarine deposits and secondary dune system), surrounding land uses, solar orientation and existing development. The proposed road layout can generally provide opportunity for residential lots to achieve an east-west or north-south orientation, which provides good opportunity for cross-breeze ventilation and solar orientation for dwelling design and outdoor living areas.

Within the structure plan, lots that face the POS and foreshore areas can increase opportunity for passive surveillance and interaction with public spaces. Lot shape and proportion of width to depth is considered important and the neighbourhood block layout in the structure plan has been designed to provide opportunity for lots to be rectangular in shape with a greater depth than width wherever possible. This ensures ability to develop the lots with high quality housing and built form and conformity with the Residential Design Codes of Western Australia and to the Pilbara housing and market expectations.

Other aspects of LN principles, such as local water management and road hierarchy are addressed further in this report. In addition, the proposed commercial use at the coastal node in the structure plan is discussed in further detail.

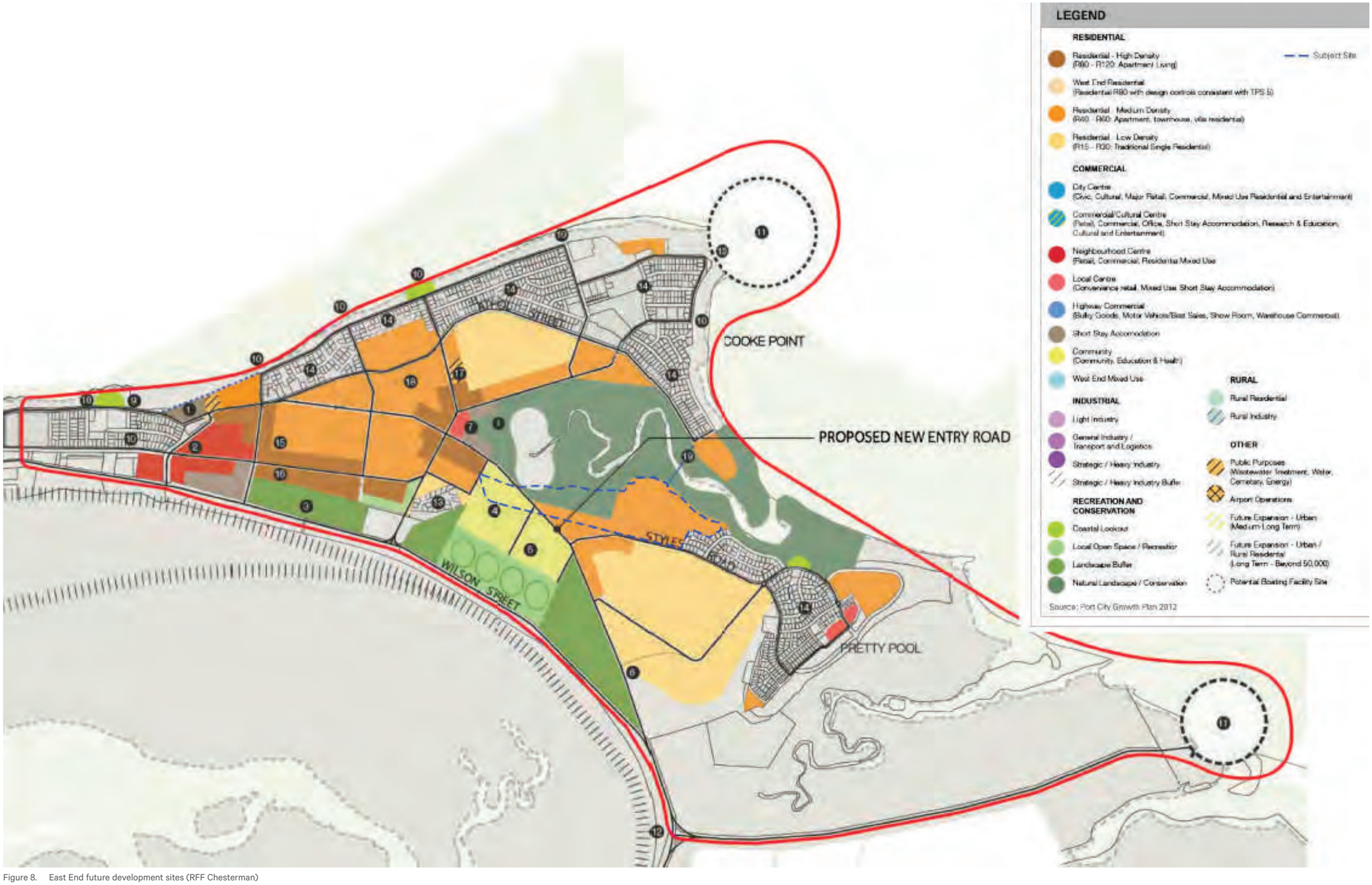


Figure 8. East End future development sites (RFF Chesterman)

4.2 Local Planning Framework

4.2.1 Pilbara's Port City Growth Plan

Pilbara's Port City Growth Plan operates as the Town's current adopted local planning strategy and seeks to guide the continued growth of Port Hedland into a Port City for the Pilbara region.

The primary aim of the plan is to promote the growth of Port Hedland as *"A nationally significant, friendly city, where people want to live and be proud to call home"*. This includes a specific focus on housing diversity and land supply capacity, to provide an adequate supply of affordable land and housing choice to cater for a diverse and permanent residential population. The location of new housing is also important, in that locations of high amenity should be preferred, in order to attract people to live permanently.

There is an intent to develop 23,043 new residential dwelling throughout Port Hedland and South Hedland. In particular, the East End of Port Hedland is to be developed as a high amenity coastal community that offers significant housing density and diversity, together with sport and recreation opportunities, and education and community facilities.

The subject site is located within 'Precinct 2 – East End Urban Village' under the plan and is identified for medium density residential development, along with other sites (refer to Figure 8).

Refer to Figure 8 – East End future development sites

4.2.2 Draft Local Planning Strategy

The Town's draft local planning strategy (advertised in June-July 2020) seeks to replace and update the Pilbara's Port City Growth Plan. The draft strategy is based on the findings of the Town's CHRMAP and thus reflects the long-term planning of the Town to address coastal hazards and SPP 2.6. The Athol Street site is identified in the draft strategy for future urban development, subject to the relevant planning and technical investigations to inform decision making.

4.2.3 Town of Port Hedland Town Planning Scheme No. 5 and Draft Town Planning Scheme No. 7

The Town of Port Hedland Town Planning Scheme No. 5 (TPS5) is the primary statutory control on land use and development within the Town. The Athol Street site is currently zoned 'Urban Development' under TPS5, which requires the preparation and approval of a structure plan prior to the subdivision and development of land. As such, the proposed structure plan will provide the necessary planning framework and guidance for the preparation and approval of more detailed subdivision and development proposals.

The wastewater treatment plant buffer notation on the scheme map affecting a portion of the western edge of the structure plan area is now redundant and has been removed under the proposed draft Town of Port Hedland Town Planning Scheme No. 7. The current urban development zone over the Athol Street site is retained under the draft scheme.

4.2.4 Port Hedland Townsite CHRMAP

The Port Hedland Townsite Coastal Hazard Risk Management and Adaptation Plan (CHRMAP), adopted in April 2019, identifies and considers coastal hazards and risks for the Port Hedland Townsite. This culminates in a recommended adaptation pathway that includes a range of actions to assist in adapting to immediate coastal inundation and erosion risks, and in undertaking appropriate planning to address increasing risks over time.

The adopted adaptation pathway accords with SPP2.6 and indicates that areas in East End are subject to a comparatively low coastal hazard risk compared with high risk areas in West End, where a managed retreat strategy is recommended.

Accordingly, the adopted CHRMAP recognises and supports the potential for future urban expansion in East End of Port Hedland. This will enable long-term investment into feasible protection of inundation in East End, which is not constrained by dust and noise impacts associated with port operations, and is capable of accommodating the full suite of urban uses, that could not otherwise be supported in West End.

In accordance with the above, the proposed structure plan provides for a design which adequately responds to the identified actions and recommendations under the CHRMAP.

4.2.5 Draft East End Village District Structure Plan

In 2012, DevelopmentWA (then LandCorp) engaged a consultant team to prepare a district structure plan to inform the future development of Port Hedland's East End. Whilst this document has not been formally adopted by the Town or the WAPC, and therefore has no statutory weight, it does serve to further inform the broader urban settlement vision for Port Hedland's East End.

Refer to Figure 9 – Draft District Structure Plan

Figure 9. Draft District Structure Plan (RFF Chesterman)

5. Structure Plan

5.1 Land Uses

The structure plan provides for a number of land uses including:

- Residential
- Commercial (coastal node)
- Public Open Space
- Drainage
- Foreshore

The foreshore area comprises most of the southern half of the structure plan area and includes the intertidal mudflats, which poses challenges to accommodate residential development. The coastal protection works (i.e. rock revetment) will form the demarcation edge between the foreshore area and the urban residential area.

A small area in the south-east portion of the structure plan is proposed as a 'coastal node'. The coastal node is situated on higher ground not subject to the coastal inundation hazard. This area has sweeping panoramic views overlooking Pretty Pool Creek and its fringing mangrove habitat. The site has excellent potential and opportunity for a future café/restaurant development.

Within the urban residential area (northern half), the structure plan proposes residential use with well-connected roads to the existing road network, drainage corridors to provide for stormwater management and a centrally located park adjacent to the foreshore.

Residential use is predominantly medium density (R25) with potential pockets of higher density around high amenity areas. Low density residential is proposed along Athol Street to mirror the existing low density residential dwellings on the northern side of Athol Street and to ensure retention of existing street trees through creation of larger lots.

5.2 Residential Yield and Densities

The Concept Plan (Figure 7) provides one option for the urban development of the subject site, with an estimated 232 dwellings (excluding multiple dwellings) that could be accommodated. The concept plan could provide for a mix of dwellings, predominately single dwellings on 12.5m – 15.0m frontage lots ranging in area from 375m^2 – 450m^2, and larger lots (i.e. along Athol Street) that are >600m^2.

Smaller medium density strata lots (R40) could be provided on larger parent lot sites to provide for a mix of accommodation types. To further increase the range of housing accommodation, multiple dwellings (maximum three storey height limit) could be considered facing the foreshore area and Pretty Pool Creek. This takes advantage of the site's elevation (post filling) and outlook of the Pretty Pool Creek natural area and foreshore. Examples of successful multiple dwelling development in Port Hedland, taking advantage of natural environment views, include Dowding Way in Pretty Pool.

The concept plan could accommodate up to approximately 650 people, based on an average household of 2.8 persons and 232 lots. The final lot yield and design would be determined as part of detailed subdivision at later stages of planning.

Table 6 provides an overview of development statistics based on the concept plan. Although the concept plan is indicative only at this structure plan level of planning (and not the subject of approval), the structure plan technical reports have been based on the concept plan. The concept plan provides a point of reference to demonstrate the capability of the proposed structure plan design over the subject site.

Table 7 demonstrates that the structure plan design, with a baseline average density code of R25 delivers approximately 26 dwellings per site hectare, which meets the Liveable Neighbourhoods density expectations for the site's locational context.

The initial estimated 232 single/grouped dwellings lots in Table 6 is based on an estimated residential housing composition as shown below:

Table 6 – Estimated dwelling yield and lot typology

Housing Typology	Estimated Dwelling Yield	Percentage
Single Dwelling (R20) (Low Density) – (Typical 20m x 30m – 600m^2)	49	21%
Single Dwelling (R25) (Medium Density) – (Typical 15m x 30m – 450m^2)	130	56%
Single Dwelling (R25) (Medium Density) – (Typical 12.5m x 30m – 375m^2)	47	20%
Single/Grouped Dwelling (R40) (Medium Density) – (Typical 10m x 30m – 300m^2)	6	3%
Multiple Dwelling (R60) (High Density) – (Mix of one, two and three bedroom apartments averaging 100m^2)	70	-
Sub-Total (excluding multiple dwellings)	232	
Total Yield	**302**	**100%**

Table 7 – Development Statistics (based on the Concept Plan)

	Site Outcomes	Target Density
Total Structure Plan Area	418,900m^2	-
Area set aside for foreshore, public purpose, coastal node, roads, drainage & POS	295,200m^2 (approximate)	-
Balance area for residential development	123,700m^2 (approximate)	-
Estimate ultimate number of single/ grouped dwellings	232 dwellings	-
Estimated number dwellings per site hectare[1]	18 dwellings per site hectare	Liveable Neighbourhoods 12 – 20 dwellings per site hectare for standard lot layouts; or 20 – 30 dwellings per site hectare for areas within 400m of neighbourhood centres

[1] Liveable Neighbourhoods definition of site hectare is the area available for residential development excluding roads, non-residential uses, public open space and drainage areas.

Image 21. Single dwellings (such as these in Panjya Parade, Pretty Pool) will be the predominant form of housing envisaged for the structure plan residential use. (Source: Google maps, 2020)

Image 22. Multiple dwellings (such as these in Dowding Way, Pretty Pool) is an emerging contemporary form of housing in the east-end of Port Hedland. (Source: Google maps, 2020)

5.3 Coastal Node

The coastal node site is on elevated land (approximately 9.0m AHD – 10.0m AHD) and has sweeping views overlooking the Pretty Pool Creek natural area. The site is accessible from Athol Street and can be readily connected to the existing servicing power, sewer, water and telecommunications infrastructure in Athol Street.

Given the value and future potential for the coastal node, a nominal area of approximately 2,000m^2 has been identified in the structure plan for an appropriate future use.

5.3.1 Objective of the coastal node

The objective of the coastal node is to provide for land uses which are limited to hospitality and/or tourism uses which can take advantage of the site's attributes and panoramic views overlooking Pretty Pool Creek.

Image 23. Coastal node sweeping views of Pretty Pool Creek make it an ideal location for tourist accommodation and/or café/restaurant.

Permissible land uses

Permitted uses are restricted to the following, with all other uses being prohibited ('X') uses:

- Restaurant (includes café)
- Tourist Resort
- Tourism Development

Built form

Proposed development is to be of high quality given the site's strategic location and prominence in the urban and natural landscape. For this reason a local development plan is required to be prepared and approved for the coastal node site, as a condition of Western Australian Planning Commission subdivision approval and/or prior to the Town of Port Hedland granting development approval.

The local development plan shall address the following planning matters:

- Orientation of development
- Plot ratio and retail floor space
- Site access and location for parking
- Retention of existing street trees in Athol Street
- Access to the foreshore
- Interface with foreshore
- Site landscaping
- Boundary setbacks
- Building height
- Building external design including materials, colours and finishes
- Bushfire management.

Image 24. A tourist accommodation or café/restaurant with scenic views overlooking Pretty Pool Creek and mangroves would be an ideal type of development for the coastal node. The image shown above is from the deck of the Mangrove Hotel restaurant in Broome overlooking coastal mangroves.(Source: booking.com, 2020)

Coastal Protection Works

No coastal protection works is envisaged for the coastal node site, as the natural ground level of the land is elevated at approximately 9.0m AHD – 10.0m AHD. This is well above the 6.7m AHD minimum finished development level for coastal flood inundation protection. An appropriate interface with the foreshore area will be required, which is likely to be soft landscaping or similar.

Tenure

The coastal node site is within Crown Reserve 30768 (Lot 511), which is managed by the Town of Port Hedland. Future tenure could consider converting the coastal node land to freehold for market disposal. Alternatively, the coastal node land could be retained in public ownership, with commercial leasing arrangements managed by the Town of Port Hedland for its future development and use. This would be subject to further consideration by the Town of Port Hedland and state government.

5.4 Public Purpose

The existing pumping station on Lot 555 Cooke Point Road will be incorporated in the structure plan within a public purpose reservation. The existing access to the Cooke Point Road will be retained. A 9 metre wide servicing corridor is proposed from the internal subdivision road network to provide for a sewer easement to service the structure plan. The 50m odour buffer for the pumping station is contained entirely within the public purpose reservation.

No changes are proposed to the existing pump station development. The coastal protection works necessary for the pump station will be the responsibility of the Water Corporation who manages the site.

5.5 Movement Network

A Traffic Report has been prepared to inform the structure planning for the subject site. Based on the concept plan, the transport assessment demonstrates that the proposed structure plan will not have any significant impact on the existing and planned transport movement network.

Refer to Appendix 5 – Traffic Report

5.5.1 Existing Roads

The subject site is currently accessible via Athol Street, with the wastewater pumping station being accessed via Cooke Point Road. The structure plan precludes any vehicle access from Cooke Point Road, except for retention of the existing access to the wastewater pump station.

Athol Street is a local distributor road carrying approximately 4,325 vehicles per day. It is constructed with a 7.2m wide pavement and has a footpath on its northern side. For the daily volume of vehicles, Athol Street would typically be classed as a 'Neighbourhood Connector A' under Liveable Neighbourhoods.

Preliminary discussions with the Town indicated that provision should be made on the southern side of Athol Street for a shared pathway, given Athol Street is a major east-west transport route and pedestrians/cyclists are likely to use the pathway to access the primary school and Colin Matheson oval. This will be addressed at the subdivision stage, however a proposed path on the southern side is shown on the structure plan map.

Cooke Point Drive is a local distributor road that provides the primary access from Wilson Street (main road entry into Port Hedland) to East End. The road is constructed with a standard 7.2m wide pavement. The structure plan does not propose any new access connections onto Cooke Point Road. Lots within the structure plan will either be orientated side-on or backing onto the road, with access from proposed internal subdivision roads.

The forecast increased traffic generated from the structure plan development will not require any additional upgrading or widening to the existing roads abutting the structure plan boundary. All new intersection connections from internal subdivision roads to Athol Street would be constructed to the Town's satisfaction.

Image 25. Residential development near the intersection of McGregor Street/Cooke Point Road with visually permeable developer uniform fencing on top of the retaining wall. The site has been raised to address coastal hazard flood inundation. The proposed structure plan development interface with Cooke Point Road will likely take on a similar form as this existing development. (Source: Google maps, 2020)

5.5.3 Proposed Roads

The structure plan proposes new internal subdivision roads connecting to Athol Street. The connections are likely to be 'T' intersections, with the eastern-most connection being restricted to a 'left-in/left-out' due to the location on a curve and the limited need for a right-hand entry/exit movement. The structure plan road layout provides an appropriate responsive design to the existing Athol Street levels and landforms to accommodate servicing of lots and stormwater drainage.

The roads within the structure plan are classified as local access roads which is consistent with Liveable Neighbourhoods, given the relatively low volumes of traffic on these roads. New subdivision roads are anticipated to be kerbed with a pavement width between 6m – 7m. Local access roads shall generally have a road reserve width consistent with Liveable Neighbourhoods, as shown in Figure 10.

Refer to Figure 10 – Indicative Road Reserve Widths and Cross-sections

Refer to Figure 11 – Section Coastal Protection Works (Multiple Dwellings)

The proposed road along the edge of the foreshore area and public open space will provide for a 'hard edge' interface. Within this foreshore road reserve, it is envisaged that provision will be made for the following public infrastructure in addition to standard road infrastructure (refer to Image 19 as an example):

- Pathway along the edge of the foreshore reserve and coastal protection works;
- Street parking parallel bays to provide for public parking facilities and access to the foreshore.

Refer to Figure 12 – Section Coastal Protection Works (Single Dwellings)

Refer to Figure 13 – Road Hierarchy Plan

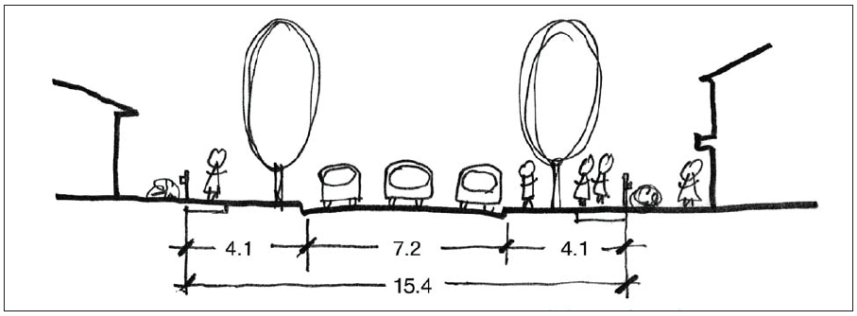
5.5.4 Pathways and Stair Access

There is an existing pathway on the northern side of Athol Street and eastern side of Cooke Point Road. The structure plan design allows for provision of pathways at detailed subdivision stage on proposed roads within the development. The general proposed pedestrian and cyclist pathway strategy for the structure plan is illustrated in Figure 12, which shows indicative pathways.

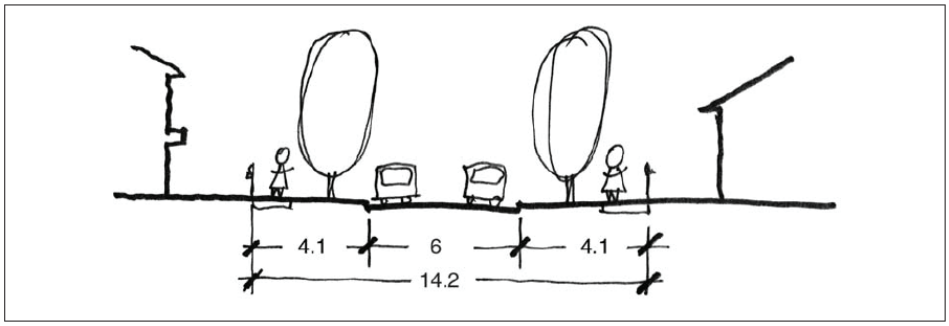
The structure plan recognises the importance of retaining recreational access to the foreshore area. In this instance, the structure plan proposes stair access to the foreshore area from the existing and planned urban development.

The exact location of pathways and stair access to the foreshore area will be determined in liaison with the Town at the subdivision stage once a more specific form of development for the subject site is proposed. In general, pathways are proposed to be provided on all streets in accordance with the requirements of Liveable Neighbourhoods.

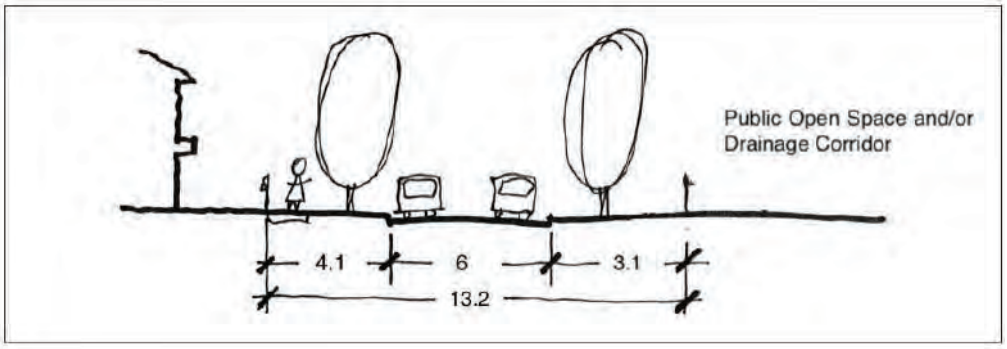
Image 26. Example of stairs integrated with coastal protection works to allow pedestrian access and connectivity with the foreshore area. (Source: Fraser Chronicle, 2020)



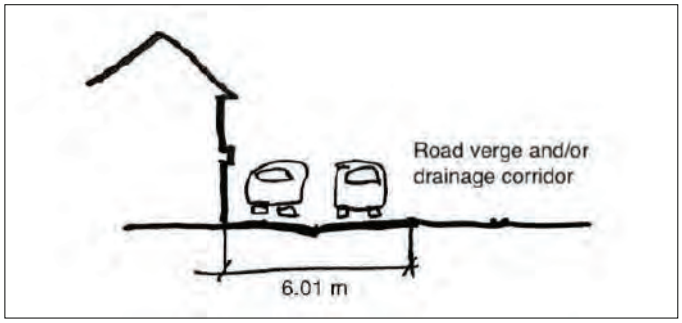
'Access Street C' – typical cross section for local street



'Access Street D' – typical cross section for local street (Development on both sides)

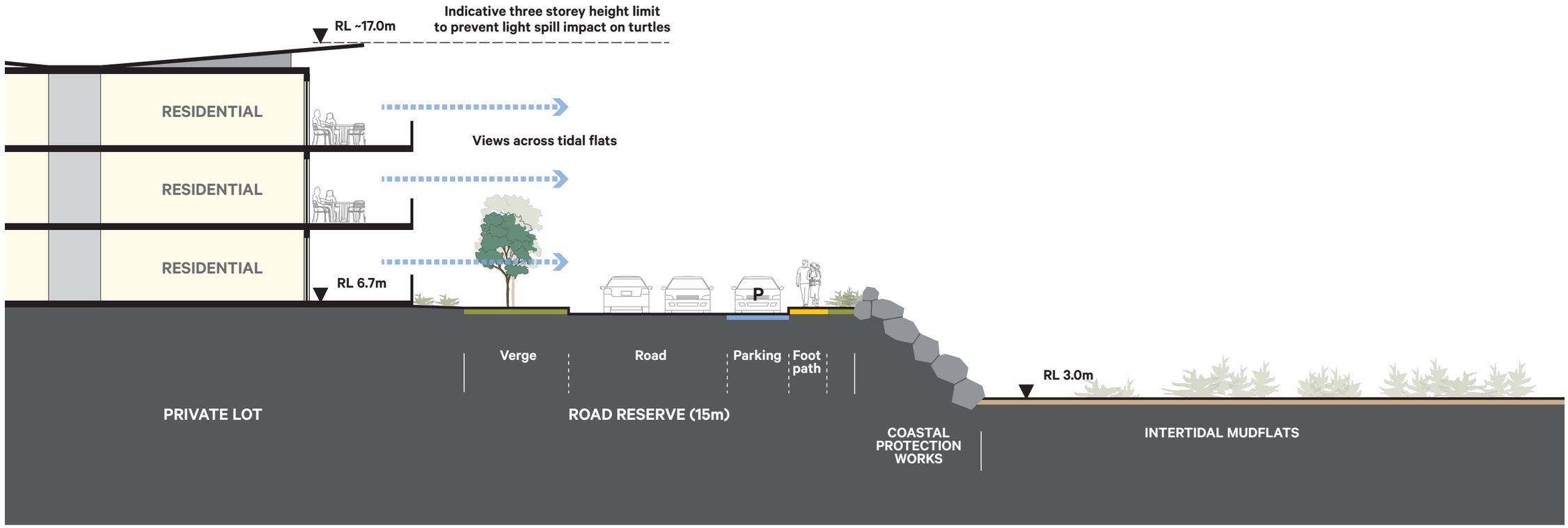


'Access Street D' – typical cross section for local street (Development on one side)



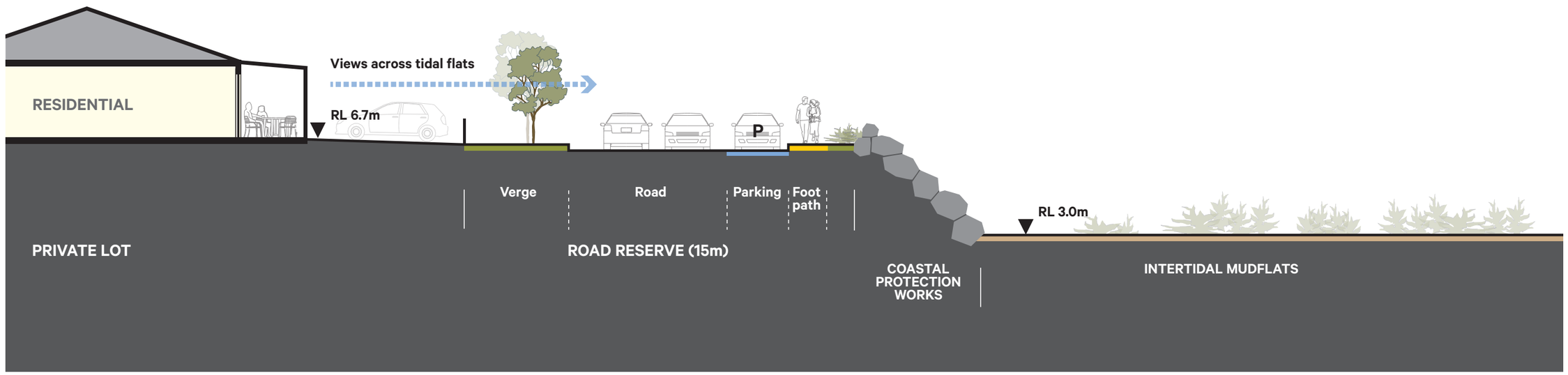
'Laneway' – typical cross section (Development on one side)

Figure 10. Indicative Road Reserve Widths and Cross-sections



Indicative section showing relationship of road, pedestrian footpath, coastal protection works and level change to mudflats.

Figure 11. Section Coastal Protection Works (Multiple Dwellings) (**element**, 2020)



Indicative section showing relationship of road, pedestrian footpath, coastal protection works and level change to mudflats.

Figure 12. Section Coastal Protection Works (Multiple Dwellings) (**element**, 2020)

Legend

- Structure Plan Boundary
- Neighbourhood Connector
- Access Street C
- Access Street D
- Laneway
- Full Movement Intersection
- Restricted Movement Intersection
- Roundabout

Figure 13. Road Hierarchy Plan (**element**, 2020)

5.6 Public Open Space

The structure plan makes provision for 6.8% public open space (POS), which is below the standard minimum 10% POS requirement. Notwithstanding, the one large and centrally located park within the structure plan area provides for an adequate level of POS for future residents. Furthermore, the large foreshore area ('Environmental Conservation' reservation) will provide for restricted recreational use, such as active walking and passive wildlife watching.

Due to the significantly high development costs (i.e. associated with filling), provision of the required 10% POS would add substantially to development costs. Whereas the proposed POS forms a sizeable park (approximately 1.23 hectares in area), that is unconstrained and can provide for the recreational needs of future residents, supplemented by the foreshore reserve which can also be used for recreation.

The provision of a single large park is consistent with the Town's public open space strategy for providing less (but bigger) parks for ease of maintenance and function. As shown in Figure 12, the majority of residents will have convenient access to POS, with existing Colin Matheson oval providing convenient POS for residents in the eastern-most part of the structure plan. All residents in the structure plan will therefore have convenient walkable access to POS. The proposed structure plan POS will also be accessible and service the existing community.

Refer to Figure 15 – Open Space and Pathways Plan

5.6.1 Proposed park

The proposed central park is adequately shaped and conveniently located adjacent to the foreshore area. This makes the park attractive, as it will have an elevated panoramic outlook to Pretty Pool Creek and the intertidal mudflats and fringing mangroves. Currently there is no park in East End comparable, in terms of its size and views overlooking intertidal mudflats and mangrove habitat.

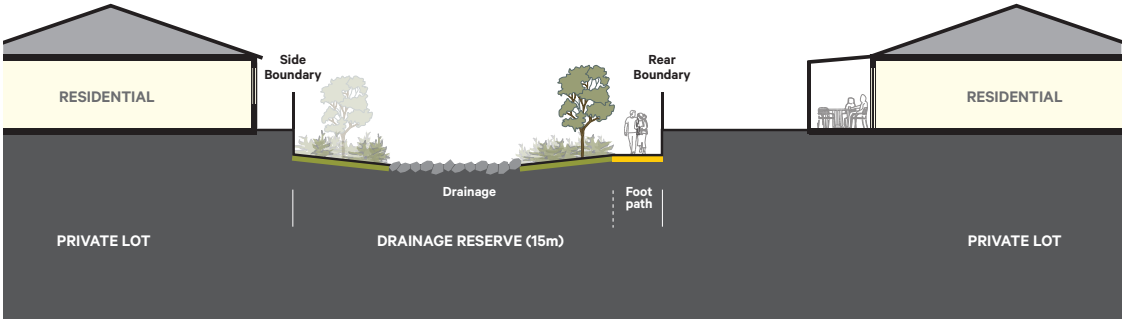
The central POS park could incorporate contemporary landscaping, using Pilbara native species and other waterwise species appropriate for the park setting. Some turf areas could also be considered for active recreation. Community art and other park amenities, along with shade structures could also be included. A park concept plan would be prepared and approved at later stages of planning.

Drainage corridors have also been included in the structure plan, primarily to accommodate the rapid transfer of stormwater during high rainfall events. These drainage corridors could serve a multiple use, by incorporating pathways alongside stormwater infrastructure to increase permeability for pedestrians and cyclists. The drainage infrastructure would comprise of swales with rock pitching to reduce water flow velocity and minimise erosion. Landscaping could be incorporated within the swales and corridors for amenity.

Refer to Figure 14 – Section Athol Street Drainage Link

Table 8 is the structure plan POS schedule based on the development concept plan. The structure plan POS and drainage corridors, along with indicative locations for pathways, are identified in Figure 12.

Image 27. Example of a landscaped open sloping swale drain in Harrier Street, South Hedland. (Source: Google maps street view, 2020)



Indicative section showing arrangement of drainage link and footpath to proposed dwellings.

Figure 14. Section Athol Street Drainage Link (**element**, 2020)

5.7 Landscaping, street trees and water conservation

Landscaping is anticipated to focus on planting local, endemic species in areas of POS, road reserves and drainage corridors. Street trees will provide 'soft works' and 'cooling effect' within the road reserves and will enhance the streetscape amenity. A street tree masterplan would be provided to the Town for approval at the subdivision stage.

The retention of existing street trees in Athol Street is an important consideration, as the trees have a high community value. The structure plan provides planning mechanisms to ensure a strong emphasis is placed on tree retention at subdivision and/or development approval stage.

The use of potable water for irrigation is restricted, due to tighter restrictions centred on improving water efficiency and conservation, until new sources of water are tapped by Water Corporation. Accordingly, the use of plants species that need minimal long-term irrigation and fertiliser application and that can tolerate the hot semi-arid climate of Port Hedland are ideal. Landscaping plans for POS and drainage areas would be submitted to the Town for approval at the subdivision approval stage.

Table 8 – Public Open Space Schedule based on Concept Plan

Calculation of Required POS Provision	Ha	Ha
Total Site Area (ha) – urban development zone	41.89	41.89
Deductions		
Foreshore Reserve	19.33	
Coastal Protection Works (20m wide linear edge)	2.10	
Dedicated Drainage	0.83	
Sewer Pumping Station	1.31	
Coastal Node	0.20	
Total Deductions		**23.77**
Gross Subdivisible area (total area minus deductions)		**18.12**
Required POS (10%)		**1.81**
Breakdown of POS Provided		
May comprise:		
minimum 80 per cent unrestricted POS	1.45	
Maximum 20 per cent restricted use POS	0.36	
Restricted Public Open Space		
Nil		
Total Restricted POS Credited to a maximum of 20%		**0.0**
Unrestricted Public Open Space : by function		
Local Park No. 1		1.23
Total Unrestricted POS		**1.23**
Public open space provision provided		**1.23**
POS Provision as Percentage of Gross Subdivisible Area		(6.8%)[1]

Notes: [1] Final POS calculations will be subject to detailed survey and approved Urban Water Management Plan. A minimum of 10% POS land contribution to be provided at Survey Deposited Plan final approval stage.

Figure 15. Open Space and Pathways Plan (**element**, 2020)

5.7.1 Retention of street trees in Athol Street

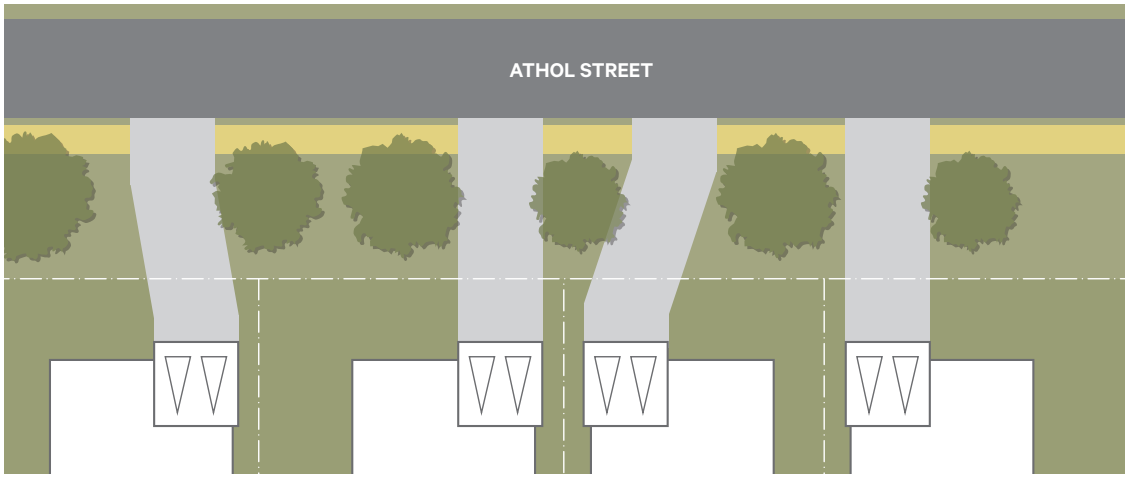
The low density residential interface along Athol Street is intended to mirror the existing low density on the northern side of the street, presenting a more uniform streetscape, but more importantly to ensure protection of existing street trees.

The majority of the existing street trees along Athol Street have reached maturity and form a valuable streetscape and community/environmental asset. Preliminary engagement with members of the community and key stakeholders have identified the desire to retain these trees.

The residential low density identified in the structure plan along the southern side of Athol Street will provide for larger lots, with wider frontages (i.e. 20m) to enable driveways/crossovers to be located so as to sustainably retain the existing street trees. In addition, it is envisaged at subdivision stage the street trees would be identified by feature survey and proposed lot boundaries designed to ensure driveways/crossovers can be adequately planned for and located so as to retain the trees.

A Local Development Plan would be prepared for the lots fronting or abutting Athol Street to require the mandatory locations for future crossovers – which will address tree retention.

Refer to Figure 16 – Diagram Athol Street Crossovers



Indicative diagram showing variable lot widths and driveway locations in order to retain existing street trees along the southern side of Athol Street.

Figure 16. Section Athol Street Drainage Link (**element**, 2020)

5.8 Education, employment and community uses

Under the existing planning framework there is no identified requirement for any educational establishments, public utilities and/or community uses within the subject land. The subject site is estimated to potentially yield approximately 232 dwellings, which is below the threshold requirement for one primary school for every 1,500 dwellings. Existing educational and community facilities in Port Hedland will service the proposed structure plan residential development.

The coastal node is proposed to accommodate non-residential uses primarily associated with tourism and hospitality. Envisaged uses include a café and/or restaurant and/or tourism development. The development of the coastal node will generate opportunities for local employment.

5.9 Servicing

An engineering servicing report has been prepared that demonstrates the site can be developed for urban development through provision of the necessary servicing. There are some challenges to provide for a fully serviced urban development, including the provision of the necessary fill, coastal protection works and re-routing and/or decommissioning of redundant servicing infrastructure within the site. However, there are no significant servicing constraints impacting the structure plan – with identified constraints able to be adequately managed. Subdivision and/or development for urban use would be subject to consultation with service providers and the necessary upgrades to existing infrastructure to support development.

Refer to Appendix 6 – Engineering Servicing Report

5.9.1 Reticulated Sewer

With the close of the Port Hedland wastewater treatment plant, all effluent generated in Port Hedland is now diverted to and pumped via the pump station on Lot 555 to the upgraded South Hedland Wastewater Treatment Plant. The Water Corporation indicates gravity fed reticulated sewer can be provided based on minimum to levels of 6.4m AHD. The proposed minimum 6.7m AHD finished development level is therefore adequate for provision of reticulated sewer.

There is an existing Water Corporation pump station and sewer pipe located within the site on Lot 1732 Athol Street. As part of future subdivision, this pump station and pressure main will be 'graded out', being replaced by new sewer infrastructure designed at the proposed finished levels.

The new structure plan sewer infrastructure network will connect with the existing gravity fed sewer in Athol Street. Existing effluent from Cooke Point and surrounding established areas to the north and east will be received by the structure plan new sewer infrastructure and gravity fed towards the Lot 555 pumping station. Consideration as to the connection with the existing pump station will be required at subdivision stage. As an example, a minimum 9m wide sewer easement corridor could be provided (indicatively shown in Figure 7) to connect the pump station with the structure plan sewer network.

A treated wastewater reuse pipe also extends through the site between the two pump stations. This treated wastewater is used to irrigate Council parks in East End, including Colin Matheson oval. This reuse pipe will need to be re-routed as part of subdivision works.

5.9.2 Reticulated Water Supply

Reticulated potable water supply from the East Pilbara Water Supply Scheme is readily available to the site from existing infrastructure in both the Athol Street and Cooke Point Road road reserves. The Water Corporation confirms that there is sufficient water supply to service the development.

5.9.3 Power, Telecommunications & Gas

Sufficient power supply exists servicing Port Hedland to supply the structure plan urban development. Existing reticulated power supply infrastructure is located in Athol Street. Typically all internal power reticulation lines and transformer installations will be constructed at the cost of the developer. Transformer sites will be determined at the detailed subdivision design stage.

The site can be adequately serviced by existing telecommunication infrastructure in Athol Street. The provision of a pit and pipe system (predominantly within road reserves) to accommodate future NBN and broadband supplier will be required as part of subdivision. There is no reticulated gas supply in Port Hedland.

5.10 Local and Urban Water Management

A local water management strategy has been prepared for the structure plan, which demonstrates that stormwater generated by proposed urban development can be adequately treated and managed. The strategy will guide the preparation and approval of an Urban Water Management Plan at subdivision stage.

Due to the intense rain events experienced in Port Hedland and the poor capacity of the local soil types to provide for adequate localised infiltration, stormwater runoff generated by residential development is not expected to be managed within individual lots.

The primary means for managing stormwater drainage will be to utilise the road network to collect and transfer stormwater runoff into drains beside the road. Drainage structures will typically consist of a kerb break and stone pitching to allow water to adequately discharge into the open drains.

Open drains are proposed to have mild longitudinal grades to avoid erosion and provide opportunities for nutrient stripping using landscaping. Drains would generally be landscaped typically using appropriately selected native species. The side slopes would typically be sloped at 1:6, but could be increased to 1:3 in certain places, or in lieu of a batter provision of retaining walls.

The overall drainage strategy would not intend to retain stormwater, which would result in standing bodies of water over long periods. This would encourage the undesirable breeding on mosquitos. During high intense rainfall events, stormwater is proposed to be conveyed in a controlled manner into the foreshore area, using vee notch (or similar) weirs to reduce the peak flows draining into the foreshore and reduce sediment inflow. Gross pollutant traps would be installed to ensure an acceptable level of treatment, prior to discharging into the marine intertidal zone of Pretty Pool Creek.

Image 28. Example in Gannet Street, South Hedland of rock pitching and kerb break to allow stormwater to discharge from road into the roadside open drain.(Source: Google maps street view, 2020)

Image 29. Example in Kennedy Street, South Hedland of an open swale drain adjacent to residential lots with a side pathway. This principle is envisaged for the drainage corridors in the structure plan where provision of a pathway is considered appropriate, to increase pedestrian connectivity and accessibility to the foreshore. (Source: Google maps street view, 2020)

5.11 Earthworks

The majority of the Athol Street site has a surface ground level of around 3.5m - 4.5m AHD. Preliminary civil engineering investigations indicate that the subject land will need to be filled to a minimum 6.7m AHD finished habitable development level to accommodate urban development. This will require substantial earthworks involving filling.

Some localised cut and fill and removal of topsoil will be required where existing site levels are higher than 6.7m AHD, particularly in the eastern portion of the site near Corney Street where there is a mound peaking at 16.0m AHD.

Site works will be required to create level lots for dwelling construction and provision of roads and services. Level sites reflect the ideal building site to reduce housing cost and improve housing affordability.

Use of retaining walls may be necessary to absorb any level differences. The height of retaining walls are expected to be minimal, with mostly low height (<1.0m) retaining walls. All retaining walls will be constructed to the City's satisfaction.

Due to the substantial amount of fill being introduced onto the site, there will be sufficient clearance to groundwater for all underground services and residential foundations. The sourcing of local fill could include dredge material, but this would be subject to consultation with the port authority and Town of Port Hedland.

5.12 Staging of development

The structure plan is likely to be delivered in multiple stages due to a number of factors, being:

- the overall size (lot yield) of the development;
- market forces;
- the availability of locally sourced adequate fill material; and
- the costs associated with coastal protection works.

There are no specific triggers for staging of development, except that the initial Stage 1 will likely commence in the east. Land within the eastern portion of the structure plan identified for urban development is on higher ground, requiring less filling. Some localised cut and fill of the mound near Corney Street could also provide an immediate source of limited fill.

Refer to Figure 17 – Staging Plan

The boundary and extent for Stage 1 would likely be formed on the eastern side of the central drainage corridor near Wyndham Street. Permanent coastal protection works (i.e. rock revetment) would be constructed interfacing with the foreshore reserve. Stage 1 could comprise approximately 80 lots, plus potentially a multiple dwelling site, which could accommodate a three storey building for around 70 apartments.

The initial stage 1 boundary would require the construction of temporary 'soft edge' coastal protection works on its western edge, behind the permanent coastal protection works front. This would be to the satisfaction of the Town of Port Hedland. The existing pumping station and servicing infrastructure west of the drainage corridor would remain until further staging.

Stage 2 would likely cover the remaining balance western area of the structure plan. This would include the construction of the public open space and completion of the permanent coastal protection works edge extending up to the wastewater pumping station.

The timeframe for undertaking Stage 2 could not be delayed for any long period of time, as the temporary 'soft edge' coastal protection works would require continual on-going monitoring and maintenance by the developer under a foreshore agreement with the Town. As soon as the next stage can occur, it is envisaged it will be undertaken, so that the permanent coastal protection works can be completed.

The Foreshore Management Plan would be prepared to reflect the intending staging and identify works and responsibilities for management of the foreshore area. Development of the coastal node could occur independently, as this site is separate to the main urban development area and is less constrained. Market demand would determine the timing for development of the coastal node.

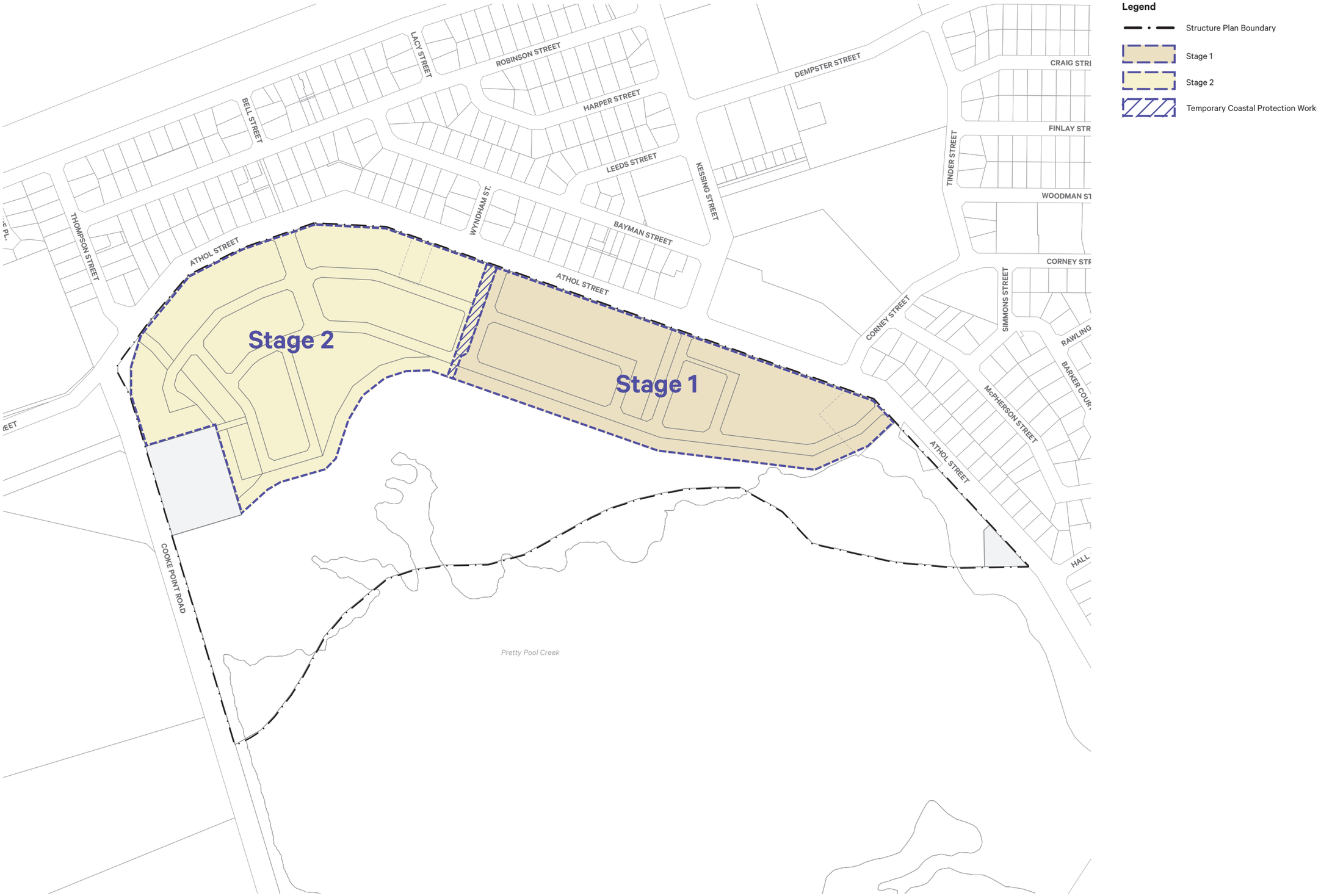


Figure 17. Staging Plan (**element**, 2020)

6. Conclusion

The Athol Street structure plan proposal is consistent with the established planning framework. The site is identified in the framework as a potential future urban development site in the East End. The structure plan technical and planning investigations has determined:

- The relevant coastal hazard risks identified in the Town's CHRMAP can be properly addressed, through adaptive measures including the provision of coastal protection works.
- An appropriate level and design response to the site's biophysical characteristics and surrounding context; and
- The site can adequately be planned and serviced to accommodate residential development.

The Athol Street site is regarded as a potentially high amenity residential development site. Urban development of the site will contribute towards providing sufficient land supply to accommodate housing for population growth in the future. The site will also provide for additional residential land supply associated with the planned reduction of residential use in West End, gives the opportunity for residents to stay in Port Hedland.

The relevant coastal planning considerations under WAPC SPP 2.6 have been addressed. The Town's CHRMAP identifies the subject site to be within a coastal hazard risk area susceptible to flood inundation. The structure plan modelling undertaken demonstrates that the SPP 2.6 coastal hazard risks (i.e. coastal flood inundation) for the 100 year planning timeframe can be satisfied by the following adaptation measures:

- Filling of the site to a minimum 6.7m AHD habitable finished development level; and
- Provision of suitable 'hard edge' engineered coastal protection works (i.e. rock revetment), providing for a high degree of protection against erosion and flood inundation.
- Provision of a Foreshore Management Plan to ensure the sustainable protection and maintenance of coastal protection works over the long term.

The structure plan balances the components of planning, heritage and environmental aspects and values to deliver a high amenity residential development, which capitalises on the site's strategic location and orientation outlook adjacent to Pretty Pool Creek. The structure plan Part One implementation provisions ensure the key planning considerations for the urban development of the site are addressed and will be addressed at later stages of planning. The timing of development is subject to market forces and the logistical sourcing of fill material. Approval of the structure plan will ensure that when the timing is ready, the next step of subdivision approval can be progressed.

Appendix 1 – Environmental Assessment Report

ENVIRONMENTAL ASSESSMENT REPORT

Athol Street Local Structure Plan, Cooke Point, Port Hedland

EEL20043.001 (formerly EEL1503002)
Rev 2
23 July 2020

rpsgroup.com

Document status

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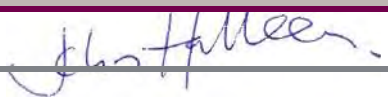
J. Halleen  23 July 2020

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SUMMARY

RPS Australia West Pty Ltd (RPS) has been commissioned to provide this Environment Assessment Report (EAR) to support the proposed structure plan for the Athol Street development (the site). The site is located within Port Hedland, in the Pilbara region of Western Australia, about 1,600 kilometres (km) north of Perth, and is situated approximately 3.5 km east of the town's centre in East Port Hedland. The site lies adjacent to existing residential development of Cooke Point directly to the north and east. To the west, the site is bordered by Cooke Point Road. The southern boundary of the site is loosely bordered by Pretty Pool Creek (Figure A).

The site is zoned to "Urban Development" under the Town of Port Hedland's (ToPH) Town Planning Scheme (TPS) No. 5 (Figure B). The 20.3 hectare (ha) proposed structure plan development footprint is a subset of the 42.5 ha TPS amendment area assessed by the EPA in 2012 for Amendment No. 58 (Figure C). The TPS amendment boundary, and subsequent proposed structure plan boundary, have been guided by project specific technical investigations, particularly regarding impacts to the Pretty Pool Creek mangroves (Cardno 2012, Appendix A; Cardno 2015, Appendix B; and Cardno 2020a, Appendix C), which underpin this current environmental assessment.

Amendment No. 58 assessment

In 2012 the ToPH initiated Amendment No. 58 to Town Planning Scheme (TPS) No. 5 to rezone the amendment area from "Parks and Recreation", "Water and Drainage", "Waste Disposal and Treatment" and "Rural" to ''Urban Development" to facilitate residential land uses.

The ToPH referred Amendment No. 58 to the Environmental Protection Authority (EPA) for assessment under Section 48a of the *Environmental Protection Act 1986*. The EPA assessed Amendment No. 58 as "Scheme Amendment Not Assessed – Advice Given (no appeals)". The EPA subsequently issued its advice and recommendations to the ToPH on 17 December 2012 (Appendix D).

The EPA's advice identified the following environmental issues that require further specific management consideration during future subdivision stages:

- Benthic habitat (Pretty Pool Creek mangroves)
- Marine fauna and flora (marine turtles)
- Terrestrial environmental quality (acid sulfate soil)
- Heritage.

To ensure that future development of the site was managed in accordance with the EPA's objectives the ToPH included the following specific key conditions within Appendix 7 of TPS No. 5:

a. Subdivision and development of the land shall have due regard to an approved Structure Plan approved by the Western Australian Planning Commission (WAPC).
b. Land identified in the Structure Plan(s) will be restricted to a built height limit that prevents light spill onto Cemetery Beach and Pretty Pool Beach and adjacent sea.
c. Environmental Management Plans addressing the following shall be prepared, adopted and implemented to the satisfaction of the ToPH on advice from the relevant state government agency:
    i. Construction management.
    ii. Foreshore management.
    iii. Mangrove management.
    iv. Drainage and nutrient management.
    v. Marine turtle management.
    vi. Acid sulfate soil (if required).
    vii. Other management plans as considered necessary on the advice from relevant state government agency.

Structure plan

The proposed structure plan has been developed to guide the subdivision and development of the northern 20.3 ha of the TPS amendment area (Figure C). The proposed structure plan promotes the following key land uses:

- Residential
- Public purposes (wastewater pumping station)
- Environmental conservation (foreshore reserve)
- Public open space.

Engineering philosophy

The proposed engineering methodology consists of filling the proposed structure plan development footprint to raise it to a safe 15 centimetre level above the modelled 500-year Average Recurrence Interval (ARI) coastal storm surge level and providing protection against coastal hazards through installing a rock revetment. The engineering drainage design involves the use of an open drain/swale network, which conveys surface water to arterial drainage corridors across the development. The purpose of this methodology is to provide the following outcomes:

- Convey stormwater run-off from rainfall events to Pretty Pool Creek.
- Provide adequate clearance from predicted coastal storm surge levels.
- Undertake coastal protection works (install rock revetment) against storm surge and flooding.
- Meet the Better Urban Water Management (WAPC 2008) stormwater design and water quality objectives.

Purpose of this report

The purpose of this EAR is to review the key environmental factors in respect to the proposed structure plan and detail the management measures outlined in the EPA's assessment of Amendment No. 58.

This EAR:

- Provides an overview of the proposed structure plan and describes the regional and local setting of the site.
- Reviews the EPA's key environmental factors including potential environmental impacts and management measures.
- Supports the planning and environmental assessment of the proposed structure plan.

Key environmental issues

This EAR addresses the following environmental factors that need to be considered in accordance with the EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2020):

- Sea factors
  - Benthic communities and habitats
  - Coastal processes
  - Marine environmental quality
  - Marine fauna
- Land factors
  - Flora and vegetation
  - Terrestrial environmental quality

  - Terrestrial fauna
- Water factor
  - Inland waters
- Air factor
  - Air quality
- People factor
  - Social surroundings.

Each of the environmental factors have been assessed to identify the potential impact of the proposed structure plan and detail the management measures to minimise these impacts.

Key environmental outcomes

Noting that the creation and formalisation of an appropriate setback to Pretty Pool Creek, and its fringing mangrove community, to ensure that no direct impacts will occur to mangrove system or the broader marine environment was achieved through Amendment No. 58, the proposed structure plan environmental outcomes are:

- Management of the ecological integrity of Pretty Pool Creek mangroves through the preparation and implementation of Mangrove Management Plan (MMP), Construction Management Plan (CMP) and Foreshore Management Plan (FMP)
- Implementation of coastal protection works in accordance with an approved FMP
- Implementation of built form height limits, Artificial Light Management Plan to manage potential light spill impacts to the Pretty Pool Beach flatback turtle rookery and Marine Turtle Management Plan minimise potential impacts from an increased residential population
- Implementation of Pilbara-centric water sensitive urban design and stormwater drainage management
- Use of native species in landscaping.

Management commitments

Table 1 summarises the key environmental issues and the proposed management commitments.

Table 1: Summary of the relevant environmental factors and management measures

Environmental factor	Objective	Applicable legislation and/or guidance	Potential impacts	Potential management measures
Sea				
Benthic Communities and Habitats	To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained	• Environmental Factor Guideline: Benthic Communities and Habitats (EPA 2016a) • Technical Guidance: Protection of Benthic Communities and Habitats (EPA 2016b)	• Loss of up to 3.46 ha of intertidal mud and samphire flats. • Halo effect due to either sediment scour or smothering around the development boundary due to changes in the local wave conditions. • Water quality changes during construction (turbidity) or due to reduced flushing could potentially cause indirect losses. • Indirect impacts to mangrove and samphire vegetation through reduced water quality from developmental run-off.	• MMP and CMP to be prepared to the satisfaction of the ToPH and the Department of Biodiversity, Conservation and Attractions (DBCA) at subdivision. The MMP will include: – Aerial photography and field surveys will be used to map the distribution and coverage of mangrove vegetation associations – Mangrove health surveys will be undertaken in an effort to ensure that any negative impacts are detected as soon as possible. Mangrove health monitoring would consist of regular visual assessments to determine mangrove condition – Mangrove monitoring sites will be established prior to the commencement of construction activities. • During the construction phase a CMP will be required which will address the following management and mitigation measures: – Ensuring no mangroves are cleared through access restrictions – Restrict access to areas outside of the proposed structure plan development footprint – Identify and manage potential impacts to the environment surrounding the proposed structure plan development footprint prior to ground disturbing activities – Dust management – Noise management – Fauna management.
Coastal Processes	To maintain the geophysical processes that shape coastal morphology so that environmental values of the coast are protected	• Environmental Factor Guideline: Coastal Processes (EPA 2016c) • State Planning Policy (SPP) 2.6: State Coastal Planning Policy • Port Hedland Townsite CHRMAP, Coastal Hazard Risk Management and Adaptation Plan (GHD 2019)	• Flooding and erosion of the shoreline as a result of tidal movement, storm surge, wave action, near shore currents and changes in water level. • Altering the natural patterns of sediment movement resulting from the installation of artificial structures associated with the development. • Altering the available area for potential mangrove migration or recruitment.	• Finished floor level for residential development of 6.7 m Australian Height Datum consistent with the findings of the Coastal and Hydrological Review (Cardno 2020b), CHRMAP (GHD 2019) and SPP 2.6. • The following steps will be implemented to develop the basis of design and confirm that the coastal protection structures (i.e. rock revetment) are the most suitable approach from a performance and financial viability perspective: – Undertake a gap assessment to identify datasets required to inform coastal processes assessment and concept option development – Undertake the required investigations to fill any gaps in the data – Develop a basis of design with available information – Develop several concept designs based on the preferred approach to be optimised to confirm the most suitable design. – Obtain required environmental approvals for the preferred design. • FMP to be undertaken at subdivision to appropriately manage access to Pretty Pool Creek, activities and conserve creek foreshore vegetation. FMP will be prepared to the satisfaction of the ToPH and the Department of Planning, Lands and Heritage (DPLH) at subdivision. The FMP will detail (but not limited to) the following: – Description of the foreshore management area – Foreshore planning and environmental approvals – FMP implementation and responsibility framework – Statutory requirements and policy context – Existing environment – Foreshore design and function – Coastal Hazard Risk Management and Adaptation Plan – Coastal protection design & future shoreline monitoring and management – Figures of the rock revetment walling – Figure of the landscape design – Lifecycle and costs of the proposed foreshore assets.
Marine Environmental Quality	To maintain the quality of water, sediment and biota so that environmental values are protected	• Environmental Factor Guideline: Marine Environmental Quality (EPA 2016d) • Technical Guidance: Protecting the Quality of Western Australia's Marine Environment (EPA 2016e) • Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline (EPA 2000) • Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment Conservation Council and Agricultural and Resource Management Council of Australia and New Zealand. 2000) • Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (Department of Environment 2006) • Better Urban Water Management (WAPC 2008)	Altering the hydrodynamics of the creek (development fill) may interrupt and alter local water circulation within the near shore areas of the Pretty Pool Creek which may reduce water quality.	• The Local Water Management Strategy (LWMS) (Appendix C) for proposed structure plan outlines the key water servicing, drainage and environmental management considerations to be progressed in support of subsequent development design and planning approval phases. • Key water management outcomes from the LWMS include: – First 15 millimetres (mm) of rainfall on lots to be detained within lots through soakwells or rainwater tanks – First 15 mm of rainfall from the road reserve to be detained in linear swales – All additional rainfall to be conveyed southward to Pretty Pool Creek via the road reserves and swales – Swale to discharge any rainfall events greater than 15mm to Pretty Pool Creek, which is consistent with the conveyance of stormwater from the surrounding residential development along Athol Street and Cooke Point. • Urban Water Management Plan(s) will be finalised to the satisfaction of the ToPH and DWER at subdivision.

Environmental factor	Objective	Applicable legislation and/or guidance	Potential impacts	Potential management measures
Marine Fauna	To protect marine fauna so that biological diversity and ecological integrity are maintained	• *Environment Protection and Biodiversity Conservation Act 1999* • *Biodiversity Conservation Act 2016* • Environmental Factor Guideline: Marine Fauna (EPA 2016f) • Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (EPA 2010) • National Light Pollution Guidelines for Wildlife including marine turtles, seabirds and migratory shorebirds (DEE 2020)	• Increased lighting from proposed development may potentially disrupt nesting and behaviour of nestling and adult turtles. • An increased residential population also has the potential to impact marine turtle nesting and hatchling behaviour, through the use of recreation vehicles, pets and interaction with nesting turtles.	• At its closet point the proposed structure plan development footprint is located over 1.4 km from the Pretty Pool beach turtle nesting area. Line of sight analysis using Lidar topography illustrated that the TPS amendment boundary and hence smaller LSP boundary was protected from light spill by the primary dunes at Pretty Pool Beach. • Proposed development will be restricted through built form height limits to ensure that no artificial light sources from the development (i.e. streetlights and residential dwellings) will be directly visible to either adult females nesting or departing hatching turtles at Pretty Pool and Cemetery beaches. • To minimise the potential for the Athol Street development to cumulatively add to the existing skyglow levels the development's lighting will be designed to accord with the National Light Pollution Guidelines (DEE 2020), and the EPA's Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (EPA 2010), while meeting legislative and regulatory requirements for human safety. • This will be achieved through the preparation of an Artificial Light Management Plan, inclusive of biological and artificial light monitoring and auditing requirements, which addresses the best practice lighting design principles identified in the National Light Pollution Guidelines (DEE 2020). The purpose of this Artificial Light Management Plan is to demonstrate that artificial light generated by the Athol Street development can be managed so that flatback turtles are: – Not disrupted within, nor displaced from, important habitat – Able to undertake critical behaviours such as reproduction and dispersal. • The Artificial Light Management Plan will include: – Description of the proposed lighting – Flatback turtle description – Risk assessment – Artificial Light Management Plan – Biological and artificial light monitoring and auditing. • The Artificial Light Management Plan will provide the technical rationale to underpin the heights of streetlights and residential dwellings within the future Athol Street development and will be prepared to the satisfaction of the ToPH on advice from the DBCA at subdivision. • CMP to include provisions restricting construction to day light hours only during turtle nesting and hatching season to avoid potential artificial light impacts to marine turtles during construction and development. • A Marine Turtle Management Plan will be prepared to minimise potential impacts, including through the use of recreation vehicles, pets and interaction with nesting turtles, to marine turtles from an increased residential population. The Marine Turtle Management Plan will be prepared to the satisfaction of the ToPH on advice from the DBCA at subdivision.
Land				
Flora and Vegetation	To protect flora and vegetation so that biological diversity and ecological integrity are maintained	• *Environment Protection and Biodiversity Conservation Act 1999* • *Biodiversity Conservation Act 2016* • Environmental Factor Guideline: Flora and Vegetation (EPA 2016g) • Technical Guidance: Flora and Vegetation surveys for Environmental Impact Assessment (EPA 2016h)	• Loss of up to 16.81 ha coastal dune vegetation. • Introduction and distribution of weed species. • Hydrological changes. • Vegetation disturbance/loss as a result of construction works, and increased use of off-road vehicles. • Vegetation quality degradation through increased pollution and waste.	• Retention of planted street trees along Athol Street. • MMP, CMP and FMP to be prepared to the satisfaction of the ToPH and the DBCA at subdivision.
Terrestrial Environmental Quality	To maintain the quality of land and soils so that the environment values are protected	**Acid sulfate soils** • Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016i) • Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes (Department of Environment Regulation (DER) 2015a) • Treatment and Management of Soils and Water in Acid Sulfate Soil Landscapes (DER) 2015b)	• Acidification and release of heavy metals from ASS into groundwater, surrounding marine environment. • Corrosion of concrete structures such as bridges, piles, pylons, drainage pipes.	• The final fill levels, engineering service excavation and dewatering requirements will dictate whether a preliminary ASS investigation and ASS and Dewatering Management Plan (ASSDMP) are required. • However, if required, the ASSDMP will: – Outline the soil management measures, the groundwater and dewatering effluent monitoring measures and the contingency management measures required to minimise any environmental impacts – Be prepared to the satisfaction of the DWER at subdivision.
Terrestrial Fauna	To protect terrestrial fauna so that biological diversity and ecological integrity are maintained	• *Environment Protection and Biodiversity Conservation Act 1999* • *Biodiversity Conservation Act 2016* • Environmental Factor Guideline: Terrestrial Fauna (EPA 2016j) • Technical Guidance: Terrestrial Fauna Surveys (EPA 2004a)	• Habitat disturbance as a result of construction, and increased use of off-road vehicles. • Impact on migratory bird species through loss of habitat. • As a result of disturbance during construction (noise and clearing activities), there may be an effect on the local abundance of fauna populations due to interruption to fauna behaviour, including displacement, injury or death. • Inadvertent injury and/or mortality as a result of increased vehicle strikes from increased traffic. • Impacts on significant fauna species. • Habitat destruction from increased activity from domestic pets. • Habitat and food source degradation through increased pollution and waste.	• Avoid clearing of rocky/boulder habitat that may contain micro-habitat suitable for refuge for some small terrestrial mammal species. • The Pretty Pool Creek line will be avoided. • Maintain equipment such that all noise emitting equipment is fully serviceable and working to the correct specifications. All construction movement will be scheduled to take place during the day. • MMP, CMP and FMP to be prepared to the satisfaction of the ToPH and the DBCA at subdivision. • FMP will also address a community education program including: – Installation of signs and educational material to inform the public of the local fauna and important habitats that people should avoid – Encourage the community to use dog leads and discourage people to allow dogs to roam off-leash – Discourage littering and pollution through educational material and fines.

Environmental factor	Objective	Applicable legislation and/or guidance	Potential impacts	Potential management measures
Air				
Air Quality	To maintain air quality and minimise emissions so that environmental values are protected	• Environmental Factor Guideline: Air Quality (EPA 2020b) • Port Hedland Air Quality Health Risk Assessment for Particulate Matter (Department of Health (DoH) 2016) • Managing Dust in Port Hedland, Industry Regulation Fact Sheet (DoH 2018) • Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities (Department of Environment and Conservation (DEC) 2011)	• In 2009, the EPA expressed concern that 24 hour PM10 dust concentrations regularly exceeded the air National Environmental Protection Measure (air NEPM) of 50 µg/m3 (+ 5 exceedances for natural events) and that existing planning arrangements allowed for residential development in the West End. • Air Quality could be potentially impacted, either directly or indirectly, through the generation of fugitive dust emissions through the following construction activities: – Clearing land for the development sites, public open space, roads and carpark – Wind-borne dust from exposed surfaces, earth moving, transport, stockpiling or loading of materials.	• Dust management shall comply with Guidelines for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities (DEC 2011) through the preparation and implementation of a Dust Management Plan to prevent or avoid excessive dust generation. The Dust Management Plan will address the following wetting procedures of the development work area will be undertaken: – Any dry engineering fill sand to be stockpiled will be actively wet down during active extraction – Water carts will be available near the site entrance to enable pre-wetting of access roads and areas of the site where vehicle movements are anticipated will be carried out. • Dust Management Plan to be prepared to the satisfaction of the ToPH and DWER at subdivision. • Prior to commencement of any construction, wind fencing will be installed on the boundaries of the site if required. • Should high wind speeds be forecast, site activities will be reviewed as deemed appropriate.
People				
Social Surroundings	To protect social surroundings from significant harm	**Aboriginal culture and heritage**		
		• *Aboriginal Heritage Act 1972* • Environmental Factor Guideline: Social Surroundings (EPA 2016k) • Guidance for the Assessment of Environmental Factors: Assessment of Aboriginal Heritage (EPA 2004b)	Excavation / construction activities may unearth and/or damage artefacts or other items of cultural Aboriginal significance.	• Consult with DPLH to determine obligations under the *Aboriginal Heritage Act 1972*. • Approval to disturb the Aboriginal archaeological site under Section 18 of the *Aboriginal Heritage Act 1972* (if required) prior to ground disturbing activities • Should any Aboriginal objects be identified or unearthed during development, works will be stopped, and the findings reported to the DPLH
		Amenity		
		• *Health Act 1911* • Environmental Factor Guideline: Social Surroundings (EPA 2016k) • Environmental Guidance for Planning and Development (EPA 2008)	The partial infilling of the Pretty Pool Creek flood plain may result in increased areas of standing water following rainfall and periods of higher tides which may have the potential to serve as mosquito breeding areas. Health and amenity issues could affect visitors and residents living adjacent to the water body if mosquito breeding occurs in large numbers.	• Mosquito monitoring program to be prepared to the satisfaction of the ToPH at subdivision. • If mosquito numbers are found to be excessive, a Mosquito Management Plan will be prepared in consultation with the ToPH and the DoH and implemented.
		Bushfire		
		• *Fire and Emergency Services Act 1998* • Environmental Factor Guideline Social Surroundings (EPA 2016k) • SPP 3.7: Planning in Bushfire Prone Areas • Guideline for Planning in Bushfire Prone Areas, Version 1.3 (DPLH and Department of Fire and Emergency Services 2017)	• Damage to people, property and infrastructure from fire. • Death and/or injury due to fire.	• Bushfire Management Plan has been prepared to provide the bushfire management framework proposed to be actioned as part of developing the site in accordance with the structure plan. • Bushfire Attack Level contour mapping within the Bushfire Management Plan will be updated (if required) to reflect the proposed structure plan and subdivision outcomes.

1 INTRODUCTION

1.1 Background

RPS Australia West Pty Ltd (RPS) has been commissioned to provide this Environment Assessment Report (EAR) to support the proposed structure plan for the Athol Street development (the site). The site is located within Port Hedland, in the Pilbara region of Western Australia, about 1,600 kilometres (km) north of Perth, and is situated approximately 3.5 km east of the town's centre in East Port Hedland. The site lies adjacent to existing residential development of Cooke Point directly to the north and east. To the west, the site is bordered by Cooke Point Road. The southern boundary of the site is loosely bordered by Pretty Pool Creek (Figure A).

The site is zoned to "Urban Development" under the Town of Port Hedland's (ToPH) Town Planning Scheme (TPS) No. 5 (Figure B). The 20.3 hectare (ha) proposed structure plan development footprint is a subset of the 42.5 ha TPS amendment area assessed by the EPA in 2012 for Amendment No. 58 (Figure C). The TPS amendment boundary, and subsequent proposed structure plan boundary, have been guided by project specific technical investigations, particularly regarding impacts to the Pretty Pool Creek mangroves (Cardno 2012, Appendix A; Cardno 2015, Appendix B; and the LWMS, RPS 2015 and Cardno 2020a, Appendix C), which underpin this current environmental assessment.

1.1.1 Amendment No. 58 assessment

In 2012 the ToPH initiated Amendment No. 58 to Town Planning Scheme (TPS) No. 5 to rezone the amendment area from "Parks and Recreation", "Water and Drainage", "Waste Disposal and Treatment" and "Rural" to ''Urban Development" to facilitate residential land uses.

The ToPH referred Amendment No. 58 to the Environmental Protection Authority (EPA) for assessment under Section 48a of the *Environmental Protection Act 1986*. The EPA assessed Amendment No. 58 as "Scheme Amendment Not Assessed – Advice Given (no appeals)". The EPA subsequently issued its advice and recommendations to the ToPH on 17 December 2012 (Appendix D).

The EPA's advice identified the following environmental issues that require further specific management consideration during future subdivision stages:

- Benthic habitat (Pretty Pool Creek mangroves)
- Marine fauna and flora (marine turtles)
- Terrestrial environmental quality (acid sulfate soil)
- Heritage.

To ensure that future development of the site was managed in accordance with the EPA's objectives the ToPH included the following specific key conditions within Appendix 7 of TPS No. 5:

a. Subdivision and development of the land shall have due regard to an approved Structure Plan approved by the Western Australian Planning Commission (WAPC).
b. Land identified in the Structure Plan(s) will be restricted to a built height limit that prevents light spill onto Cemetery Beach and Pretty Pool Beach and adjacent sea.
c. Environmental Management Plans addressing the following shall be prepared, adopted and implemented to the satisfaction of the ToPH on advice from the relevant state government agency:
    i. Construction management.
    ii. Foreshore management.
    iii. Mangrove management.
    iv. Drainage and nutrient management.
    v. Marine turtle management.
    vi. Acid sulfate soil (if required).
    vii. Other management plans as considered necessary on the advice from relevant state government agency.

1.2 Purpose of this report

The purpose of this EAR is to review the key environmental factors in respect to the proposed structure plan and detail the management measures outlined in the EPA's assessment of Amendment No. 58.

This EAR:

- Provides an overview of the proposed structure plan and describes the regional and local setting of the site
- Reviews the EPA's key environmental factors including potential environmental impacts and management measures
- Supports the planning and environmental assessment of the proposed structure plan.

1.3 Key reports

The following key environmental investigations identified the environmental factors and defined the TPS amendment boundary as assessed by the EPA in 2015 for Amendment No. 58:

- Fatal Flaws for Proposed Development of East Port Hedland based on Hydrodynamic Modelling (Cardno 2012, Appendix A)
- Review of the impacts to the Pretty Pool Mangroves based on the hydrodynamic modelling (Cardno 2012, Appendix A)
- the Cardno hydrodynamic modelling and mangrove assessment was independently peer reviewed by Dr Erik Paling
- site survey with mangrove and mudflat vegetation mapping by RPS botanist in 2010
- Bamford Consulting Ecologists survey of waterbirds in the Pretty Pool Creek area (Appendix E)
- Preliminary Noise Impact Assessment (Herring Storer Acoustic 2011)
- Athol Street District Water Management Strategy (RPS 2012a)
- Review of state and Commonwealth ecological databases
- Review of key Port Hedland specific reports including:
  - Port Hedland Air Quality and Noise Management Plan: The Port Hedland Dust Management Taskforce Report (Department of State Development 2010)
  - Proposed Outer Harbour Development, Port Hedland: Public Environmental Review / Draft Environmental Impact Statement (BHP Billiton 2011)
  - Port Hedland Coastal Vulnerability Study (Cardno 2011)
- Undertaking a preliminary environmental assessment of the East Port Hedland area (RPS 2011) to identify areas of land (precincts) which are less constrained by environmental factors. RPS (2011) identified the site was significantly less constrained than other areas in the East Port Hedland area
- undertaking an environmental interrogation of the Athol Street Precinct (RPS 2012b) to identify a potential area where development could be proposed based upon hydraulic coastal monitoring and level of impact to the mangrove community which fringes Pretty Pool Creek.

The following additional key environmental investigations and government technical reports, which relate to coastal hazard risk management, marine turtles, terrestrial fauna, air quality, noise and bushfire, have been undertaken to provide contemporary information relevant to the proposed TPS amendment:

- Port Hedland Townsite CHRMAP (GHD 2019)
- Mangrove and Potential Erosion Impacts Assessments (Cardno 2015; Appendix B)
- LWMS (RPS 2015) and the Local water management addendum (Cardno 2020a; Appendix C)
- Coastal Hydrodynamic Modelling (Cardno 2020b, Appendix F)

- A decade of monitoring Flatback turtles in Port Hedland, Western Australia, 2004/05 – 2013/14 (Imbricata Environmental 2016)
- Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy (Department of the Environment and Energy (DEE) 2017)
- National Light Pollution Guidelines for Wildlife including marine turtles, seabirds and migratory shorebirds (DEE 2020)
- Review of state and Commonwealth ecological databases (Appendix G)
- Review of key Port Hedland specific reports including:
  - Port Hedland Air Quality Health Risk Assessment for Particulate Matter (Department of Health (DoH) 2016)
  - Managing Dust in Port Hedland, Industry Regulation Fact Sheet (DoH 2018)
  - Port Hedland West End Improvement Scheme No. 1, Scheme Report (WAPC 2020)
- Noise Impact Assessment (Herring Storer Acoustic 2020)
- Bushfire Management Plan (Bushfire Prone Planning 2020).

1.4 Identified key environmental factors

This EAR addresses the following environmental factors that need to be considered in accordance with the EPA's Statement of Environmental Principles, Factors and Objectives (EPA 2020):

- Sea factors
  - Benthic communities and habitats
  - Coastal processes
  - Marine environmental quality
  - Marine fauna
- Land factors
  - Flora and vegetation
  - Terrestrial environmental quality
  - Terrestrial fauna
- Water factor
  - Inland waters
- Air factor
  - Air quality
- People factor
  - Social surroundings.

Each of the environmental factors have been assessed to identify the potential impact of the proposed structure plan and detail the management measures to minimise these impacts.

2 STRUCTURE PLAN

2.1 Description

The proposed structure plan boundary, has been guided by project specific technical investigations, particularly regarding impacts to the Pretty Pool Creek mangroves (Cardno 2012, Appendix A; Cardno 2015, Appendix B; and Cardno 2020a, Appendix C) which underpin this current environmental assessment.

The proposed structure plan has been developed to guide the subdivision and development of the northern 20.3 ha of the TPS amendment area (Figure C). The proposed structure plan promotes the following key land uses:

- Residential
- Public purposes (wastewater pumping station)
- Environmental conservation (foreshore reserve)
- Public open space.

2.2 Environmental influences

The key environmental influences of the structure plan were:

- Pretty Pool Creek mangroves
- Pretty Pool Beach flatback turtle rookery
- Coastal processes and the implementation of coastal management measures
- Management of acid sulfate soils (ASS).

2.2.1 Coastal hazard consideration

In 2018, the ToPH prepared a Port Hedland Townsite Coastal Hazard Risk Management and Adaptation Plan (CHRMAP; GHD 2019) consistent with the WAPC's State Planning Policy (SPP) No. 2.6: State Coastal Planning Policy. The CHRMAP (GHD 2019) included an assessment of the Athol Street and Stables development sites, both of which are located adjacent to Pretty Pool Creek. The CHRMAP (GHD 2019) was formally adopted by the ToPH and the WAPC post public consultation in 2019. The proposed structure plan development footprint is smaller in spatial extent when compared to the TPS amendment area to account for the revised coastal hazard risk profile.

2.3 Engineering philosophy

The proposed engineering methodology consists of filling the proposed structure plan development footprint to raise it to a safe level at 15 centimetre (cm) above the modelled 500-year Average Recurrence Interval (ARI) coastal storm surge level and providing protection against coastal hazards through installing a rock revetment. The engineering drainage design involves the use of an open drain/swale network, which conveys surface water to arterial drainage corridors across the development. The purpose of this methodology is to provide the following outcomes:

- Convey stormwater run-off from rainfall events to Pretty Pool Creek
- Provide adequate clearance from predicted coastal storm surge levels
- Undertake coastal protection works (install rock revetment) against storm surge and flooding
- Meet the Better Urban Water Management (WAPC 2008) stormwater design and water quality objectives.

2.4 Land use

2.4.1 Previous and existing land uses

A review of the historic aerial photography, from 1995 to 2012, shows there has been no observable change to the natural environment of site. The extents of vegetated land and areas of bare tidal flats remain consistent over time and the area of vegetated land does not appear to have diminished.

An eastern portion of the site was cleared of vegetation in 2013 and developed as a wastewater pumping station. Most of the site remains undeveloped and is characterised by coastal dune vegetation and open mud flats with areas of samphire (Plate 1). Outside of the site, mangroves surround the margins of Pretty Pool Creek.

Plate 1: Vegetation and bare tidal flats within the site

Identified from site visits and aerial photographs the existing land uses of the site are primarily for wastewater pumping, water conveyance and maintenance of the local hydrological / ecological function. Four-wheel drive vehicles have created numerous informal access tracks across the mud flats and secondary dunes.

2.4.2 Surrounding land uses

The Athol Street road reserve contains planted street trees which provide locally important landscape amenity and sense of place identity (Plate 2). The planted street trees are planned to be retained by the future development of the site.

Plate 2: Planted street trees to be retained by the future development of the site

The residential development of the Port Hedland's east end (Cooke Point) is situated directly to the north of the site. The Port Hedland's east end supports a range of urban land uses including "Residential" "Commercial", "Community", "Education" and "Parks and Recreation".

3 LEGISLATIVE AND POLICY FRAMEWORK

3.1 State legislation

3.1.1 Environmental Protection Act 1986

The *Environmental Protection Act 1986* (EP Act) is the key legislative tool for environmental protection in Western Australia. The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment.

The EP Act is administered by the EPA and the Minister for the Environment.

3.1.2 Relevant legislation and regulations

The proposed residential development of the site will be required to comply with the requirements of other relevant of pieces of state legislation and regulations. Table 2 provides a summary of the key state legislation and regulations relevant to the residential land use of the site.

Table 2: Key state and Commonwealth legislation

State legislation	
Aboriginal Heritage Act 1972	*Contaminated Sites Act 2003*
Aboriginal Heritage Regulations 1974	*Environmental Protection Act 1986*
Biodiversity Conservation Act 2016	Environmental Protection (Clearing of Native Vegetation) Regulations 2004
Biodiversity Conservation Regulations 2018	*Fire and Emergency Services Act 1998*
Bush Fires Act 1954	*Land Administration Act 1997*
Conservation and Land Management Act 1984	*Planning and Development Act 2005*
Conservation and Land Management Regulations 2002	*Rights in Water and Irrigation Act 1914*
Commonwealth legislation	
Environment Protection and Biodiversity Conservation Act 1999	Environment Protection and Biodiversity Conservation Regulations 2000

3.1.3 Relevant guidelines and standards

Proposed residential development of the site will be subject to compliance with applicable guidance developed by the EPA, and other relevant policy documents, to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process.

State Planning Policies (SPPs) are prepared under Part 3 of the *Planning and Development Act 2005* to provide planning policy control and guidance to project proponents. The development of a structure plan for the site will be required to respond to relevant SPPs.

Table 3 details the key EPA guidance, other relevant policy documents and state planning policies relevant to the residential land use of the site.

Table 3: Applicable guidelines, standards and policies

EPA factor guidelines
Environmental Factor Guideline: Benthic Communities and Habitats (EPA 2016a)
Environmental Factor Guideline: Coastal Processes (EPA 2016c)
Environmental Factor Guideline: Marine Fauna (EPA 2016f)
Environmental Factor Guideline: Flora and Vegetation (EPA 2016g)
Environmental Factor Guideline: Landforms (EPA 2016l)
Environmental Factor Guideline: Terrestrial Environmental Quality (EPA 2016i)

EPA factor guidelines
Environmental Factor Guideline: Terrestrial Fauna (EPA 2016j)
Environmental Factor Guideline: Air Quality (EPA 2020b)
Environmental Factor Guideline: Social Surroundings (EPA 2016k)
EPA technical guidance
Technical Guidance: Protection of Benthic Communities and Habitats (EPA 2016b)
Technical Guidance: Protecting the Quality of Western Australia's Marine Environment (EPA 2016e)
Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016h)
Technical Guidance: Terrestrial Fauna Surveys (EPA 2004a)
EPA guidance statements and assessment guidelines
Guidance Statement for Protection of Tropical Arid Zone Mangroves along the Pilbara Coastline. Perth, Western Australia (EPA 2000)
Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (EPA 2010)
Environmental Guidance for Planning and Development (EPA 2008)
Guidance for the Assessment of Environmental Factors: Assessment of Aboriginal Heritage (EPA 2004b).
Relevant policy documents
Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment Conservation Council and Agricultural and Resource Management Council of Australia and New Zealand. 2000).
Pilbara Coastal Water Quality Consultation Outcomes: Environmental Values and Environmental Quality Objectives (Department of Environment 2006)
Port Hedland Air Quality Health Risk Assessment for Particulate Matter (Department of Health (DoH) 2016)
Managing Dust in Port Hedland, Industry Regulation Fact Sheet (DoH 2018)
Guideline for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities (Department of Environment and Conservation (DEC) 2011)
State planning policies
SPP 2.6: State Coastal Planning Policy
SPP 3.7: Planning in Bushfire Prone Areas
SPP 5.4: Road and Rail Transport Noise

3.2 Commonwealth legislation

3.2.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects Matters of National Environmental Significance (MNES) and is administered by the Commonwealth Minister of the Environment. If an action is likely to have a significant impact on any MNES a referral to Department of Agriculture, Water and Environment (DAWE) is required. MNES: Significant impact guidelines 1.1 (Department of the Environment 2015) outlines a 'self-assessment' process, including detailed criteria, to assist proponents in deciding whether or not referral may be required.

MNES that relate to the site are listed Threatened species and Migratory species protected under international agreements.

3.3 Recovery plan for marine turtles

The Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy (DEE) 2017) identifies that habitat critical to the survival of a species for marine turtle stocks has been identified by consensus of a panel of experts in marine turtle biology. Specifically, regarding flatback turtles nesting and inter-nesting habitat has been identified based on the following criteria:

- Nesting habitat critical to the survival of flatback turtles includes at least 70% of nesting for the stock.

- Nesting habitat critical to survival of marine turtles is of a geographically relevant scale.
- Where relevant, nesting habitat determined to be critical to the survival of marine turtles includes areas that are: geographically dispersed; major and minor rookeries; mainland and island beaches; and winter or summer nesting.
- To ensure the validity of long-term monitoring programs for assessing trends in nesting turtle abundance, all index beaches are considered habitat critical to survival of marine turtles.
- Inter-nesting habitat critical to the survival of marine turtles is located immediately seaward of designated nesting habitat critical to the survival of marine turtles. The inter-nesting habitat critical buffer for flatback turtles is 60 km.

3.4 National light pollution guidelines for wildlife including marine turtles, seabirds and migratory shorebirds

Light pollution was identified as a high-risk threat in the Recovery Plan for Marine Turtles in Australia (DEE 2017) because artificial light can disrupt critical behaviours such adult nesting and hatchling orientation, sea finding and dispersal, and can reduce the reproductive viability of turtle stocks. A key action identified in the Recovery Plan was the development of guidelines for the management of light pollution in areas adjacent to biologically sensitive turtle habitat.

The National Light Pollution Guidelines for Wildlife including marine turtles, seabirds and migratory shorebirds (DEE 2020) have been developed to address potential impacts to critical behaviours in wildlife from artificial light. The aim of the National Light Pollution Guidelines for Wildlife is that artificial light will be managed so wildlife is:

- Not disrupted within, nor displaced from, important habitat [1]
- Able to undertake critical behaviours such as reproduction and dispersal.

The National Light Pollution Guidelines for Wildlife (DEE 2020) recommend:

1. Always using best practice lighting design to reduce light pollution and minimise the effect on wildlife. Best practice lighting design principles that can be used to reduce light pollution, including:
    a. Start with natural darkness and only add light for specific purposes
    b. Use adaptive light controls to manage light timing, intensity and colour
    c. Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill
    d. Use the lowest intensity lighting appropriate for the task
    e. Use non-reflective, dark-coloured surfaces
    f. Use lights with reduced or filtered blue, violet and ultra-violet wavelengths
2. Undertaking an environmental impact assessment for effects of artificial light on wildlife for listed species for which artificial light has been demonstrated to affect behaviour, survivorship or reproduction.

[1] Important habitat for marine turtles includes all areas that have been designated as habitat critical to survival of marine turtles and biologically important areas (DEE 2020).

4 PORT HEDLAND CLIMATE

4.1 Regional overview

Port Hedland is located within the hot, semi-arid climatic zone. Summers (October to April) are very hot with an average maximum temperature of 31.8 °C and daily maximum of up to 35.2 °C in March, the hottest month. Winter temperatures range from an average monthly minimum of 17.2 °C to an average monthly maximum of 26.8 °C (Bureau of Meteorology 2020a).

Most of the annual rainfall occurs during the summer period from scattered thunderstorms and the occasional tropical cyclone. A secondary peak in the rainfall occurs in May and June because of rainfall events caused by tropical cloud bands that intermittently affect the area. These events can also produce low maximum temperatures particularly away from the coast. Thunderstorms average 20 to 30 events per annum in the Pilbara; however, 15 to 20 events per annum are more common near the coast (Bureau of Meteorology 2020a). Thunderstorms can result in erratic and localised rainfall events that lead to tidal surges and localised flooding of Port Hedland's low coastal plain area (Bureau of Meteorology 2020a).

The winds at Port Hedland vary in direction and strength with seasonal conditions. Generally, the windiest conditions are experienced in summer with winds generally prevailing from a north-westerly direction. Westerly winds are dominant in the morning, shifting to north-westerly in the afternoon, with an accompanying increase in speed (Bureau of Meteorology 2020a). In winter, east to south-easterly winds are dominant in the mornings and shift to north easterlies in the afternoon before easing in the evening in response to diurnal land temperature changes (Bureau of Meteorology 2020a).

4.1.1 Cyclones

The coastline from Port Hedland to the Exmouth Gulf is the most cyclone prone area in Australia. Port Hedland has been severely impacted by 50 cyclones since 1910 (Bureau of Meteorology 2020b). Cyclones are most common in the Pilbara between February and March and sometimes result in extreme rainfall events (Bureau of Meteorology 2020b).

Cyclones can cause significant increases in the ocean level through the combined effects of low atmospheric pressure, strong onshore winds and large waves breaking near shore. This increase in the water level (storm surge) has implications for coastal development.

5 SEA-THEMED FACTORS

5.1 Benthic communities and habitat

5.1.1 Pretty pool creek mangroves

Port Hedland is surrounded by areas of arid zone mangroves, within the intertidal zone of creeks, where tidal inundation is sufficiently frequent. Mangroves are a potential refuge to a large variety of fauna species, including birds and bats (Paling et al. 2001).

The site is located to the north of the Pretty Pool Creek mangroves which is comprised of the following associations:

1. *Avicennia marina* (scattered) – comprising scattered individuals of the mangrove *Avicennia marina*, often with scattered samphires, but without high densities.
2. *Avicennia marina* (closed canopy, landward edge) – a forest/scrub comprising the typical zone of mangroves immediately behind the mixed association of *Avicennia marina* and *Rhizophora stylosa* (Plate 3).

Plate 3*:* ***Avicennia marina*** **(closed canopy, landward edge) in Pretty Pool Creek**

The proposed structure plan development footprint is setback from the Pretty Pool Creek mangroves by an average of 239 m and at its closet point is 112 m from the mangroves. The average separation distance between the Pretty Pool Creek mangroves and residential development has been increased by 160 m when compared to the TPS amendment.

5.1.1.1 Hydrodynamic modelling and mangrove assessment

A key study undertaken to validate Amendment No. 58 area was the Cardno (2012) fatal flaw analysis of the TPS amendment area and the hydrodynamic implications to Pretty Pool Creek and surrounding mangroves (Appendix A). The following investigations were undertaken to define the spatial extent of the TPS amendments area to ensure no direct impacts on the Pretty Pool mangrove system and the broader marine environment:

- Coastal vulnerability modelling in accordance with State Coastal Planning Policy 2.6 (SPP2.6), the proposed development will be required to be above the ARI-500 storm tide inundation level for the 100-years planning period (2110). To investigate the effects of changed tidal prism characteristics on the mangroves, a Delft3D model of the Pretty Pool Estuary was set up based on Cardno's previous work in the area (Cardno 2011). The tidal processes were simulated for the existing bathymetry as well as the developed layout, which enabled differences in exchange and velocity to be investigated. Four scenarios were modelled to determine the extent of changes to exchange and velocities within the creek between pre and post development conditions. The modelled scenarios include
    a. An ambient one-month simulation that encompassed two spring tides with a mean high water level equal to mean high water springs (2.8 m Australian Height Datum (m AHD)). This is a typical tidal scenario
    b. A seven-day simulation for a 2-year ARI spring tide level of approximately 3.3 m AHD
    c. An extreme 20-year ARI tropical cyclone event (tropical cyclone Terry, January 1973)
    d. An extreme 500-year ARI tropical cyclone event, incorporating 0.9 m sea level rise.
- Specifically, the following was investigated to determine any impacts on the mangroves
    a. Decreased tidal prism as a result of the filled development area
    b. Changes to the current velocity through the mangrove area
    c. Change in mangrove inundation level and duration
    d. Change in flushing characteristics of the Pretty Pool Estuary.
- Post-modelling a matrix containing criteria critical to mangrove health and their relative tolerance levels was finalised by a mangrove specialist. The matrix assessed the outcomes from the modelling study against the criteria for mangrove health.
- Assessment of development setbacks from the creek and mangroves in accordance with
    a. Environmental Protection Bulletin No. 14: Guidance for the assessment of benthic primary producer habitat loss in and around Port Hedland (EPA 2011)
    b. EPA Bulletin No. 18 Sea level rise (EPA 2012).

5.1.1.1.1 Mangrove and potential erosion impact assessments

Cardno (2015) provide a fatal flaw analysis of the combined impact of the Athol Street and Stables TPS amendment areas and the hydrodynamic implications to Pretty Pool Creek and surrounding mangroves (Appendix B). The preliminary modelling and impact matrix determined that there would be no direct losses or impacts to the existing mangroves as a result of the development of the combined extent of the Athol Street and Stables TPS amendment areas (Table 4).

Table 4: Pretty Pool mangrove potential impacts risk matrix

Potential impact	Mechanism for positive impacts	Mechanism for negative impacts	Conclusions
Water Levels	Increased water levels associated with storm events may increase flushing of hyper-saline flats and increase areas suitable for mangrove growth.	Increased water levels during extreme storm events.	Water level differences during typical conditions are patchy and of small magnitude. Therefore water level changes are considered likely to have a minimal impact on mangroves. An increase in the severity of impacts on mangroves as a result of hydrodynamic changes during extreme events is possible; however, these are likely to be minimal and insignificant in comparison to likely wind damage at such times.

Potential impact	Mechanism for positive impacts	Mechanism for negative impacts	Conclusions
Groundwater Flows	Increased flows during storm events may lead to erosion of salt-flat sediments, creation of new drainage lines, reduction in salinity and increase in area available for mangrove recruitment.	Negative impacts to mangroves near mouth of the creek are indicated during extreme storm events (cyclones).	Direct cyclonic impacts on vegetation likely to be greater than effects from altered hydrodynamics associated with the development, therefore impacts on mangroves associated with altered current flows are also considered to be minimal. As for water level increases, an increase in the severity of impacts on mangroves as a result of hydrodynamic changes during extreme events is considered to be insignificant in comparison to likely wind damage at such times.
Groundwater Salinity	Increased localised freshwater flows due to hinterland effect, stormwater drainage and altered land use. Localised freshwater input is predicted to result in a decrease in groundwater salinity (and increase nutrient concentrations) in tidal flats, potentially promoting mangrove colonisation and growth, particularly on the salt flat along the development margin.	Altered hydrology and weight of development may cause hydrostatic head and alter groundwater flows such that hyper-saline groundwater under and adjacent to the development move towards mangroves.	Mangrove recruitment along the bund wall is predicted. Mangrove condition on the seaward margin of the salt flats may improve due to decreased salinity associated slight increases in inundation and current flow, conversely there is potential for delayed negative impacts on creek mangroves along salt flat margin. On balance, it is considered most likely that the development will decrease the salinity of the salt flats and promote the survival and growth of mangroves.
Nutrients	Nutrients introduced by altered land use may result in increased growth of mangroves.	Nutrients may cause increased cyanobacterial mat (algal) growth on the salt flats which may be visually apparent from the development area.	Both positive and negative impacts from increased nutrients are likely to be minimal.

Source: Cardno 2015

The assessment was undertaken to determine if changes in creek hydrology would impact the mangroves and be a resultant fatal flaw to the development. As such the assessment did not consider any secondary effects that may occur such as reduced water quality in the creek from run-off via the development. These secondary effects will be assessed and managed through the application of Better Urban Water Management principles.

Although the development will not directly impact on the existing mangrove areas of Pretty Pool Creek it is proposed that a Mangrove Management Plan (MMP) be prepared to monitor for changes in mangrove health as an early indicator of potential secondary impacts from the development, and to identify management measures for mitigating any potential impacts.

A Local water management addendum – Athol Street (Cardno 2020a; Appendix C) has been prepared to address the water management principles for the structure plan. This addendum incorporates the 2015 LWMS undertaken by RPS and the findings from the ToPH's CHRMAP (GHD 2019). Cardno (2020a) confirmed in the addendum that the findings of Cardno (2015) hydrodynamic modelling and LWMS stormwater management principles remained valid (i.e. that there would be no direct losses or impacts to the existing mangroves as a result of the development of the combined extent of the Athol Street and Stables structure plan areas).

5.1.1.1.2 Previous mangrove monitoring for the Pretty Pool development

As part of the implementation of the monitoring and reporting commitments for the Pretty Pool Development, an MMP was prepared, to the satisfaction of the ToPH and the (then) DEC.

The mangrove monitoring consisted of a baseline mangrove study of Four Mile Creek, which was undertaken prior to the commencement of construction in January 2009, and subsequent annual monitoring from 2010 until 2012. The monitoring result over a 3-year period concluded that there was no notable change in the health and the overall condition of the mangroves.

The monitoring results demonstrate that the implementation of the management measures for Pretty Pool residential stages 1, 2, 2a, 4 and 4b have been successful in mitigating potential impacts to the mangroves.

5.1.2 Intertidal mudflats

Typically, areas of intertidal mud flats are found in association with these mangrove areas. Samphire communities are known to exist in the littoral land system, which occurs along the coast of the Pilbara in level plains, slightly raised above the adjacent intertidal mudflats (Van Vreeswyk et al. 2004).

Within Pretty Pool Creek area, inclusive of the site, the samphire community is known to consist of a mixed dwarf shrubland of *Tecticornia halocnemoides, Hemichro adiandra*, *Frankenia pauciflora*, with patches of grassland of *Sporobolus virginicus*.

5.1.2.1.1 Assessment of benthic primary producer habitat loss

Technical Guidance: Protection of Benthic Communities and Habitats (EPA 2016b) is spatially based meaning that it is based on the evaluation of areas of benthic communities and habitats which have been historically lost or are currently present and proposed to be lost or impacted within defined areas. The areas within which to calculate losses are termed Local Assessment Units (LAUs), for which that are no standard size or shape and need to be defined on a case-by case basis.

The EPA's Environmental Protection Bulletin No. 14: Guidance for the assessment of benthic primary producer habitat loss in and around Port Hedland (EPA 2011) has been superseded by the more general EPA (2016b). However, for the purpose of reviewing an area where benthic communities and habitats have been historically lost, are currently present and proposed to be lost or impacted the Inner Port Hedland Port Area LAU identified by EPA (2011) has been used to inform the potential impact of the Athol Street development on benthic communities and habitats at the local, regional and State-wide scales.

The Inner Port Hedland Port Area LAU encompasses near shore barrier islands, tidal creeks and adjacent intertidal areas in the vicinity of the Port Hedland Inner Port and has a total area of 15,102.5 ha (EPA 2011).

The intertidal mud flats within the site, and the Pretty Pool Creek area, are not unusual and are representative of Beard Vegetation Associations: 127 – Bare areas; mud flats recorded in the Inner Port Hedland Port Area LAU and more broadly throughout the Pilbara. Kendrick and Stanley (2001) detail that Beard Vegetation Association: 127 – Bare areas; mud flats has a low priority for reservation in the Pilbara due to the substantial amount of this community already in reservation (30,345.4 ha). The extent of Beard Vegetation Association: 127 – Bare areas; mud flats within the LAU is shown in Figure E.

The proposed structure plan development footprint is smaller in spatial extent when compared to the TPS amendment area to account for the revised coastal hazard risk profile. The development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats (Figure F).

Table 5 demonstrates the loss of Beard Vegetation Association: 127 in the context of the Inner Port Hedland Port Area LAU and, more holistically, in Western Australia.

Table 5: Loss of Beard vegetation association: 127 in the LAU

	Beard vegetation association:127 – bare areas; mud flats	Percentage of Beard vegetation association:127 – bare areas; mud flats in LAU	Percentage of Beard vegetation association:127 – bare areas; mud flats in WA
Pre-European extent in WA (ha)	778,381	N/A	100%
Current extent in WA (ha)	778,153	N/A	99.9%
Extent in LAU (ha)	6,963.7	100%	0.89%
Original extent in Pretty Pool Creek (ha)	56.1	0.8%	0.007%

	Beard vegetation association:127 – bare areas; mud flats	Percentage of Beard vegetation association:127 – bare areas; mud flats in LAU	Percentage of Beard vegetation association:127 – bare areas; mud flats in WA
Extent in Athol Street proposed structure plan development footprint (ha)	3.46	0.05%	0.0004%
Extent in Stables TPS proposed structure plan development footprint (ha)	0.40	0.006%	0.00005%
Remaining extent in Pretty Pool Creek after the implementation of the Athol Street and Stables structure plan development footprints (ha)	52.24	0.75%	0.007%

Sources: Shepherd et al. (2002); ENV (2011); EPA (2011)

Table 5 identifies that 3.46 ha of Beard Vegetation Association:127 – Bare areas; mud flats is within the proposed structure plan development footprint. The 3.46 ha extent represents approximately 0.05% of Beard Vegetation Association 127 within the Inner Port Hedland Port Area LAU and 0.0004% in Western Australia. When the cumulative loss of 3.86 ha of Beard Vegetation Association:127 – Bare areas; mud flats is considered in the context of the Stables proposed structure plan development envelope, approximately 0.75% of the intertidal mud flats within Pretty Pool Creek, 0.05% within the Inner Port Hedland Port Area LAU and 0.0005% in Western Australia will be permanently lost.

Given that the small amount of intertidal mud flats within the Athol Street and Stables structure plan development footprints in the context of Pretty Pool Creek, LAU and Western Australia, development of the sites will not result in reducing the mapped extent Beard Vegetation Association:127 – Bare areas; mud flats above the 10% cumulative loss guideline at either the local, LAU or State scales.

5.2 Coastal processes

5.2.1 State Planning Policy 2.6: State Coastal Planning Policy

SPP 2.6: State Coastal Planning Policy provides guidance for decision making within the coastal zone including establishment of foreshore reserves, managing development, land use change and to protect, conserve and enhance coastal values.

SPP 2.6 applies to the coast throughout Western Australia, including:

- Sandy coasts, rocky coasts, mixed sandy and rocky shorelines, coastal lowlands, and tidal reaches of inland waters
- Near shore marine waters, state waters
- All islands within the state lying seawards of the mainland
- Land use and development within the coastal zone.

It is considered that Pretty Pool Creek is classified as a tidal reach of inland water body and therefore SPP 2.6 is applicable to the site. SPP 2.6 identifies that Port Hedland is located in Area 2. In this area, the allowance for current risk of erosion and inundation should be based on a tropical cyclone storm event. SPP 2.6 is based on a 100-year time frame when a subject proposal is being assessed. For storm surge inundation, consideration is given to ocean forces and coastal processes that have a 500-year ARI probability of being equalled or exceeded in any given year over the planning timeframe.

5.2.1.1 Hydrodynamic modelling and mangrove assessment

5.2.1.1.1 Coastal modelling outcomes

The Cardno (2012) modelling predicted minimal changes to occur to the hydrology of the creek for the ambient tidal scenario and 2-year ARI event scenario, however a very minor reduction in overall tidal exchange was noted for these scenarios (<1%).

There were minimal differences noted in the results of the extreme event scenarios (20-year and 500-year ARI). The modelling predicted a 6% and 10% reduction (post-development) in the volume of water exchanged (during the event) for the 20-year and 500-year ARI events respectively. In both extreme scenarios this reduction in water exchange translated to an increase in inundation of the mangrove areas of approximately 5 cm (Cardno 2012). In addition a flood plain area south of Styles Road would likely experience some additional inundation (approximately 10 cm) during a 500-year ARI event. This would need to be considered in future planning for the region (Cardno 2012).

The model results suggest that minor changes in peak current velocities would occur in all scenarios. Peak current velocities would likely be increased in the vicinity of the development area and decreased in the eastern areas of the creek. As expected, the maximum predicted change in velocities occurs in the 500-year ARI event (Cardno 2012). The predicted peak velocities for the post-construction scenario are between 10–15 cm (up to 50% increase) which could cause redistribution of some sediment within the creek and possible redistribution of mangroves. It was noted that other direct impacts (i.e. wind) would be more significant than alterations of the hydrodynamic regime during the infrequent extreme weather events (Cardno 2012). The increase in peak current velocities could be minimised through use of stormwater controls, and engineering technologies within the development interface area (interface treatments).

5.2.1.2 Mangrove and potential erosion impact assessments

5.2.1.2.1 Coastal modelling outcomes

Cardno (2015) provide a fatal flaw analysis of the combined impact of the Athol Street and Stables TPS amendment areas and the hydrodynamic implications to Pretty Pool Creek and surrounding mangroves (Appendix B). With respect to coastal modelling outcomes, the differences between the findings of Cardno (2015) which modelled both Athol Street and Stables TPS amendment areas and Cardno (2012) which only modelled the Athol Street TPS amendment area were:

- Modelling predicted a 9% and 16% reduction (post-development) in the volume of water exchanged (during the event) for the 20-year and 500-year ARI events, which translated to an increase in inundation of the mangrove areas of approximately 5 -20 cm (Cardno 2015)
- Flood plain area south of Styles Road would likely experience some additional inundation (approximately 15 cm) during a 500-year ARI event.
- Predicted peak velocities for the post-construction scenario are up to 30 cm which will likely result in the redistribution of sediment during extreme events.

Cardno (2015) reconfirmed that other direct impacts (i.e. wind) would be more significant than alterations of the hydrodynamic regime during the infrequent extreme weather events.

5.2.1.3 Coastal hydrodynamic modelling

Cardno recently undertook hydrodynamic modelling of the Athol Street and Stables proposed local structure plans. The Coastal Hydrodynamic Modelling (Cardno 2020b; Appendix F):

- Considers the applicable requirements from SPP 2.6, including the storm events specifications provided in Schedule One – Calculation of Coastal Processes
- Adjusts Cardno's existing model to represent the two extreme storm tide events specified in SPP 2.6 Schedule One
  - 100-year storm tide to 2120 to assess erosion hazard
  - 500-year storm tide to 2120 to assess inundation hazard

- Models the influence of the proposed structure plan development footprints pre- and post-construction for the following configurations
  - No development
  - TPS amendment areas
  - Proposed structure plan development footprints
  - Proposed structure plan development footprints and wastewater treatment plant site
- Characterises the potential inundation and erosion hazards for the proposed structure plan development footprints and surrounds pre- and post-construction for the specified storm events
- Evaluates the sensitivity of the results to the TPS Amendment area and proposed structure plan development footprints from the inclusion of the wastewater treatment plant site.

The interpretation of the coastal hydrodynamic modelling indicates:

- Finished floor level of 6.7 m AHD is sufficient to prevent inundation of the proposed development, with an estimated free board of 15 cm under the 500-year storm tide event for the proposed structure plan development footprints
- Insignificant excess inundation (less than 5 cm) above the baseline is expected due to the presence of the proposed structure plan development footprints under the 500-year storm tide event
- Limited excess erosion (less than 10 cm/s) above the baseline is expected due to the presence the proposed structure plan development footprints under the 100-year storm tide event
- Proposed structure plan development footprints reduce the influence of development within Pretty Pool Creek when compared to the total TPS amendment areas
- Proposed structure plan development footprints and wastewater treatment plant site has the potential to alter the flood flow pattern more significantly than the TPS amendment areas and may contribute to a meaningful increase in inundation depth (in the order of 10 cm) to adjacent properties between the wastewater treatment plant and Wilson Street.

5.2.2 Port Hedland townsite CHRMAP

The CHRMAP (GHD 2019) identifies and considers coastal hazards and risks for the Port Hedland Townsite culminating in a recommended adaptation pathway with actions to assist in adapting to immediate coastal inundation and erosion risks and undertaking appropriate planning to address increasing risk over time. The CHRMAP (GHD 2019) considers hazards and risks in the immediate term (2010), the current planning horizon (to 2060) and the long-term (to 2120).

The CHRMAP (GHD 2019) was prepared as a strategic document for long-term planning and decision-making by the community and key stakeholders to adapt the current and future Port Hedland settlement and infrastructure to coastal erosion and inundation.

The CHRMAP (GHD 2019) assessment was inclusive of the ToPH's current Local Planning Strategy, and therefore addressed proposed new residential development area in the east end of Port Hedland. The CHRMAP (GHD 2019) multi-criteria analysis used to assess options for the Athol Street and Stables development determined the options of accommodation and protection respond similarly to local environmental and social values, therefore financial feasibility is the key differentiator to determine the most appropriate adaptation response.

Therefore, future urban development in the East Port Hedland area needs to include feasibility investigations that compare protection through raised land levels with accommodation, with an appropriate decision made at the time of development. All urban development must be undertaken in accordance with SPP 2.6, with finished floor levels above the required inundation event through engineering fill or accommodation (building design).

The CHRMAP (GHD 2019) identifies the following adaption options for the East Port Hedland area:

- Managed retreat through expansion of the foreshore reserve
- Interim protection through groynes with sand replenishment
- Interim protection through an intertidal rocky platform with sand replenishment.

Consistent with the CHRMAP (GHD 2019), the following steps will be implemented to develop the basis of design and confirm that the coastal protection structures (i.e. rock revetment) are the most suitable approach from a performance and financial viability perspective:

1. Undertake a gap assessment to identify datasets required to inform coastal processes assessment and concept option development
2. Undertake the required investigations to fill any gaps in the data
3. Develop a basis of design with available information
4. Develop several concept designs based on the preferred approach to be optimised to confirm the most suitable design
5. Obtain required environmental approvals for the preferred design.

To be compliant with SPP 2.6, the planned coastal protection works will need to demonstrate adequate funding for construction and maintenance in addition to the above design elements.

5.3 Marine fauna

Pretty Pool Beach is a known nesting beach for Flatback turtles. Flatback turtles are protected species under both the Western Australian *Biodiversity Conservation Act 2016* and the Commonwealth EPBC Act.

5.3.1 Flatback turtles in Port Hedland

Numerous flatback turtle studies have been undertaken in Port Hedland to support development projects including BHP Billiton's Outer Harbour Development (Pendoley Environmental (PENV) 2009, 2010, 2011a, 2011b), DevelopmentWA 's Pretty Pool Development (RPS 2009; 2010a, 2010b, 2012c, 2012d, 2013) and more recently Port Hedland Marina (PENV (2019); RPS (2020)). The findings of CHEA's Community Volunteer Turtle Monitoring Program monitoring program at Cemetery Beach and Pretty Pool have been documented by Conservation Volunteers Australia (2013) and Imbricata Environmental (2016).

5.3.1.1 Nesting adult flatback turtles

5.3.1.1.1 Regional significance

The nesting period for the flatback turtles occurs during the summer months, primarily between October and February (Pendoley et al 2014). Of the regionally important flatback turtle nesting areas identified by DEE (2017), Mundabullangana Station and Cemetery Beach are proximate to Port Hedland.

Mundabullangana Station is located approximately 60 km southwest of Port Hedland (DEE 2017). The primary nesting site is Cowrie Beach, a 3.3 km long, narrow, low energy beach bounded by a mangrove creek to the northeast and a rocky headland to the southwest (Pendoley et al 2014). Mundabullangana Station supports a substantial reproductive flatback turtle population with an estimated 1,861 female turtles nesting annually (Pendoley et al 2014).

Cemetery Beach is located approximately 1.5 km west from the Athol Street development. The population of nesting turtles appears to be relatively stable between 148 to 202 females/year (PENV 2019).

5.3.1.1.2 Local significance

Nesting sites within the Port Hedland townsite are Cemetery Beach and Pretty Pool Beach. Pretty Pool Beach is a north-east facing marine embayment, sheltered by Cooke Point, on the eastern side of Port Hedland. The flatback turtle nesting area is situated approximately 1.1 km south-east from the Athol Street development at the closest point. The population of female turtles nesting on Pretty Pool Beach ranges between 31 to 222 females/year (PENV 2019).

At both Cemetery and Pretty Pool beaches, the greatest abundance of nesting was recorded on the eastern side of the beaches where the dunes are higher and less exposed to onshore artificial light sources (Imbricata Environmental 2016).

Other nesting sites proximate to Port Hedland include Reefs Island, Downes Island, Paradise Beach, Spit Point and various unnamed beaches (PENV 2009). The relative abundance of turtle tracks attained from snap-shot aerial track count surveys during the peak nesting period in December 2009 indicate that these other nesting sites support low nesting densities with approximately 6.7 tracks/km recorded at Paradise Beach and 1.4 tracks/km recorded at Downes Island (PENV 2009).

A comparison of the population size of the Port Hedland nesting sites (i.e. Cemetery and Pretty Pool beaches) to Mundabullangana Station identifies that the Port Hedland nesting sites support significantly smaller numbers of nesting turtles (Table 6).

Table 6: Size of flatback turtle nesting sites proximate to Port Hedland

Nesting site	Estimated annual population size (females/year)
Mundabullangana Station	1,861
Cemetery Beach	148 to 202
Pretty Pool Beach	31 to 222

(Sources: Pendoley et al 2014, PENV 2019)

5.3.1.2 Hatchling flatback turtles

5.3.1.2.1 Reproductive output

The average hatch success recorded for Mundabullangana Station, Cemetery Beach and Pool Beach is presented in Table 7. The average hatch success recorded for Mundabullangana Station and Cemetery Beach are very low for flatback rookeries (Pendoley et al 2014). The average hatch success at Pretty Pool Beach is comparable to other flatback turtle rookeries in the Pilbara (e.g. Barrow Island hatch success is 83.4%). The low hatch success at Mundabullangana Station and Cemetery Beach is most likely due to the elevated natural sand temperature experienced during egg incubation compared to the more southerly populations within the Pilbara (PENV 2019). Alternatively, storm surges associated with high cyclonic activity in the region affecting the embryonic development may also be a factor (DEE 2017).

Table 7: Reproductive outputs of flatback turtle nesting sites proximate to Port Hedland

Nesting site	Average hatch success (%)
Mundabullangana Station	68.2
Cemetery Beach	57.3
Pretty Pool Beach	73.0

(Source: Pendoley et al 2014, Imbricata Environmental 2016)

5.3.1.2.2 Nest emergence

Hatchlings start emerging from the nests at Pretty Pool Beach in early December, with a peak in early January, and continue until mid-February (Imbricata Environmental 2016).

After emerging from nests hatchlings crawl directly towards the sea, a behaviour known as sea finding. The sea finding process is directed by several cues including light wavelength, light intensity and shape and form (Lohmann et al. 1997; Tuxbury and Salmon 2005). Beach slope and sound are considered secondary cues relative to vision and are overruled by light (Lohmann et al. 1997).

5.3.1.2.3 Nearshore disbursal

The disbursal of flatback hatchlings entering the water have been shown to be primarily influenced by ocean currents under natural conditions (Wilson et al 2018). Nearshore currents in the Port Hedland region are primarily driven by astronomical tides, which causes a periodic inflow (flood tide) and outflow (ebb tide) of oceanic water to/from the Northwest shelf region (Cardno 2011). On an incoming flood tide currents generally flow in a south-southeast easterly direction, whilst on an outgoing ebb tide currents generally flow in a north-northwest direction (Cardno 2011).

5.3.2 Artificial light impacts

Artificial lighting has the potential to reduce the reproductive success of marine turtles by deterring adult females from approaching nesting beaches or nesting; and disorienting and / or misorienting hatchlings on the beach and in the nearshore environments (DEE 2020).

RPS reviewed the impacts from artificial light at Pretty Pool and Cemetery beaches as part of Amendment No. 58. Pretty Pool Beach was used as a reference point to inform the review as it is the closest nesting beach for marine turtles to the site. Due to the greater separation distance and the higher elevation of the coastal dunes between Cemetery Beach and the site potential impacts to the marine turtles from artificial light sources directly visible to marine turtles at Pretty Pool Beach was considered to be the limiting factor to the heights of built infrastructure within the TPS amendment boundary. The proposed structure plan development footprint is smaller in spatial extent when compared to the TPS amendment area to account for the revised coastal hazard risk profile.

5.3.2.1.1 Line of sight analysis – Pretty Pool Beach

To investigate the maximum heights at which direct light from built infrastructure within the TPS amendment boundary is visible from Pretty Pool Beach, RPS undertook a study using a specifically developed Line of Sight model (Appendix H).

To inform the Line of Sight model house pads were inserted within TPS amendment boundary at medium density locations and views were exported from a turtle “eye level” (0 m AHD) at 3 m increments. The results of the Line of Sight model show:

- Site 01 – buildings are not visible at +18 m AHD (four storeys) however become visible at +21m AHD (five storeys)
- Site 02 – buildings are not visible at +33m AHD (nine storeys) however become visible at +36m AHD (ten storeys).

The line of sight analysis shows that the Athol Street development can be designed so that no artificial light sources from the development (i.e. streetlights and residential dwellings) will be directly visible to either adult females nesting or departing hatching turtles at Pretty Pool Beach, which significantly reduces the pathway for potential impacts to marine turtles.

5.3.2.1.2 Line of sight analysis - Cemetery Beach

There is a significant coastal dune and existing built form that separates Cemetery Beach from the site. An analysis of the topography shows the coastal dune, and therefore existing houses, are higher in elevation than the topography which separates Pretty Pool Beach from site.

Figure G clearly illustrates built form scenario at +36m AHD (10 storeys) that no direct light is visible at turtle “eye level” on Cemetery Beach from the site.

The line of sight analysis shows that the Athol Street development can be designed so that no artificial light sources from the development (i.e. streetlights and residential dwellings) will be directly visible to either adult females nesting or departing hatching turtles at Cemetery Beach, which significantly reduces the pathway for potential impacts to marine turtles.

5.3.2.1.3 Lighting design

Skyglow will be generated from the Athol Street development which has the potential to contribute additional light to the Port Hedland night light environment, which is already significantly impacted by the port operations. To minimise the potential for the Athol Street development to cumulatively add to the existing skyglow levels the development’s lighting will be designed to accord with the National Light Pollution Guidelines (DEE 2020), and the EPA’s Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (EPA 2010), while meeting legislative and regulatory requirements for human safety.

This will be achieved through the preparation of an Artificial Light Management Plan, inclusive of biological and artificial light monitoring and auditing requirements, prepared to the satisfaction of the DBCA which addresses the best practice lighting design principles identified in the National Light Pollution Guidelines (DEE 2020):

1. Start with natural darkness and only add light for specific purposes
2. Use adaptive light controls to manage light timing, intensity and colour
3. Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill
4. Use the lowest intensity lighting appropriate for the task
5. Use non-reflective, dark-coloured surfaces
6. Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.

The Artificial Light Management Plan will provide the technical rationale to underpin the heights of streetlights and residential dwellings within the future Athol Street development.

6 LAND FACTORS

6.1 Flora and vegetation

6.1.1 Interim Biogeographical Regionalisation of Australia

Port Hedland lies within the Interim Biogeographical Regionalisation of Australia region of Pilbara 4 and within the costal subregion of Roebourne (Kendrick and Stanley 2001).

The Roebourne subregion is described as:

Quaternary alluvial plains with a grass savannah of mixed bunch and hummock grasses, and dwarf Shrub Steppe of *Acacia translucens* or *A. pyrifolia* and *A. inaequilatera*. Resistant linear ranges of basalts occur across the coastal plains. These uplands are dominated by Triodia hummock grasslands. Ephemeral drainage lines support Eucalyptus woodlands. Samphire, Sporobolus grasslands and mangal occur on the marine alluvial flats and river deltas (Kendrick and Stanley 2001).

6.1.2 Pilbara vegetation mapping

Beard (1975) mapped the vegetation of the Pilbara region at a scale of 1:1,000,000. Beard Vegetation Associations 117 – Hummock grasslands, grass steppe, soft spinifex and 127 – Bare areas; mud flats occur over the extent of the site.

Shepard et al. (2002) updated the Beard (1975) vegetation boundaries to account for clearing in the intensive land use zone and divided some larger vegetation units into smaller units. Shepard et al. (2002) identifies that 99.9% of the pre-European extent of these vegetation type remains. Kendrick and Stanley (2001) identifies that both Beard Vegetation Associations are of low priority for reservation.

6.1.3 Desktop assessment

A desktop assessment was undertaken to determine the floristic values of the site using the following databases and reference materials reports:

1. DBCAs NatureMap database search for species which are declared as “Rare or likely to become extinct”, “Birds protected under international agreement” and “Other specially protected fauna” identified as occurring within a 5 km radius of the site on 05 June 2020 (Appendix G)
1. An EPBC Act Protected Matters Report was generated using a radial buffer of 5 km from the site on 05 June 2020. Species of conservation significance that may potentially utilise the landholdings are identified by the EPBC Act Protected Matters Report (Appendix G)
2. Port Hedland Regional Flora and Vegetation Assessment (ENV 2011a), synthesised 31 technical flora and vegetation surveys / reports undertaken in Port Hedland and its surrounding hinterlands to inform its findings, was reviewed.

6.1.3.1 Conservation significant flora

There are no known occurrences of Threatened flora species recorded in or immediately surrounding Port Hedland (ENV 2011a). This finding is supported by searches of Department of Biodiversity Conservation and Attractions (DBCA) NatureMap database and the EPBC Act Protected Matters Tool.

The NatureMap database results identify two priority species within the search area:

- *Gomphrena pusilla* (Priority 2)
- *Gymnanthera cunninghamii* (Priority 3).

ENV (2011a) identifies that 1,030 *G. pusilla* (P2) individuals have been recorded around Port Hedland at three locations with all the recordings occurring on low sandy rises that occur in conjunction with mangroves along the coastline. Given that 1,030 *G. pusilla* (P2) individuals have been recorded around Port Hedland, it is considered likely *G. pusilla* (P2) is well represented in the locality. There are no known records of *G. pusilla* (P2) within the site.

G. cunninghamii (P3) is known from 12 locations around Port Hedland, with a total of seven individuals being recorded by ENV (2011a) at these locations on low sandy rises near the coast and on creek banks in the north-west of the ENV's Port Hedland study area. There are no known records of *G. cunninghamii* (P3) within the site.

6.1.3.2 Conservation significant vegetation

The EPBC Act Protected Matters Report identified that there were no known occurrences of Threatened Ecological Communities (TECs) protected under the EPBC Act identified within the site or within a surrounding five-kilometre radius buffer.

Further, Kendrick and Stanley (2001) identifies that there are no TECs in the Pilbara 4 Bioregion.

6.1.3.3 Landscape-vegetation types

The site is underlain by primary and secondary coastal dune associations which are known to consist of the following landscape-vegetation types:

- Secondary dune comprising low shrub of *Acacia stellaticeps* over hummock grassland of *Triodia epactia*) with open herbland of *Euphorbia tannensis*
- Bare tidal salt flats comprised mixed dwarf shrubland of *Tecticornia halocnemoides, Hemichro adiandra, Frankenia pauciflora,* with patches of grassland of *Sporobolus virginicus* (Figure F).

6.2 Landforms

6.2.1 Topography

Figure H shows that the general topography of the site slopes from higher points of elevation along Athol Street (approximately 6 to 7 m AHD on average) southwards to Pretty Pool Creek. A small dune in the north-west of the site is the point of highest elevation at approximately 16.5 m AHD.

6.2.2 Geology and soils

A Geotechnical Reconnaissance was undertaken for the East Port Hedland area by GHD in September 2011 (GHD 2011). GHD (2011) identifies that the natural geology of the Pretty Pool Creek area can be broadly described as consisting of:

- Sand, pale grown to orange, fine to medium grained, trace silt and clay
- Silty clay/clay silt, brown to orange, medium to high plasticity, with some fine to medium-grained sand, with some silt.

6.3 Terrestrial environmental quality

6.3.1 Acid sulfate soils

The Department of Water and Environmental Regulation (DWER) Acid Sulfate Soils (ASS) risk mapping indicates the site contains small areas of "High to Moderate" risk of ASS occurring within 3 m of natural soil surface with the remainder of project area being "Moderate to Low" risk of ASS occurring within 3 m of natural soil surface (Figure I).

To construct future subdivisions fill will be required to achieve the finished floor level for development of 6.7 m AHD to mitigate storm surge inundation and future sea level rise. In providing advice regarding the environmental issues of the site, the EPA recommended that a Detailed Site Investigation and Management Plan should be prepared in accordance with DWER's Acid Sulfate Soils Guideline Series to the satisfaction of the DWER (Appendix D).

The final fill levels, and subsequent engineering service excavation and dewatering requirements, will dictate whether a site investigation and ASS and Dewatering Management Plan is required to be prepared.

6.3.2 Potential contamination

A search of the DWER's Contaminated Sites database was undertaken on 22 June 2020 and no matches were recorded for the site. Given that the site is vacant land comprised predominantly of native vegetation significant contamination is unlikely to be present.

6.4 Terrestrial fauna

6.4.1 Fauna habitat

The key fauna habitats within the site are the tidal flats between the Pretty Pool Creek mangrove community and coastal vegetation on the secondary dune (Figure F).

6.4.2 Desktop assessment

A desktop search was undertaken using the following databases:

1. DBCAs NatureMap database search for species which are declared as "Rare or likely to become extinct", "Birds protected under international agreement" and "Other specially protected fauna" identified as occurring within a 5 km radius of the site on 05 June 2020 (Appendix G)
2. An EPBC Act Protected Matters Report was generated using a radial buffer of 5 km from the site on 05 June 2020. Species of conservation significance that may potentially utilise the landholdings are identified by the EPBC Act Protected Matters Report (Appendix G).

Species that potentially occur within the site and that are identified as protected under the BC Act and / or under the EPBC Act are listed in Table 8.

The analysis of the likely fauna to occur within the site is considered limited due to the sparse nature of vegetation extents. The Pretty Pool Creek environments immediately adjacent to the site provide a diverse range of fauna habitats that support conservation significant species, for example migratory birds.

Table 8: Conservation significant fauna species potentially occurring within the site

Species	Conservation status (state)	Conservation status (EPBC)	Occurrence within the proposed structure plan
Reptiles			
Ctenotus angusticeps (Airlie Island skink)	Priority 3	N/A	The Airlie Island skink is known from approximately 12 locations in north-west WA: Airlie Island (offshore from Onslow), Thangoo Station (Roebuck Bay), Pretty Pool and Wedgefield (Port Hedland), Redbank (Port Hedland), Finucane Island (Port Hedland), Beebingarra Creek, Roebuck (Crab Creek), Cape Keraudren (Pardoo), Port Smith (Lagrange), Willie Creek (Broome), Boodarie Station and Karratha. On the mainland, the Airlie Island skink is known to inhabit the landward fringe of salt marsh communities in samphire shrubland or marine couch grassland in the intertidal zone along mangrove margins. This species is strongly associated with samphire species, *Tectornia halocnemoides* subsp. *tenuis* and *Suaeda arbusculoides*, which occur on clayey soils, and mixed herb and grass cover of *Muellerolimon salicorniaceum* and *Sporobolus virginicus*, which occur on sandy soils (DAWE 2020a). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the Airlie Island skink is dependent upon for species survival.
Liasis olivaceus barroni (Pilbara olive python)	Schedule 3	Vulnerable	The Pilbara olive python is common and widespread in the Pilbara and has been identified as a species that should not be listed as threatened or declining (Kendrick and Stanley 2001). Pilbara olive pythons are most often seen at night and are generally found around rocky areas, rocky outcrops and cliffs, particularly in the vicinity of watercourses and water holes, but are also known to shelter in logs, flood debris, caves, tree hollows and thick vegetation (Burbidge 2004). Given that the site lacks rocky habitats preferred by the Pilbara olive python it is not considered likely that this species would occur within the development footprint.
Birds			
Anous stolidus (common noddy)	Schedule 5	Migratory	In Australia, the common noddy occurs mainly in ocean off the Queensland coast, but the species also occurs off the north-west and central Western Australia coast. During the breeding season, the common noddy usually occurs on or near islands, on rocky islets and stacks with precipitous cliffs, or on shoals or cays of coral or sand. When not at the nest, individuals will remain close to the nest, foraging in the surrounding waters. During the non-breeding period, the species occurs in groups throughout the pelagic zone (open ocean) (DAWE 2020b). Given that the preferred breeding habitat of the common noddy does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed development.
Actitis hypoleucos (common sandpiper)	Schedule 5	Migratory	Common sandpipers mainly breed in parts of Europe and Asia, and occasionally Africa. The population that migrates to Australia breeds in the Russian far east. European breeding birds rarely remain in Europe during the non-breeding period, with individuals moving to Africa and Asia. In Australia, it is found along all coastlines and in many areas inland, the common sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia with areas of national importance in Western Australia including Nutysland Nature Reserve and Roebuck Bay. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. The common sandpiper has been recorded in estuaries and deltas of streams, as well as on banks farther upstream, around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties (DAWE 2020c). There is potential habitat within the site for the common sandpiper, however given the substantial extent of potential habitat available for this species in Port Hedland, and the broader Pilbara region, the risk of significant impact occurring to this species as a result of developing the landholdings for residential purposes is considered to be low. The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the common sandpiper is dependent upon for species survival.
Apus pacificus (fork-tailed swift)	Schedule 5	Migratory	The fork-tailed swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. In Australia, they mostly occur over inland plains but sometimes are found above foothills or in coastal areas. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh (DAWE 2020d). Given that the aerial nature of this species it is unlikely to be significantly impacted by the proposed development.
Ardea ibis (cattle egret)	N/A	Migratory	The cattle egret is widespread in southern and eastern Asia and Australasia and is highly mobile, rendering them less susceptible to population fragmentation. In Western Australia breeding colonies nest predominantly in Melaleuca swamps in November and December although breeding is dependent to some extent on rainfall (DAWE 2020e). Given that the preferred wetland habitat of the cattle egret does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed development.
Ardea modesta (eastern great egret)	N/A	Migratory	The Eastern great egret is widespread in southern and eastern Asia and Australasia and is highly mobile, rendering them less susceptible to population fragmentation. In Western Australia breeding colonies nest predominantly in Melaleuca swamps in November and December although breeding is dependent to some extent on rainfall (DAWE 2020f). Given that the preferred wetland habitat of the Eastern great egret does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed development.
Arenaria interpres / Arenaria interpres subsp. Interpres (ruddy turnstone)	Schedule 5	Migratory	Ruddy turnstones are widespread within Australia during its non-breeding period of the year, including from Tasmania in the south to Darwin in the north and many coastal areas in between. It is found in most coastal regions, with occasional records of inland populations. It strongly prefers rocky shores or beaches where there are large deposits of rotting seaweed (DAWE 2020g). Given that the preferred coastal habitat of ruddy turnstones does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed development.
Calidris acuminate (Sharp-tailed sandpiper)	Schedule 5	Migratory	Sharp-tailed sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. In Western Australia (WA), scattered records occur along the Nullarbor Plain and the southern areas of the Great Victoria Desert. They are widespread from Cape Arid to Carnarvon, around coastal and sub-coastal plains of Pilbara Region to south-west and east Kimberley Division. Inland records indicate the species is widespread and scattered from Newman, east to Lake Cohen, south to Boulder and west to Meekatharra. In Australasia, the Sharp-tailed sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, salt marsh or other low vegetation (DAWE 2020h). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the Sharp-tailed sandpiper is dependent upon for species survival.
Calidris alba. (sanderling)	Schedule 5	Migratory	In Australia, the species is almost always found on the coast, mostly on open sandy beaches exposed to open sea swell, and also on exposed sandbars and spits, and shingle banks, where they forage in the wave-wash zone and amongst rotting seaweed. Sanderlings also occur on beaches that may contain wave-washed rocky outcrops Rarely, they are recorded in near-coastal wetlands, such as lagoons, hypersaline lakes, salt ponds and samphire flats (DAWE 2020i). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the sanderling is dependent upon for species survival.

Species	Conservation status (state)	Conservation status (EPBC)	Occurrence within the proposed structure plan
Calidris canutus (red knot)	Schedule 2	Endangered	The Red knot is common in all the main suitable habitats around the coast of Australia with very large numbers being regularly recorded in north-west Australia. In Australasia the red knot mainly inhabit intertidal mudflats, sand flats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs (DAWE 2020j). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the red knot is dependent upon for species survival.
Calidris ferruginea (curlew sandpiper)	Schedule 1	Critically Endangered	In Australia, curlew sandpipers occur around the coasts and are also quite widespread inland, though in smaller numbers. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding one-year old birds remain in Australia rather than migrating north. Curlew sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in salt works and sewage farms (DAWE 2020k). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the curlew sandpiper is dependent upon for species survival.
Calidris tenuirostris (great knot)	Schedule 1	Migratory	The great knot breeds in north-east Siberia and winters along coastal areas. It feeds on bivalves, gastropods, crustaceans and other invertebrates it finds in shallow coastal waters (DAWE 2020l). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the great knot is dependent upon for species survival.
Calidris melanotos (pectoral sandpiper)	Schedule 5	Migratory	In Australasia, the pectoral sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (DAWE 2020m). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the pectoral sandpiper is dependent upon for species survival.
Calidris ruficollis (red-necked stint)	Schedule 5	Migratory	In Australasia, the red-necked stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. They also occur in salt works and sewage farms; salt marsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in salt flats (DAWE 2020n). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the red-necked stint is dependent upon for species survival.
Calidris subminuta (long-toed stint)	Schedule 5	Migratory	In Western Australia, the species is found mainly along the coast, with a few scattered inland records. It is widespread around the Pilbara region and the Kimberley Division between Karratha and Wyndham-Kununurra. The long-toed stint occurs in a variety of terrestrial wetlands. They prefer shallow freshwater or brackish wetlands including lakes, swamps, river floodplains, streams, lagoons and sewage ponds (DAWE 2020o). Given that the preferred wetland habitat of the long-toed stint does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed development.
Calonectris leucomelas (streaked shearwater)	Schedule 5	Migratory	The streaked shearwater can be found over both pelagic and inshore waters. It feeds mainly on fish and squid which it catches by surface-seizing and shallow plunges. It often associates with other seabirds and will follow fishing boats. Breeding begins in March in colonies on offshore islands, occupying burrows on forested hills. It undergoes trans-equatorial migration (Birdlife International 2020a) Given that the preferred breeding habitat of the streaked shearwater does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed development.
Charadrius leschenaultii (greater sand plover)	Schedule 3	Vulnerable	In Australia, the greater sand plover occurs in coastal areas in all states, though the greatest numbers occur in northern Australia, especially the north-west with the species being especially widespread between North West Cape and Roebuck Bay in Western Australia. In the non-breeding grounds in Australasia, the species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons (DAWE 2020p). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the greater sand plover is dependent upon for species survival.
Charadrius mongolus (lesser sand plover)	Schedule 1	Endangered	Internationally important sites in Western Australia and counts include Eighty Mile Beach,1575; Roebuck Bay, 1057; Broome, 745; Port Hedland Saltworks, 668. This species usually occurs in coastal littoral and estuarine environments. It inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. It also sometime occurs in short saltmarsh or among mangroves. The species also inhabits saltworks and near-coastal saltpans, brackish swamps and sandy or silt islands in riverbeds (DAWEq). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the lesser sand plover is dependent upon for species survival.
Charadrius veredus (oriental plover)	Schedule 5	Migratory	The oriental plover is a non-breeding visitor to Australia where it occurs in both coastal and inland areas. In coastal habitats this species is found on estuarine mudflats and sandbanks, sandy or rocky ocean beaches or nearby reefs, or in near-coastal grasslands. In inland regions the oriental plover inhabit flat, open, semi-arid or arid grasslands, where the grass is short and sparse, and interspersed with hard, bare ground, such as claypans, dry paddocks, playing fields, lawns and cattle camps (DAWE 2020r). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the oriental plover is dependent upon for species survival.
Chlidonias leucopterus (white-winged tern)	Schedule 5	Migratory	In Western Australia, the species is widespread on the southern west coast, mainly from Ballingup and the estuary of Vasse River north to Mongers Lake, and also on coasts of the Pilbara region and Kimberley Division, with occasional records farther inland, mainly along major river systems, such as the Ord. The species only rarely occurs in the Gascoyne Region of the central-western coast and is occasionally recorded along the southern coast. The species mostly inhabits fresh, brackish or saline, and coastal or subcoastal wetlands. White-winged black terns frequent tidal wetlands, such as harbours, bays, estuaries and lagoons, and their associated tidal sandflats and mudflats (DAWE 2020s). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the white-winged tern is dependent upon for species survival.
Fregata ariel (lesser frigatebird)	Schedule 5	Migratory	The lesser frigatebird is almost exclusively aerial and the most common and widespread frigatebird in Australia. It is common in tropical seas breeding on remote islands, in mangroves or bushes / scrub (Birdlife International 2020b). Given that the aerial nature of this species it is unlikely to be significantly impacted by the proposed development.

Species	Conservation status (state)	Conservation status (EPBC)	Occurrence within the proposed structure plan
Gelochelidon nilotica (gull-billed tern)	Schedule 5	Migratory	Gull-billed terns are found in freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands. They are only rarely found over the ocean (Birdlife Australia 2020a). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the gull-billed tern is dependent upon for species survival.
Glareola maldivarum (oriental pratincole)	Schedule 5	Migratory	The oriental pratincole is a medium-sized shorebird that occurs in small to very large flocks of thousands to millions of individuals. It is widespread in the northern extent of Australia, particularly along the coastlines of Western Australia's Pilbara and Kimberley regions. The breeding season is spent in southern, south-eastern and eastern Asia, with the non-breeding season spent largely in Australia. During this time, the oriental pratincole preferably inhabits beaches, mudflats, islands, open plains, flood plains or short grassland, often with extensive areas of bare ground (DAWE 2020t). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the oriental pratincole is dependent upon for species survival.
Haliaeetus leucogaster (white-bellied sea eagle)	N/A	Migratory	The white-bellied sea eagle is not globally threatened but has been subject to population decline within Australia and South East Asia. In Australia, it is distributed along the coastline, and is restricted to a narrow band of coastline in south-western Australia. The population residing within Australia is estimated at 500 mating pairs. The white-bellied sea eagle is found in coastal habitats and tends to occupy dunes, tidal flats, woodlands, forests and grasslands (generally in areas associated with large bodies of water). When not migrating, the home range of the White-bellied sea eagle can be up to 100 square km, although breeding adult birds are generally sedentary (breeding season runs from June to January). The nests of these birds are large and conspicuous, generally constructed in large trees, cliffs, rocky outcrops, mangroves, caves or on artificial structures (DAWE 2020u). It is considered likely that the White-bellied sea eagle may be observed overflying the development footprint infrequently, however given the substantial extent of potential habitat available for this species in Port Hedland, and the broader Pilbara region, the risk of significant impact occurring to this species as a result of the proposed structure plan is considered to be low.
Hirundo rustica (barn swallow)	Schedule 5	Migratory	The barn swallow occurs in open land, such as agricultural pasture and plains, roosting or nesting in dead trees, banks, cliff cavities and rock shelves. It is a regular non-breeding summer migrant to northern Australia, where its range extends from the Kimberley region to north-eastern and south-eastern Queensland (DAWE 2020v). Given that the preferred plain habitat of the barn swallow does not occur within the development footprint is considered unlikely that this species will be significantly impacted by proposed development.
Limicola falcinellus (broad-billed sandpiper)	Schedule 5	Migratory	In Western Australia, few records occur in the south-west, but the broad-billed sandpiper may be regular in small numbers at scattered locations, from Warden Lake Nature Reserve and Coramup Creek to Guraga Lake Nature Reserve and Hurstview Lake. They mostly occur on the coasts of the Pilbara and Kimberley between Onslow and Broome but are also recorded north to the mouth of Lawley River, and inland at Lake Daley. The broad-billed sandpiper occurs in sheltered parts of the coast, favouring estuarine mudflats but also occasionally occur on saltmarshes, shallow freshwater lagoons, saltworks and sewage farms, and in areas with large soft intertidal mudflats, which may have shell or sandbanks nearby (DAWE 2020w). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the broad-billed sandpiper is dependent upon for species survival.
Limnodromus semipalmatus (Asian dowitcher)	Schedule 5	Migratory	The Asian dowitcher was first recorded in Australia in 1972 and is a regular visitor to the north-west between Port Hedland and Broome. The Asian Dowitcher occurs in sheltered coastal Environments, such as embayments, coastal lagoons, estuaries and tidal creeks. They are known to frequent shallow water and exposed mudflats or sandflats (DAWE 2020x). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the Asian dowitcher is dependent upon for species survival.
Limosa lapponica (*bar-tailed godwit)/ Limosa lapponica* subsp. *Baueri (*bar-tailed godwit [western Alaskan])/ *Limosa lapponica* subsp. *Menzbieri* (bar-tailed godwit [northern Siberian]).	Schedule 5 / Schedule 3 / Schedule 1	Migratory / Vulnerable / Critically Endangered	Bar-tailed godwits have been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. Bar-tailed godwits are found mainly in coastal habitats such as large intertidal sand flats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. (DAWE 2020y). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which bar-tailed godwits are dependent upon for species survival.
Limosa limosa (black-tailed godwit)	Schedule 5	Migratory	The black-tailed godwit breeds in eastern Siberia and moves to south-eastern Asia and Australia during the non-breeding season This is one of the most abundant migratory shorebirds visiting Australia each year. The black-tailed godwit has a primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets (DAWE 2020z). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the black-tailed godwit is dependent upon for species survival.
Macronectes giganteus (southern giant petrel)	Schedule 5	Endangered	In Australia, the southern giant petrel breeds on six subantarctic and Antarctic islands in Australian territory; Macquarie Island, Heard Island and McDonald Island in the Southern Ocean, and Giganteus Island, Hawker Island, and Frazier Island in the Australian Antarctic Territories. The southern giant petrel is marine bird that occurs in Antarctic to subtropical waters. In summer, it mainly occurs over Antarctic waters, and it is widespread south as far as the pack ice and onto the Antarctic continent (DAWE 2020aa). Given the southern giant petrel's preference for subantarctic and Antarctic habitats it is not considered likely that this species would occur within the development footprint.
Motacilla flava (yellow wagtail)	Schedule 5	Migratory	The yellow wagtail has an extremely large range, extending from Europe, east through Siberia to west Asia and north-western China; and south through the Arabian peninsula to Egypt. This species occupies a range of damp or wet habitats with low vegetation, from damp meadows, marshes, waterside pastures, sewage farms and bogs to damp steppe and grassy tundra. In the north of its range it is also found in large forest clearings (Birdlife International 2020c). Given that the preferred freshwater habitats of the Yellow wagtail do not occur within the development footprint is considered unlikely that this species will be significantly impacted by proposed structure plan.
Numenius madagascariensis (eastern curlew)	Schedule 1	Critically Endangered	Within Australia, the eastern curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. Eastern curlews are rarely recorded inland. They have a continuous distribution from Barrow Island and Dampier Archipelago, Western Australia, through the Kimberley Division and along Northern Territory, Queensland, and NSW coasts and the islands of Torres Strait. They are patchily distributed elsewhere. The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbors, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass. Occasionally, the species occurs on ocean beaches (often near estuaries), and coral reefs, rock platforms, or rocky islets. The birds are often recorded among salt marsh and on mudflats fringed by mangroves, and sometimes use the mangroves. The birds are also found in salt works and sewage farms (DAWE 2020ab). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the eastern curlew is dependent upon for species survival.

Species	Conservation status (state)	Conservation status (EPBC)	Occurrence within the proposed structure plan
Numenius minutus (little curlew)	Schedule 3	Migratory	Little curlews generally spend the non-breeding season in northern Australia from Port Hedland in Western Australia to the Queensland coast. The little curlew is most often found feeding in short, dry grassland and sedgeland, including dry flood plains and black soil plains, which have scattered, shallow freshwater pools or areas seasonally inundated (DAWE 2020ac). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the little curlew is dependent upon for species survival.
Numenius phaeopus (whimbrel)/ *Numenius phaeopus* subsp. *Variegatus* (whimbrel)	Schedule 5	Migratory	The whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, un-vegetated mudflats (DAWE 2020ad). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which whimbrels are dependent upon for species survival.
Pezoporus occidentalis (night parrot)	Schedule 1	Endangered	The night parrot is a highly elusive nocturnal ground dwelling parrot found in the arid and semi-arid zones of Australia. The night parrot was thought to be extinct but in 2013 it was rediscovered in Queensland (Pullen Pullen Reserve). Subsequently, the Night Parrot Recovery Team confirms that there is one population recently recorded in the Diamantina National Park/Pullen Pullen Reserve area in western Queensland, and other recent records in the Wiluna district of central WA, and the Lake Gregory area of northern WA (DAWE 2020ae) It is likely that the night parrot is locally absent from the Port Hedland townsite.
Pandion haliaetus (osprey)	Schedule 5	Migratory	The breeding range of the osprey extends around the northern coast of Australia (including many offshore islands) from Albany in Western Australia to Lake Macquarie in NSW; with a second isolated breeding population on the coast of South Australia. Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging. They frequent a variety of wetland habitats including inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes and waterhole (DAWE 2020af) It is considered likely that the osprey may be observed overflying the development footprint infrequently, however given the substantial extent of potential habitat available for this species in Port Hedland, and the broader Pilbara region, the risk of significant impact occurring to this species as a result of the proposed structure plan is considered to be low.
Plegadis falcinellus (glossy ibis)	Schedule 5	Migratory	Within Australia, the largest contiguous areas of prime habitat is inland and northern flood plains. The glossy ibis is commonly in largest numbers in drying Top End grass/sedge swamps and Channel Country grass/forb meadows. The species is sometimes recorded in wooded swamps, artificial wetlands (such as irrigated fields), and in mangroves for breeding (DAWE 2020ag). Given that the preferred habitat of the glossy ibis does not occur within the development envelope it is considered unlikely that this species will be significantly impacted by proposed structure plan.
Pluvialis fulva (Pacific golden plover)	Schedule 5	Migratory	Within Australia, the Pacific golden plover is widespread in coastal regions, though there are also a number of inland records (in all states), sometimes far inland and usually along major river systems, especially the Murray and Darling rivers and their tributaries In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific golden plovers usually occur on beaches, mudflats and sand flats (sometimes in vegetation such as mangroves, low salt marsh such as Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks (DAWE 2020ah). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the Pacific golden plover is dependent upon for species survival.
Pluvialis squatarola (grey plover)	Schedule 5	Migratory	The grey plover breeds around the Arctic, and winters along tropical and temperate coasts worldwide. Non-breeding birds occur around coastal Australia, with approximately 12,000 annually migrating to Australia. They inhabit intertidal mud flats, salt marshes, sand flats and beaches and feed on polyochaete worms, molluscs and crustaceans (DAWE 2020ai). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the grey plover is dependent upon for species survival.
Rostratula australis (Australian painted snipe)	Schedule 2	Endangered	Painted snipes generally inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and claypans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum Muehlenbeckia or canegrass or sometimes tea-tree (Melaleuca) (DAWE 2020aj). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the Australian painted snipe is dependent upon for species survival.
Sterna hirundo (common tern)	Schedule 3	Migratory	The species is a non-breeding migrant to Australia, where it is widespread and common on the eastern coast south to eastern Victoria, and common on parts of the northern coast, mainly east of Darwin. Common terns are marine, pelagic and coastal. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores (DAWE 2020ak). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the common tern is dependent upon for species survival.
Sternula albifrons (little tern)	Schedule 5	Migratory	Little terns inhabit sheltered coastal environments, including lagoons, estuaries, river mouths and deltas, lakes, bays, harbours and inlets, especially those with exposed sandbanks or sand-spits, and also on exposed ocean beaches (DAWE 2020al). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the little tern is dependent upon for species survival.
Thalasseus bergii (crested tern)	Schedule 5	Migratory	The crested tern is widely distributed throughout most of the Australian coastline. They breed in colonies on small offshore islands where their nests are so densely packed together that adjacent owners can touch each other's bills. Though the crested tern is usually a strictly coastal species, there are occasional records in the arid interior of Australia, where birds were possibly blown by passing tropical cyclones (Birdlife Australia 2020b). Given that the preferred coastal habitat of the crested tern does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed structure plan.
Tringa brevipes (grey-tailed tattler)	Priority 4, Schedule 5	Migratory	Within Australia, the grey-tailed tattler has a primarily northern coastal distribution and is found in most coastal regions. The grey-tailed tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide (DAWE 2020m). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the grey-tailed tattler is dependent upon for species survival.
Tringa glareola (wood sandpiper)	Schedule 5	Migratory	The wood sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and river red gums *Eucalyptus camaldulensis* and often with fallen timber (DAWE 2020an). Given that the preferred habitat of the wood sandpiper does not occur within the development footprint it is considered unlikely that this species will be significantly impacted by proposed structure plan.

Species	Conservation status (state)	Conservation status (EPBC)	Occurrence within the proposed structure plan
Tringa nebularia (common greenshank)	Schedule 5	Migratory	The common greenshank does not breed in Australia, however, the species occurs in all types of wetlands and has the widest distribution of any shorebird in Australia. The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and salt flats (DAWE 2020ao). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the common greenshank is dependent upon for species survival.
Tringa stagnatilis (marsh sandpiper)	Schedule 5	Migratory	The marsh sandpiper is found on coastal and inland wetlands throughout Australia. The marsh sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, salt marshes, estuaries, pools on inundated flood plains, and intertidal mudflats and also regularly at sewage farms and salt works (DAWE 2020ap). The proposed structure plan development footprint correlates with the secondary dune vegetation type and primarily avoids lower lying portions of the TPS amendment area mapped as intertidal mudflats. It is considered unlikely that the development footprint would contain habitat on which the marsh sandpiper is dependent upon for species survival.
Mammals			
Dasyurus hallucatus (northern quoll)	Schedule 1	Endangered	In the Pilbara, the Great Sandy Desert, Gibson Desert and Little Sandy Deserts define the distributional boundaries of northern quoll in the north, east and south. Records from the Pilbara bioregion are scattered across the four subregions; namely the Hamersley, Fortescue Plains, Chichester and Roebourne Plains subregions with records extending as far west as the Little Sandy Desert and as far south as Karinjini National Park (DAWE 2020aq). Habitat critical to the survival of the species includes rocky habitats, such as ranges, escarpments, mesas, ranges, gorges, breakaways, boulder fields, major drainage lines or treed creeklines; structurally diverse woodland or forest areas containing large diameter trees, termite mounds or hollow logs; and offshore islands where the northern quoll is known to exist (Commonwealth of Australia 2011). As part of the Regional Fauna Assessment of the Port Hedland area, completed by ENV for BHP Billiton, targeted searches were undertaken in all rocky habitats within the Port Hedland area for northern quoll focusing on locations where the species had been previously recorded (ENV 2011b). No northern quolls were recorded in the locality of Pretty Pool by ENV (2011b) with all the searches and recent recordings of this species being in Pippingarra, approximately 20 km south of Pretty Pool (ENV 2011b). Given the lack of detection of this species by ENV (2011b), it is not considered likely that the northern quoll would occur within the development footprint or adjacent areas in Pretty Pool.
Macrotis lagotis (greater bilby)	Schedule 2	Vulnerable	The greater bilby is restricted to drier desert areas in the Northern Territory, Western Australia and a small portion of south-western Queensland. Greater bilbys live in sandy desert areas in spinifex grasslands. They dig large burrows up to 2 metres deep in sandplain country. They also seem to prefer freshly burnt country where there are more plentiful supplies of preferred foods. The greater bilby has not been recorded within the general area of East Port Hedland (DAWE 2020ar). Given the greater bilby's preference for sandplain habitats it is not considered likely that this species would occur within the development footprint.
Macroderma gigas (ghost bat)	Schedule 3	Vulnerable	Ghost bats currently occupy habitats ranging from the arid Pilbara to tropical savanna woodlands and rainforests. During the daytime they roost in caves, rock crevices and old mines (Commonwealth of Australia 2016). Given the lack of suitable roosting habitat in the development footprint, it is considered unlikely that the proposed structure plan would significantly impact the ghost bat.

6.4.2.1 Preliminary waterbird assessment report

Bamford Consulting Ecologists prepared a Preliminary Waterbird Assessment Report detailing the significance of Pretty Pool Creek as a waterbird habitat. Bamford's report was based upon existing waterbird survey data for Pretty Pool Creek (Appendix E).

Bamford Consulting Ecologists (2012) identifies that low numbers of five conservation significant waterbird species have been recorded in the Pretty Pool Creek area. Specifically, the Athol Street site recorded lower numbers of conservation significant bird species and has a lower species diversity when compared to key sites around Port Hedland (e.g. Pretty Pool Bay, Cemetery Beach). This comparison indicates that Pretty Pool Creek is of lower significance as habitat for conservation significant waterbird species than the other identified areas the around Port Hedland area.

Bamford Consulting Ecologists notes the Pretty Pool Creek mangroves community supports a range of terrestrial bird species, some of which are mangrove dependent. The mangroves will not be significantly impacted by the proposed development and therefore the ecosystem service of habitat provision for the terrestrial bird species will not be diminished.

7 WATER FACTOR

7.1 Inland waters

7.1.1 Surface drainage

Pretty Pool Creek, directly to the south of site, is predominantly marine based tidal system with occasional freshwater inflows from the surrounding catchments. The surface drainage within Pretty Pool Creek generally runs towards the mangroves and south-west towards the southern intertidal flats.

Although average rainfall is low, the Port Hedland region is characterised by periodic cyclonic events yielding high volume storm flows. During extreme cyclonic events, stormwater from the west flows towards Pretty Pool Creek and contributes to flooding in low-lying areas.

Stormwater from the surrounding residential developments of Cooke Point, in the north, and Pretty Pool, in the east, is currently conveyed towards Pretty Pool Creek following rainfall events.

7.1.2 Groundwater

The key groundwater resources for the Pilbara coast are the alluvial aquifers. Three aquifer units have been identified within the alluvial deposits (SKM 2007):

- Upper aquifer – an unconfined aquifer within alluvium, calcarenite and/or paleosol stratigraphic units
- Middle aquifer – located within red beds of clays and sands of low permeability
- Lower aquifer – an aquifer of low permeability conglomerate with highly permeable gravel lenses.

Groundwater data from the coastal plain aquifers from the surrounding Pretty Pool area indicate the groundwater is generally highly saline to brackish. As the Athol Street development is located adjacent to the Indian Ocean interface, it is anticipated groundwater flow will generally be towards the ocean.

8 AIR FACTOR

8.1 Air quality

Port Hedland, a regional town in Western Australia, is home to the world's largest iron ore export port. Air quality, and specifically dust, has been recognised as a significant environmental issue by the EPA in 2009. Dust in Port Hedland can be generated from natural sources (such as the dry dusty land of the Pilbara region) and anthropogenic sources (such as the handling and stockpiling of bulk commodities such as iron ore). Specifically, in 2009 the EPA expressed concern that 24 hour PM10 dust concentrations regularly exceeded the air National Environmental Protection Measure (air NEPM) of 50 µg/m^3 (+ 5 exceedances for natural events) and that existing planning arrangements allowed for residential development in the West End. In response, the Port Hedland Dust Management Taskforce reporting to the Premier was convened by the Department of State Development in May 2009. The Port Hedland Dust and Noise Management Plan (DNMP) was prepared and released in March 2010.

Concurrently, the Port Hedland Industries Council (PHIC) was founded in 2009 to provide an integrated and coordinated approach to establishing and operating an ambient air quality monitoring network in Port Hedland.

The Port Hedland Air Quality and Noise Management Plan (Department of State Development 2010) identified the need to establish an 'independent, comprehensive air quality monitoring regime' in Port Hedland. The Taskforce intended that the monitoring regime would provide a basis to measure the performance of industry against relevant targets, and the data would inform and guide future industry and community planning. In 2009 PHIC established an ambient air quality monitoring network in Port Hedland.

The PHIC ambient air quality monitoring network consists of eight (8) stations distributed across the Port Hedland region. The stations measure a combination of PM10, PM2.5, meteorological conditions (wind speed, wind direction and temperature) and oxides of nitrogen (reported as NO_2). Data from each station is uploaded to a public website for viewing in real-time (www.phicmonitoring.com.au).

The monitoring data collected in 2012-2014 at the Port Hedland and South Hedland sites show that with the exception of PM10 and PM2.5 all other pollutants meet the air quality standards and guidelines adopted for the Health Risk Assessment (HRA). The risk characterisation has shown that the pollutant that is having the greatest impact on public health in both Port Hedland and South Hedland is PM10.

In 2013, peak levels of PM10 reached as high as 400 µg/m^3 at the Taplin Street site and analysis of the data indicates that these exceedances were not due primarily to regional dust events but to local sources of dust in the Port Hedland area. The sandy environment of the spoilbank land formation was identified as most likely to have contributed to exceedances at both the Taplin Street and Kingsmill Street monitors (DoH 2016).

RPS notes that the Taskforce's recommendation for a current interim guideline of 24-hour PM10 of 70 µg/m^3 continues to apply to residential areas of Port Hedland and that measures should be introduced to cap (and if possible, reduce) the number of permanent residents in dust affected areas of Port Hedland.

This recommendation to reduce permanent residents in dust-affected areas of Port Hedland (i.e. the west end of Port Hedland) was a significant driver to strategically identify land areas in Port Hedland's east end outside of the dust affected areas to provide alternative housing locations. This advice from the Taskforce was the catalyst for identifying the Athol Street and Stables developments in the ToPH's 2011 Pilbara's Port City Growth Plan and the WAPC in 2018 endorsed an Improvement Plan and Improvement Scheme designed to achieve the land use outcomes described in the Taskforce report and reduce permanent residents in dust affected west end of Port Hedland.

9 PEOPLE FACTORS

9.1 Social surroundings

9.1.1 Aboriginal heritage and culture

A search of the DPLH's Aboriginal Heritage Inquiry System (AHIS) identified that Other Heritage Place (Name: LAN22-11-22; ID: 35216) is located within the site (Figure J; Appendix I).

In providing advice regarding the environmental issues of the site, the EPA recommended that the (then) Department of Aboriginal Affairs be consulted with respect to obligations under the *Aboriginal Heritage Act 1972*.

9.1.2 Natural and historical heritage

A search of the Heritage Council's inHerit database and the ToPH's Heritage Inventory undertaken on 16 June 2020 did not identify any State-listed heritage sites or places of considerable cultural significance on the ToPH's Heritage List within the site.

World War Two Rifle Range / Merv's Lookout, which is a place of some cultural heritage significance (Grade C), is identified within Lot 512 by the ToPH's Heritage Inventory (Figure J). The Heritage Inventory notes that the rifle range site and Merv's Lookout are significant for the associations with World War Two and the Port Hedland involvement at that time. A picturesque planted area on the road verge, together with a bench seat, overlooking the rifle range site, and gum trees along the street (Plate 4).

The World War Two Rifle Range / Merv's Lookout heritage place has been retained by the proposed structure plan.

(Source: ToPH 2017)

Plate 4: World War Two rifle range, Merv's Lookout

9.1.3 Noise

9.1.3.1 Preliminary noise assessment

A preliminary noise assessment was undertaken by Herring Storer Acoustics in 2011 for the East Port Hedland area to determine the extent to which potential acoustic impacts received from vehicles on Wilson Street, passing trains and the salt harvesters would constrain development opportunities in the area.

Herring Storer Acoustics (2011) determined that noise received from passing trains during the night period is the critical noise source and period for compliance. Under SPP 5.4: Road and Rail Noise, the noise received by the passing trains needs to comply with the following target acoustic criteria:

- External
  - LAeq(Day)of 55 dB(A)
  - LAeq(Night) of 50 dB(A).

Herring Storer (2011) identified the Athol Street site as being outside the LAeq (Night) of 50 dB (A), therefore no further action or analysis relating to noise ingress is required.

9.2 Amenity

9.2.1 Mosquitos

Mosquito borne viruses can occur anywhere where conditions are warm and wet. In the Pilbara the mosquito-borne diseases of most concern are:

- Ross River virus
- Barmah Forest virus
- Murray Valley encephalitis.

The critical factor in determining whether mosquitoes and midges are likely to be a nuisance or a health risk is the presence of water, as mosquitoes and midges require standing water to breed during their larval stage (Russell 1999). To determine the likely risk of mosquitoes and midges breeding within or proximate to the subject land it is necessary to identify any potential breeding areas.

Any areas within the site (including during and after construction) where pooling of water may occur could act as a potential breeding site, the following examples are provided:

- Stormwater drainage systems
- Low-lying areas temporarily flooded by rainfall
- Temporary areas created during construction works such as bunded areas or trenches
- Pretty Pool Creek may provide mosquito-breeding habitat.

Mosquito studies have been carried out in the Pretty Pool Creek area by the Arbovirus Surveillance and Research Laboratory at the University of Western Australia and the ToPH. The studies indicated that most of mosquito species include *Aedes vigilax*, which are associated with mangrove and intertidal habitats and *Culex annulirostris*, which are associated with fresh and polluted water in domestic areas.

9.2.2 Bushfire

A search of Department of Fire and Emergency Services' Map of Bushfire Prone Areas identified that the site is mapped as a Bushfire Prone Area (Figure K).

The WAPC released SPP 3.7: Planning in Bushfire Prone Areas to reduce the risk of bushfire to people, property and infrastructure. SPP 3.7 defines a bushfire-prone area as an area that has been designated by the Fire and Emergency Services Commissioner under Section 18 of the *Fire and Emergency Services Act 1998* (as amended) as an area that is subject, or likely to be subject, to bushfires.

10 KEY ENVIRONMENTAL FACTORS IDENTIFIED

10.1 Benthic communities and habitat

10.1.1 Environmental objective

To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained

10.1.2 Potential impacts

Aspects of this proposal that may affect the mangrove community of Pretty Pool includes:

- Loss of up to 3.46 ha of intertidal mud and samphire flats
- Halo effect due to either sediment scour or smothering around the development boundary due to changes in the local wave conditions
- Water quality changes during construction (turbidity) or due to reduced flushing could potentially cause indirect losses
- Indirect impacts to mangrove and samphire vegetation through reduced water quality from developmental run-off.

10.1.3 Management response

Cardno (2012) and (2015) mangrove assessment concluded that any modifications to the creek hydrodynamics from the TPS amendment boundary would be minor and would not have a significant impact on the mangrove community. The assessment was undertaken to determine if changes in creek hydrology would impact the mangroves and be a resultant fatal flaw to the development. Cardno (2020a) confirmed that the mangrove and potential erosion impacts study undertaken as part of Cardno (2012) and (2015) remained valid in when consideration was provided to the coastal hazards identified by the CHRMAP (GHD 2019) and consistent with SPP 2.6.

Figure D shows the separation distances from the proposed structure plan development footprint (which is significantly reduced from the TPS Amendment boundary) is setback from the Pretty Pool Creek mangroves by an average of 239 m and at its closet point is 112 m from the mangroves. The following measures ensure the Pretty Pool Creek mangroves will not be directly impacted as a result of the proposed structure plan:

- The increased separation between the Pretty Pool Creek mangroves to the structure plan development area boundary
- The spatial extent of the TPS amendment boundary being defined by the detailed hydrodynamic modelling undertaken by Cardno (2012) and (2015)
- Preparation and implementation of a Mangrove Management Plan (MMP) and Construction Management Plan (CMP) to the satisfaction of the ToPH and the DBCA at subdivision.

The MMP will include:

- Aerial photography and field surveys will be used to map the distribution and coverage of mangrove vegetation associations
- Mangrove health surveys will be undertaken in an effort to ensure that any negative impacts are detected as soon as possible. Mangrove health monitoring would consist of regular visual assessments to determine mangrove condition
- Mangrove monitoring sites will be established prior to the commencement of construction activities.

All site works required as part of the future development of the site are proposed to be undertaken within the proposed structure plan development footprint. No site works, for example the installation of walling or earth bund / infrastructure, is proposed outside of the proposed structure plan development footprint.

During the construction phase a CMP will be required which will address the following management and mitigation measures:

- Ensuring no mangroves are cleared through access restrictions
- Restrict access to areas outside of the proposed structure plan development footprint
- Identify and manage potential impacts to the environment surrounding the proposed structure plan development footprint prior to ground disturbing activities
- Dust management
- Noise management
- Fauna management.

The implementation of the CMP will ensure site works are only undertaken within the proposed structure plan development footprint and that site works do not impact the Pretty Pool Creek mangroves. The CMP will also ensure any potential impacts to the environment surrounding the proposed structure plan development footprint are identified and appropriately managed prior to ground disturbing activities.

10.2 Coastal processes

10.2.1 Environmental objective

To maintain the geophysical processes that shape coastal morphology so that environmental values of the coast are protected.

10.2.2 Potential impacts

- Flooding and erosion of the shoreline as a result of tidal movement, storm surge, wave action, near shore currents and changes in water level.
- Altering the natural patterns of sediment movement resulting from the installation of artificial structures associated with the development.
- Altering the available area for potential mangrove migration or recruitment.

10.2.3 Management response

- Final finished floor level for residential development of 6.7 m AHD consistent with the findings of the Coastal and Hydrological Review (Cardno 2020a), CHRMAP (GHD 2019) and SPP 2.6.
- The following steps will be implemented to develop the basis of design and confirm that the coastal protection structures (i.e. rock revetment) are the most suitable approach from a performance and financial viability perspective
  - Undertake a gap assessment to identify datasets required to inform coastal processes assessment and concept option development
  - Undertake the required investigations to fill any gaps in the data
  - Develop a basis of design with available information
  - Develop several concept designs based on the preferred approach to be optimised to confirm the most suitable design
  - Obtain required environmental approvals for the preferred design.
- Foreshore Management Plan (FMP) to be undertaken at subdivision to appropriately manage access to Pretty Pool Creek, activities and conserve creek foreshore vegetation. FMP will be prepared to the satisfaction of the ToPH and the Department of Planning, Lands and Heritage (DPLH) at subdivision. The FMP will detail (but not limited to) the following
  - Description of the foreshore management area
  - Foreshore planning and environmental approvals

- FMP implementation and responsibility framework
- Statutory requirements and policy context
- Existing environment
- Foreshore design and function
- Coastal Hazard Risk Management and Adaptation Plan
- Coastal protection design & future shoreline monitoring and management
- Figures of the rock revetment walling
- Figure of the landscape design
- Lifecycle and costs of the proposed foreshore assets.

10.3 Marine environmental quality

10.3.1 Environmental objective

To maintain the quality of water, sediment and biota so that environmental values are protected.

10.3.2 Potential impacts

Altering the hydrodynamics of the creek (development fill) may interrupt and alter local water circulation within the near shore areas of the Pretty Pool Creek which may reduce water quality.

10.3.3 Management response

- The LWMS for proposed structure plan outlines the key water servicing, drainage and environmental management considerations to be progressed in support of subsequent development design and planning approval phases (Appendix C).
- Key water management outcomes from the LWMS include
  - First 15 millimetres (mm) of rainfall on lots to be detained within lots through soakwells or rainwater tanks
  - First 15 mm of rainfall from the road reserve to be detained in linear swales
  - All additional rainfall to be conveyed southward to Pretty Pool Creek via the road reserves and swales
  - Swale to discharge any rainfall events greater than 15 mm to Pretty Pool Creek, which is consistent with the conveyance of stormwater from the surrounding residential development along Athol Street and Cooke Point
  - Finished floor level for residential development of 6.7 m AHD consistent with the CHRMAP (GHD 2019) and SPP 2.6
- Urban Water Management Plan(s) will be finalised to the satisfaction of the ToPH and the DWER at subdivision.

10.4 Marine fauna

10.4.1 Environmental objective

To protect marine fauna so that biological diversity and ecological integrity are maintained.

10.4.2 Potential impacts

- Increased lighting from proposed development may potentially disrupt nesting and behaviour of nestling and adult turtles.

- An increased residential population also has the potential to impact marine turtle nesting and hatchling behaviour, through the use of recreation vehicles, pets and interaction with nesting turtles.

10.4.3 Management response

10.4.3.1 Siting

At its closet point the proposed structure plan is located over 1.4 km from the Pretty Pool beach turtle nesting area. Line of sight analysis using Lidar topography illustrated that the TPS amendment boundary and hence smaller LSP boundary was protected from light spill by the primary dunes at Pretty Pool Beach.

Proposed development will be restricted through built form height limits to ensure that no artificial light sources from the development (i.e. streetlights and residential dwellings) will be directly visible to either adult females nesting or departing hatching turtles at Pretty Pool and Cemetery beaches.

10.4.3.2 Lighting design

To minimise the potential for the Athol Street development to cumulatively add to the existing skyglow levels the development's lighting will be designed to accord with the National Light Pollution Guidelines (DEE 2020), and the EPA's Environmental Assessment Guideline for Protecting Marine Turtles from Light Impacts (EPA 2010), while meeting legislative and regulatory requirements for human safety.

This will be achieved through the preparation of an Artificial Light Management Plan, inclusive of biological and artificial light monitoring and auditing requirements, which addresses the best practice lighting design principles identified in the National Light Pollution Guidelines (DEE 2020):

a. Start with natural darkness and only add light for specific purposes.
b. Use adaptive light controls to manage light timing, intensity and colour.
c. Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill.
d. Use the lowest intensity lighting appropriate for the task.
e. Use non-reflective, dark-coloured surfaces.
f. Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.

The purpose of this Artificial Light Management Plan is to demonstrate that artificial light generated by the Athol Street development can be managed so that flatback turtles are:

- Not disrupted within, nor displaced from, important habitat
- Able to undertake critical behaviours such as reproduction and dispersal.

The Artificial Light Management Plan will include:

- Description of the proposed lighting
- Flatback turtle description
- Risk assessment
- Artificial Light Management Plan
- Biological and artificial light monitoring and auditing.

The Artificial Light Management Plan will be prepared to the satisfaction of the ToPH on advice from the DBCA at subdivision.

10.4.3.3 Construction management

CMP (Section 10.1.3) to include provisions restricting construction to day light hours only during turtle nesting and hatching season to avoid potential artificial light impacts to marine turtles during construction and development.

10.4.3.4 Marine turtle management plan

A Marine Turtle Management Plan will be prepared to minimise potential impacts, including through the use of recreation vehicles, pets and interaction with nesting turtles, to marine turtles from an increased residential population. Specifically, the Marine Turtle Management Plan:

- Focuses on management actions and strategies associated with operational activities
- Outlines management strategies and monitoring programs that will be adopted to mitigate potential impacts associated with recreation vehicles, pets and interaction with nesting turtles.

The contents of the Marine Turtle Management Plan would include (but not be limited to):

- Purpose
- Residential development overview
- Relevant legislation
- Existing environment
- Overview
- Port Hedland turtle nesting beaches context
- Turtle habitats
- Migratory pathways
- Impacts and management
- Objectives and performance indicators.

The Marine Turtle Management Plan will be prepared to the satisfaction of the ToPH on advice from the DBCA at subdivision.

10.5 Flora and vegetation

10.5.1 Environmental objective

To protect flora and vegetation so that biological diversity and ecological integrity are maintained.

10.5.2 Potential impacts

- Loss of up to 16.81 ha coastal dune vegetation
- Introduction and distribution of weed species
- Hydrological changes
- Vegetation disturbance/loss as a result of construction works
- Vegetation quality degradation through increased pollution and waste.

10.5.3 Management response

- Retention of planted street trees along Athol Street
- MMP (Section 10.1.3), CMP (Section 10.1.3) and FMP (Section 10.2.3) to be prepared to the satisfaction of the ToPH and the DBCA at subdivision.

10.6 Terrestrial environmental quality

10.6.1 Environmental objective

To maintain the quality of land and soils so that the environment values are protected.

10.6.2 Potential impacts

ASS soils are stable when left undisturbed, but when they are exposed to air, during excavation or dewatering, this can set off a reaction resulting in acidity (sulfuric acid) being produced.

The potential impacts include:

- Acidification and release of heavy metals from ASS into groundwater, Pretty Pool Creek, and surrounding marine environment
- Corrosion of concrete structures such as bridges, piles, pylons and drainage pipes.

10.6.3 Management response

The final fill levels, engineering service excavation and dewatering requirements will dictate whether a preliminary ASS investigation and ASS and Dewatering Management Plan (ASSDMP) are required.

However, if required, the ASSDMP will:

- Outline the soil management measures, the groundwater and dewatering effluent monitoring measures and the contingency management measures required to minimise any environmental impacts
- Be prepared to the satisfaction of the DWER at subdivision.

10.7 Terrestrial fauna

10.7.1 Environmental objective

To protect terrestrial fauna so that biological diversity and ecological integrity are maintained.

10.7.2 Potential impacts

Activities that impact on flora and vegetation typically extend to fauna that rely on this habitat for nesting, foraging and/or shelter. The potential impacts to terrestrial fauna may include:

- Habitat disturbance as a result of construction, and increased use of off-road vehicles
- Impact on migratory bird species through loss of habitat
- As a result of disturbance during construction (noise and clearing activities), there may be an effect on the local abundance of fauna populations due to interruption to fauna behaviour, including displacement, injury or death
- Inadvertent injury and/or mortality as a result of increased vehicle strikes from increased traffic
- Impacts on significant fauna species
- Habitat destruction from increased activity from domestic pets
- Habitat and food source degradation through increased pollution and waste.

The proposed development is likely to result in disturbance to waterbirds which inhabit the Pretty Pool Creek shoreline and mud flats. The impacts to these waterbirds are likely to include a permanent loss of foraging habitats and noise impacts resulting from the use of heavy machinery during the construction phase.

10.7.3 Management response

- Avoid clearing of rocky/boulder habitat that may contain micro-habitat suitable for refuge for some small terrestrial mammal species.
- The Pretty Pool Creek line will be avoided.
- Maintain equipment such that all noise emitting equipment is fully serviceable and working to the correct specifications. All construction movement will be scheduled to take place during the day.

- MMP (Section 10.1.3), CMP (Section 10.1.3) and FMP (Section 10.2.3) to be prepared to the satisfaction of the ToPH and the DBCA at subdivision.
- FMP will also address a community education program including
  - Installation of signs and educational material to inform the public of the local fauna and important habitats that people should avoid
  - Encourage the community to use dog leads and discourage people to allow dogs to roam off-leash
  - Discourage littering and pollution through educational material and fines.

10.8 Air quality

10.8.1 Environmental objective

To maintain air quality and minimise emissions so that environmental values are protected.

10.8.2 Potential impacts

In 2009, the EPA expressed concern that 24 hour PM10 dust concentrations regularly exceeded the air National Environmental Protection Measure (air NEPM) of 50 µg/m^3 (+5 exceedances for natural events) and that existing planning arrangements allowed for residential development in Port Hedland's West End.

Air quality could be potentially impacted, either directly or indirectly, through the generation of fugitive dust emissions through the following construction activities:

- Clearing land for the development sites, public open space, roads and car park
- Windborne dust from exposed surfaces, earth moving, transport, stockpiling or loading of materials.

10.8.3 Management response

- Dust management shall comply with Guidelines for Managing the Impacts of Dust and Associated Contaminants from Land Development Sites, Contaminated Sites Remediation and Other Related Activities (DEC 2011) through the preparation and implementation of a Dust Management Plan to prevent or avoid excessive dust generation. The Dust Management Plan will address the following wetting procedures of the development work area will be undertaken
  - Any dry engineering fill sand to be stockpiled will be actively wet down during active extraction
  - Water carts will be available near the site entrance to enable pre-wetting of access roads and areas of the site where vehicle movements are anticipated will be carried out
- Dust Management Plan to be prepared to the satisfaction of the ToPH and DWER at subdivision
- Prior to commencement of any construction, wind fencing will be installed on the boundaries of the site if required
- Should high wind speeds be forecast, site activities will be reviewed as deemed appropriate.

10.9 Social surroundings

10.9.1 Environmental objective

To protect social surroundings from significant harm.

10.9.2 Aboriginal culture and heritage

10.9.2.1 Potential impacts

The potential impacts of the proposed development on Aboriginal Heritage sites are related primarily to direct disturbance of sites and include:

- Excavation / construction activities may unearth and/or damage artefacts or other items of cultural Aboriginal significance.

10.9.2.2 Management response

- Consult with DPLH to determine obligations under the *Aboriginal Heritage Act 1972.*
- Approval to disturb the Aboriginal archaeological site under Section 18 of the *Aboriginal Heritage Act 1972* (if required) prior to ground disturbing activities.
- Should any Aboriginal objects be identified or unearthed during development, works will be stopped and the findings reported to the DPLH.

10.9.3 Amenity – mosquitos

10.9.3.1 Potential impacts

The partial infilling of the Pretty Pool Creek flood plain may result in increased areas of standing water following rainfall and periods of higher tides which may have the potential to serve as mosquito breeding areas. Health and amenity issues could affect visitors and residents living adjacent to the water body if mosquito breeding occurs in large numbers.

10.9.3.2 Management response

- Mosquito monitoring program to be prepared to the satisfaction of the ToPH at subdivision
- If mosquito numbers are found to be excessive, a Mosquito Management Plan will be prepared in consultation with the ToPH and the DoH and implemented.

10.9.4 Bushfire

10.9.4.1 Potential impacts

- Damage to people, property and infrastructure from fire.
- Death and/or injury due to fire.

10.9.4.2 Management response

- Bushfire Management Plan has been prepared to provide the bushfire management framework proposed to be actioned as part of developing the site in accordance with the structure plan.
- Bushfire Attack Level contour mapping within the Bushfire Management Plan will be updated (if required) to reflect the proposed structure plan and subdivision outcomes.

11 FRAMEWORK FOR MANAGEMENT PLAN IMPLEMENTATION

The planning instrument that will be used to ensure the proposed management plans are implemented for the Athol Street development is the *Planning and Development Act 2005*.

Specifically, to regulate the production, delivery and approval of the management plans, subdivision conditions, which identify the requirement for the management plans to be provided, will be contained in the WAPC's subdivision approval.

In the absence of appropriate Model Subdivision Conditions, Non-standard Subdivision Conditions will be placed upon the subdivision application(s) for the Athol Street development. The Non-standard Subdivision Conditions will be placed upon the subdivision application(s) by the ToPH, with advice provided by the DBCA (where appropriate).

The Non-standard Subdivision Conditions will detail the requirements for the management plans and the appropriate regulatory authority(s) responsible for the approval of the management plans / clearance of the specific subdivision condition.

Regulation of the management plans through subdivision conditions provides certainty that the management plans will be approved prior to the development of the Athol Street development commencing. It will also allow for development to proceed in accordance with the management plans to ensure potential impacts are appropriately managed / mitigated.

12 CONCLUSIONS

Table 1 in the Summary, details the following key environmental factors and proposes management measures:

- Benthic communities and habitat
- Coastal processes
- Marine environmental quality
- Marine fauna
- Flora and vegetation
- Terrestrial environmental quality
- Terrestrial fauna
- Air quality
- Social surroundings.

The proposed structure plan recognises the importance of the key environmental and landscape attributes of the site, and surrounding areas, and incorporates these in an urban form, that creates an environmentally responsive residential development that meets the EPA's environmental objectives for the management of the identified environmental factors.

Noting that the creation and formalisation of an appropriate setback to Pretty Pool Creek, and its fringing mangrove community, to ensure that no direct impacts will occur to mangrove system or the broader marine environment was achieved through Amendment No. 58, the proposed structure plan environmental outcomes are:

- Management of the ecological integrity of Pretty Pool Creek mangroves through the preparation and implementation of MMP, CMP and FMP
- Implementation of coastal protection works in accordance with an approved FMP
- Implementation of built form height limits, Artificial Light Management Plan to manage potential light spill impacts to the Pretty Pool Beach flatback turtle rookery and Marine Turtle Management Plan minimise potential impacts from an increased residential population
- Implementation of Pilbara-centric water sensitive urban design and stormwater drainage management
- Use of native species in landscaping.

This EAR concludes that through the implementation of the proposed mitigation measures the development of the site, in accordance with the proposed structure plan, will meet the EPA's environmental objectives for the assessed environmental factors.

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FIGURES

LEGEND

- Development area (20.27 ha)
- TPS Amendment boundary (42.47 ha)
- Structure plan boundary (41.88 ha)

CEMETERY BEACH
COOKE POINT
COLIN MATHESON OVAL
CAPTAIN BERT MADIGAN PARK
WATER TREATMENT PARK
RACECOURSE
TJALKA BOORDA ABORIGINAL COMMUNITY
COOKE POINT CARAVAN PARK
PRETTY POOL BEACH
PRETTY POOL
PRETTY POOL CREEK
SUTHERLAND ST
LACY ST
BELL ST
ROBINSON ST
THOMPSON ST
NEPTUNE PL
OCEANUS CT
THETIS PL
NEREUS CT
CLARK ST
MOSELEY ST
TREMBATH ST
MCGREGOR ST
HARPER ST
KEESING ST
LEEDS ST
BAYMAN ST
LYNDHAM ST
ATHOL ST
DEMPSTER ST
CRAIG ST
FINLAY ST
WOODMAN ST
CORNEY ST
GOODE ST
LOUIS ST
MCPHERSON ST
BARKER CT
HALL ST
TAYLOR ST
COOKE POINT RD
CHARLES BALL DR
STYLES RD
WILSON ST
JOHNSON LT
NICHOLLS RTT
MATHESON DR
LANGLEY GDNS
COUNIHAN CRSY
BUTLER WY
PENNINGS CT
MONKS PL

Site Location

CAMDEN SOUND
DERBY
BROOME
PRETTY POOL
DAMPIER
KARRATHA
MARBLE BAR
ONSLOW
EXMOUTH
CORAL BAY
NEWMAN
CARNARVON
WESTERN AUSTRALIA
GERALDTON
PERTH
BUNBURY
ALBANY
0 250 500 km

Level 2, 27-31 Troode Street, West Perth | T +61 8 92111111 | F +61 8 92111122 |

Figure A

Site location

GDA 1994 MGA Zone 50

0 125 250 500 m

Job Number: L20043-001
Doc Number: 001
Date: 17.07.20
Scale: 1:10,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

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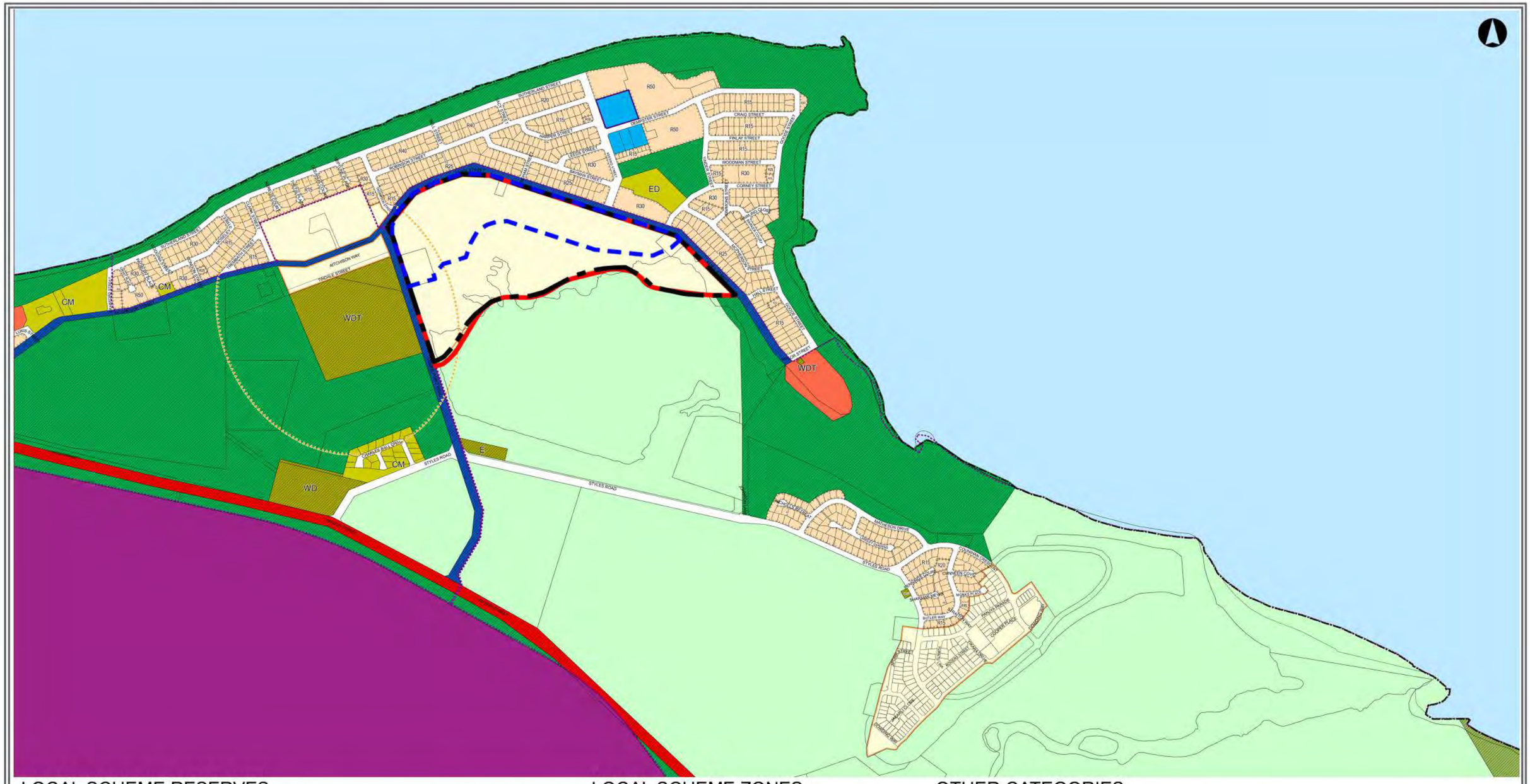

LOCAL SCHEME RESERVES

- Conservation Recreation and Natural Landscapes
- District Road
- Local Road
- C — Other Public Purposes : Cemetery
- E — Other Public Purposes : Energy
- I — Other Public Purposes : Infrastructure
- T — Other Public Purposes : Telecommunications
- WDT — Other Public Purposes : Waste Disposal and Treatment
- WD — Other Public Purposes : Water and Drainage
- EX — Other Public Purposes : Explosives Safety Area
- I — Other Purposes : Infrastructure
- P — Other Purposes : Port Facilities
- Parks and Recreation
- State and Regional Road

LOCAL SCHEME ZONES

- Airport
- Commercial
- Community
- CM — Community : Community
- ED — Community : Education
- H — Community : Health
- Industrial Development
- Industry
- Light Industry
- Mixed Business
- Residential
- Rural
- Rural Residential
- Strategic Industry
- Tourism
- Town Centre
- Transport Development
- Urban Development
- West End Residential

OTHER CATEGORIES

(see scheme text for additional information)

- Scheme boundary
- Local Government Boundary
- R20 R Codes
- A1 Additional Uses
- Development Plan Areas
- Mining Dust Buffer Special Control Area
- South Hedland Landfill Odour Buffer SCA
- Special Control Areas
- No Zone
- Waterbodies
- TPS Amendment boundary
- Structure plan boundary
- Development area

Figure B

Town of Port Hedland's Town Planning Scheme No. 5

Job Number: L20043-001
Doc Number: 002
Date: 17.07.20
Scale: NTS @ A3
Created by: MA
Source: Department of Planning - 14.01.14

rps

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LEGEND

- TPS Amendment boundary (42.47 ha)
- Structure plan boundary (41.88 ha)
- Development area (20.27 ha)

Local scheme reserves

- Environmental conservation (21.52 ha)
- Public Open Space (2.05 ha)
- Public purposes (1.36 ha)

Local scheme zones

- Residential (Low density) (4.88 ha)
- Residential (Medium density) (7.49 ha)

SUTHERLAND ST
LACY ST
BELL ST
HARPER ST
LEEDS ST
WYNDHAM ST
BAYMAN ST
KEESING ST
TUNE PL
THOMPSON ST
MCGREGOR ST
DEMPSTER ST
CRAIG ST
GOODE ST
FINLAY ST
WOODMAN ST
TINDER ST
CORNEY ST
SIMMONS ST
RAWLING CL
BARKER CT
MCPHERSON ST
ATHOL ST
HALL ST
GOODE ST
TAYLOR ST
COOKE POINT RD
CREEK
POOL
PRETTY

Figure C

Structure plan

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: L20043-001
Doc Number: 003
Date: 17.07.20
Scale: 1:5,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

Document Path: G:\Jobs\L_Jobs\L20043 - DevWA Athol_Stables\Figures L20043-001 Athol\L20043-001_G_003_FigC Structure plan_200717.mxd

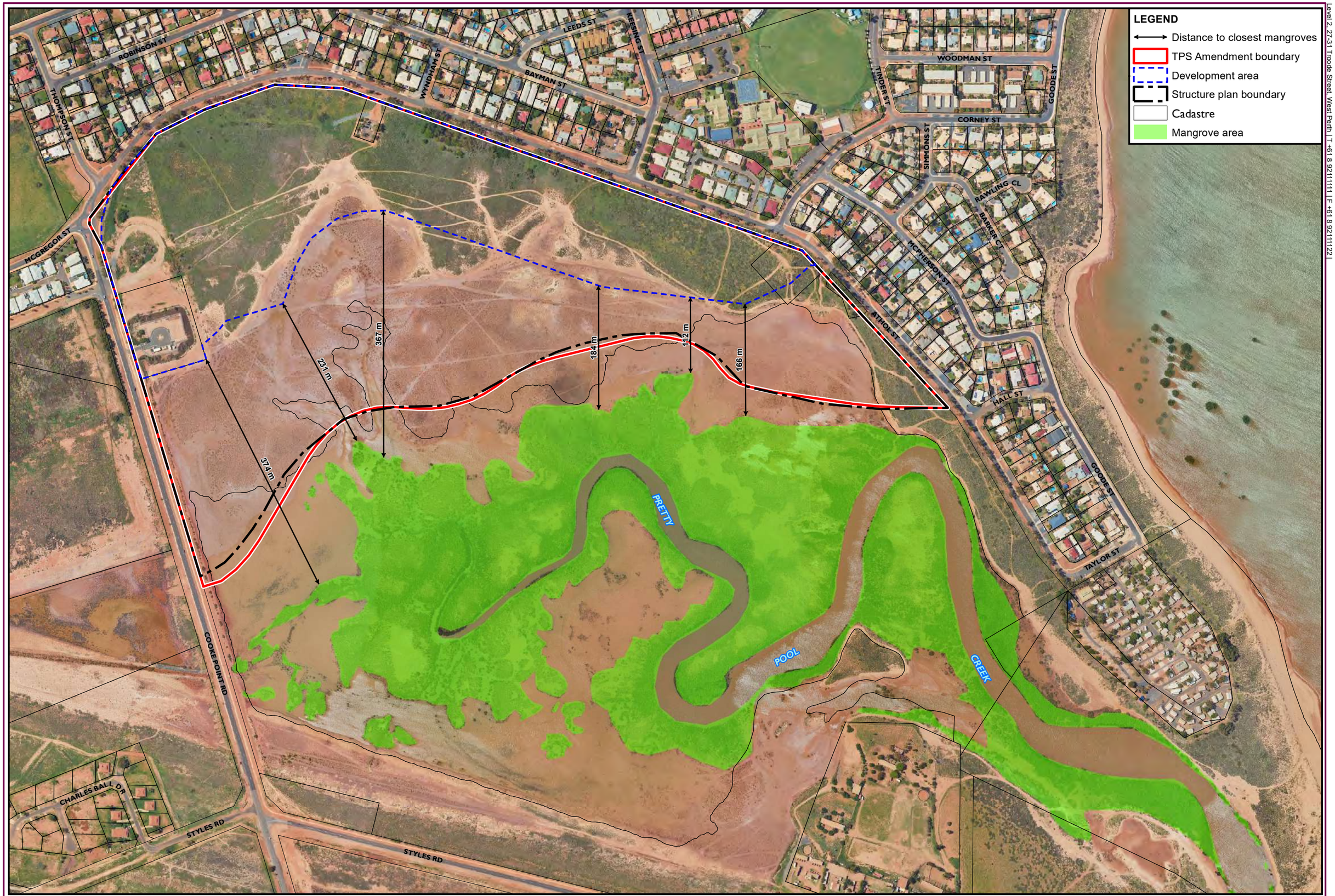

Figure D

Distance to the Pretty Pool Creek mangroves

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: L20043-001
Doc Number: 004
Date: 17.07.20
Scale: 1:5,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

Document Path: G:\Jobs\L_Jobs\L20043 - DevWA Athol_Stables\Figures L20043-001 Athol\L20043-001_G_004_FigD Distance to Mangroves_200717.mxd

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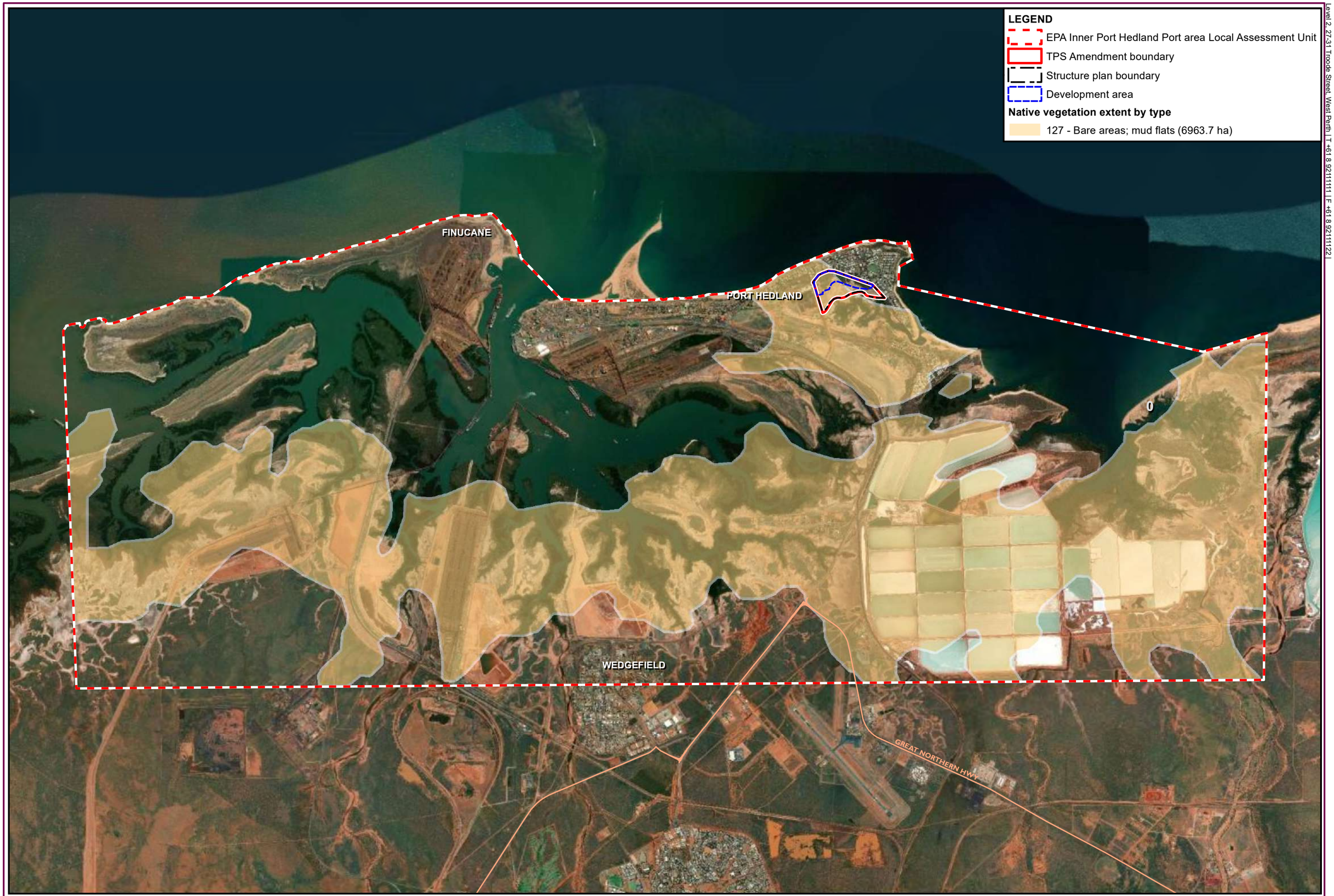

Figure E
Extent of Beard Vegetation Association: 127 within EPA Inner Port Hedland Port Area Local Assessment Unit

GDA 1994 MGA Zone 50
0 750 1,500 3,000 m

Job Number: L20043-001
Doc Number: 005
Date: 16.07.20
Scale: 1:60,000 @ A3
Created by: MA
Source: Orthophoto - Esri World Imagery

Document Path: G:\Jobs\L_Jobs\L20043 - DevWA Athol_Stables\Figures L20043-001 Athol\L20043-001_G_005_FigE LAU Beard Vegetation Association127_200716.mxd

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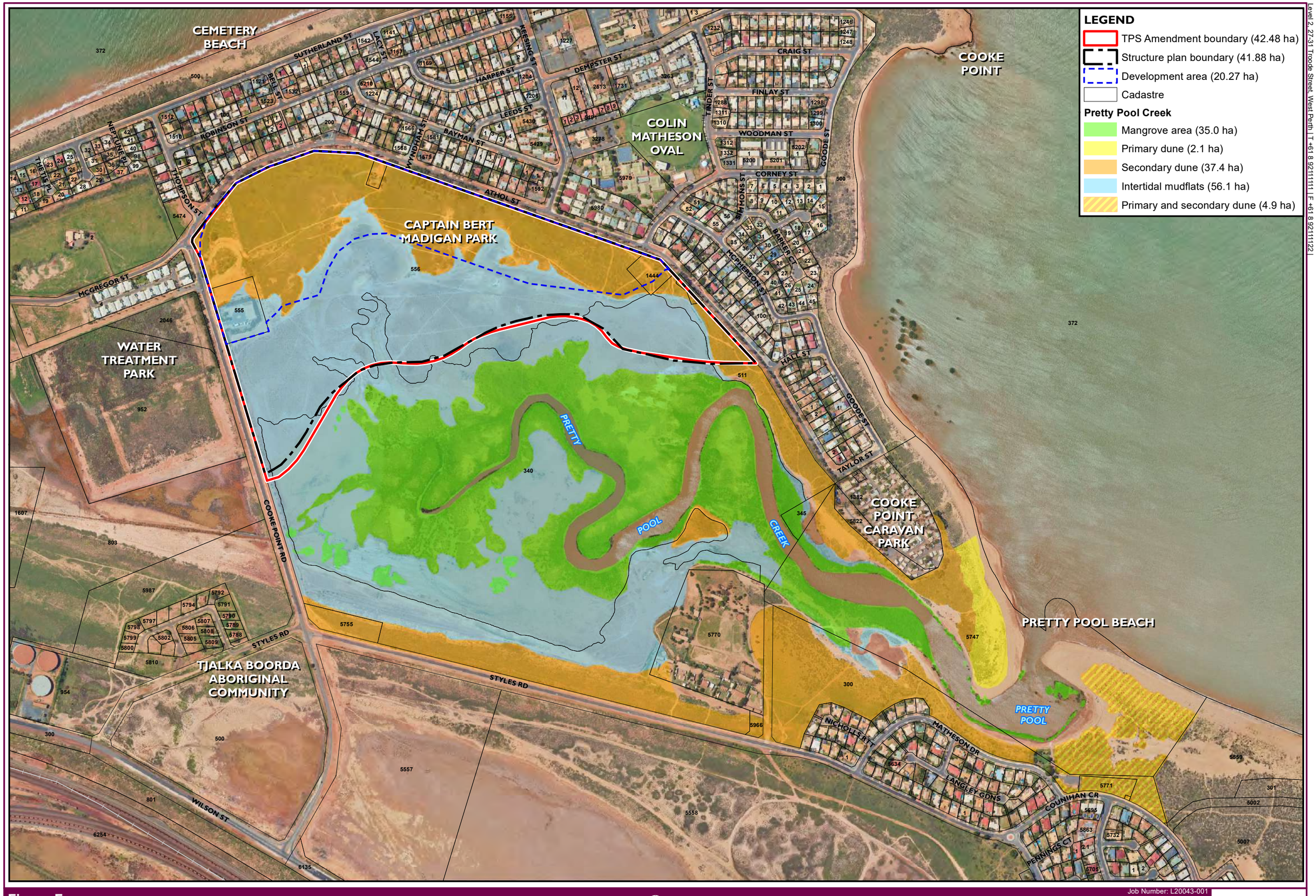

Figure F

Design considerations

GDA 1994 MGA Zone 50

0 95 190 380 m

Job Number: L20043-001
Doc Number: 006
Date: 17.07.20
Scale: 1:7,500 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

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LEGEND

- TPS Amendment boundary
- Structure plan boundary
- Development area
- Topography (mAHD)
- Marine Turtles

Line of Sight at 36m

- Visible
- Not visible

CEMETERY BEACH

RACECOURSE

POOL

CREEK

PRETTY

Figure G

Line of sight from Cemetery Beach at +36 m AHD

GDA 1994 MGA Zone 50

0 80 160 320 m

Job Number: L20043-001
Doc Number: 007
Date: 17.07.20
Scale: 1:8,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

Document Path: G:\Jobs\L_Jobs\L20043 - DevWA Athol_Stables\Figures L20043-001 Athol\L20043-001_G_007_FigG LoS Cemetry beach_200717.mxd

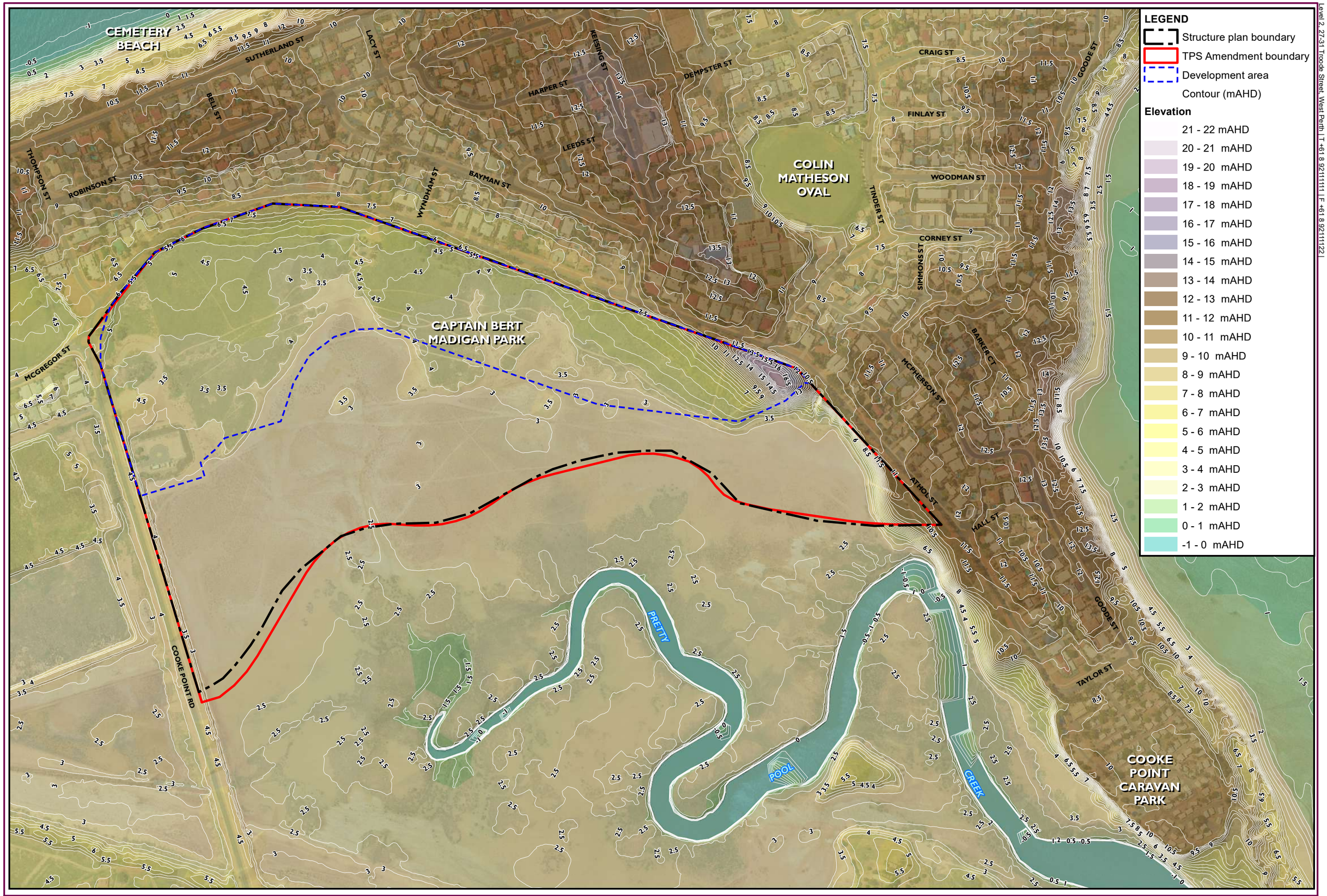

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Figure H

Topography

GDA 1994 MGA Zone 50

0 62.5 125 250 m

Job Number: L20043-001
Doc Number: 008
Date: 17.07.20
Scale: 1:5,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

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LEGEND

- Structure plan boundary
- TPS Amendment boundary
- Development area
- Cadastre

Acid sulfate soil risk mapping (DWER, 2017)

- High to moderate risk
- Moderate to low risk

CEMETERY BEACH
CAPTAIN BERT MADIGAN PARK
COLIN MATHESON OVAL
COOKE POINT CARAVAN PARK
PRETTY POOL CREEK
PRETTY PC
SUTHERLAND ST
KEESING ST
LACY ST
BELL ST
HARPER ST
DEMPSTER ST
TINDER ST
CRAIG ST
GOODE ST
FINLAY ST
WOODMAN ST
CORNEY ST
ROBINSON ST
WYNDHAM ST
BAYMAN ST
LEEDS ST
OCEANUS CT
NEPTUNE PL
THOMPSON ST
SIMMONS ST
RAWLING CL
BARKER CT
MCPHERSON ST
ATHOL ST
HALL ST
GOODE ST
TAYLOR ST
MCGREGOR ST
COOKE POINT RD
STYLES RD
STYLES RD

Figure I

Acis sulfate soil risk mapping

GDA 1994 MGA Zone 50

0 75 150 300 m

Job Number: L20043-001
Doc Number: 009
Date: 17.07.20
Scale: 1:6,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

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LEGEND

- TPS Amendment boundary
- Structure plan boundary
- Development area
- Local heritage - WW2 rifle range (site) and Merv's lookout

Aboriginal heritage sites (DAA, July 2020

- Registered Site
- Lodged

DEMPSTER ST
CRAIG ST
GOODE ST
FINLAY ST
WOODMAN ST
CORNEY ST
RAWLING CL
BARKER CT
TINDER ST
SIMMONS ST
MCPHERSON ST
ATHOL ST
HARPER ST
LEEDS ST
BAYMAN ST
WYNDHAM ST
KEESING ST
ROBINSON ST
NEPTUNE PL
THOMPSON ST
MCGREGOR ST
COOKE POINT RD
HALL ST
TAYLOR ST
PLACE ID: 6021
PORT HEDLAND TOWNSITE
PLACE ID: 10170
COOKE POINT
PLACE ID: 35216
LAN22-11-22
PLACE ID: 28249
Pretty Pool
PRETTY
POOL
CREEK

Figure J

Heritage mapping

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: L20043-001
Doc Number: 010
Date: 17.07.20
Scale: 1:5,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

Document Path: G:\Jobs\L_Jobs\L20043 - DevWA Athol_Stables\Figures L20043-001 Athol\L20043-001_G_010_FigJ Heritage_200717.mxd

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LEGEND

- TPS Amendment boundary
- Structure plan boundary
- Development area
- Bushfire prone areas (OBRM, 2019)

DEMPSTER ST
CRAIG ST
GOODE ST
FINLAY ST
WOODMAN ST
TINDER ST
CORNEY ST
SIMMONS ST
RAWLING CL
BARKER CT
MCPHERSON ST
ATHOL ST
HALL ST
TAYLOR ST
SUTHERLAND ST
LACY ST
BELL ST
HARPER ST
LEEDS ST
ROBINSON ST
BAYMAN ST
WYNDHAM ST
KEESING ST
NEPTUNE PL
THOMPSON ST
MCGREGOR ST
COOKE POINT RD
PRETTY POOL CREEK

Figure K

Bushfire prone areas

GDA 1994 MGA Zone 50

0 50 100 200 m

Job Number: L20043-001
Doc Number: 011
Date: 17.07.20
Scale: 1:5,000 @ A3
Created by: MA
Source: Orthophoto - Landgate, 2020

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