

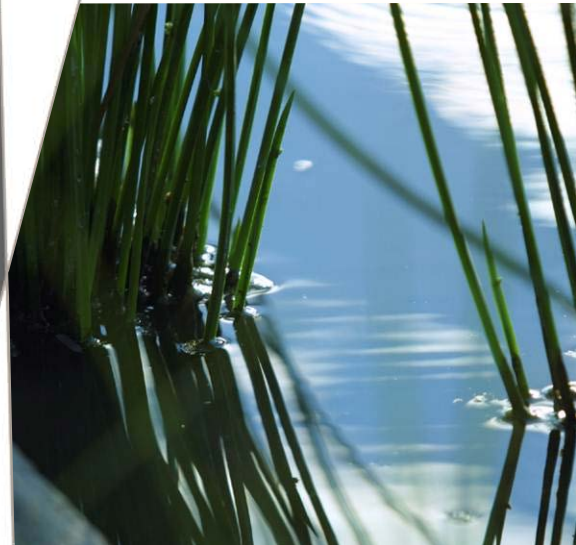
Site Conditions and Constraints

LOT 555 MURDOCH DR
STRUCTURE PLAN

P14005

Prepared for
Department of Housing

8/12/2014



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1 Site Conditions and Constraints

1.1 Biodiversity and Natural Area Assets

1.1.1 Environmentally Sensitive Areas

There are no Environmentally Sensitive Areas (ESA) within the site as classified under Environmental Protection ESA Notice, 2005.

1.1.2 Vegetation

In 2011, ENV.Australia Pty Ltd (ENV) undertook a Level 2 Regional Flora and Vegetation Assessment of the Port Hedland area. Lot 555 was included in the assessment. The assessment involved a review of previous surveys conducted in the area and a site specific field survey.

The assessment identified that vegetation associations on site can be described as an open *Acacia colei* var. *colei* shrublands over low *Acacia stellaticeps* shrublands over *Triodia epactia* and *Triodia secunda* hummock grasslands/low *Acacia stellaticeps* shrublands over *Triodia epactia* and *Triodia secunda* hummock grasslands mosaic. Remnant vegetation over an area covering the site was considered in a desktop assessment to be in Very Good condition with areas associated with tracks, drainage lines and infrastructure having greater levels of disturbance than the surrounding vegetation (ENV, 2011). However, a site visit revealed that the site has been historically cleared and the remnant vegetation is mainly degraded.

1.1.3 Declared and Rare Flora

1.1.3.1 *Threatened and Priority Ecological Communities*

Communities of plants are described as Threatened Ecological Communities (TECs) if they have been defined by the Western Australian Threatened Ecological Communities Scientific Advisory Committee and gazetted under the Wildlife Conservation Act 1950 (Wildlife Conservation Act, 1950).

Some communities which are under consideration for listing as TEC's but do not meet the defined criteria, or have not yet been adequately surveyed for a decision to be made, are added to the Department of Parks and Wildlife's (DPaW) list of Priority Ecological Communities (PEC's). PEC categories are ranked in order of survey priority for evaluation of conservation status (Priority 1 to 3), are rare but not threatened (Priority 4) or conservation dependent (Priority 5). Table 1-1 and Table 1-2 describe definitions of conservation significant communities.

Table 1-1 Definition of Conservation Significant Communities

Category Code	Category
Threatened Ecological Communities (TEC)	
PTD	Presumed Totally Destroyed An ecological community will be listed as Presumed Totally Destroyed if there are no recent records of the community being extinct and either of the following applies: (i) records within the last 50 years have not been confirmed despite thorough searches of known likely habitats; or (ii) all occurrences recorded within the last 50 years have since been destroyed.
	Critically Endangered An ecological community will be listed as Critically Endangered when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future, meeting any one of the following criteria: (i) The estimated geographic range and distribution has been reduced by at least 90% and is either continuing to decline with total destruction imminent, or is unlikely to be
CE	

Category Code	Category
	<p>substantially rehabilitated in the immediate future due to modification;</p> <p>(ii) The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or</p> <p>(iii) The ecological community is highly modified with potential of being rehabilitated in the immediate future.</p>
E	<p>Endangered</p> <p>An ecological community will be listed as Endangered when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. The ecological community must meet any one of the following criteria:</p> <p>(i) The estimated geographic range and distribution has been reduced by at least 70% and is either continuing to decline with total destruction imminent in the short term future, or is unlikely to be substantially rehabilitated in the short term future due to modification;</p> <p>(ii) The current distribution is limited i.e. highly restricted, having very few small or isolated occurrences, or covering a small area; or</p> <p>(iii) The ecological community is highly modified with potential of being rehabilitated in the short term future.</p>
V	<p>Vulnerable</p> <p>An ecological community will be listed as Vulnerable when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing high risk of total destruction in the medium to long term future. The ecological community must meet any one of the following criteria:</p> <p>(i) The ecological community exists largely as modified occurrences that are likely to be able to be substantially restored or rehabilitated;</p> <p>(ii) The ecological community may already be modified and would be vulnerable to threatening process, and restricted in range or distribution; or</p> <p>(iii) The ecological community may be widespread but has potential to move to a higher threat category due to existing or impending threatening processes.</p>

Table 1-2 Priority Ecological Communities Definitions

Priority Ecological Communities (PEC)	
P1	<p>Poorly-known ecological communities</p> <p>Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist.</p>
P2	<p>Poorly-known ecological communities</p> <p>Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, un-allocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.</p>
P3	<p>Poorly known ecological communities</p> <p>Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:</p> <p>Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat; or</p> <p>Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing and inappropriate fire regimes.</p>
P4	<p>Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened or that have been recently removed from the threatened list. These communities require regular monitoring.</p>
P5	<p>Conservation dependent ecological communities</p> <p>Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.</p>

DPaW Threatened and Priority Ecological Communities (TEC/PEC) database searches were conducted in March 2014, the searches indicated that there are no TEC/PECs located within the site or within 50 km of the site.

1.1.3.2 Threatened and Priority Flora

Species of flora acquire 'Declared Rare' Flora (DRF) or 'priority' conservation status where populations are restricted geographically or threatened by local processes. DPaW recognises these threats and subsequently applies regulations towards population protection and species conservation. DPaW enforces regulations under the Wildlife Conservation Act 1950 to conserve DRF species and protect significant populations. Priority flora species that are potentially rare or threatened are classified in order of threat as described in Table 1-3.

Table 1-3 Declared Rare and Priority Flora List Conservation Categories (DPaW, 2014)

Conservation Code	Description
T	<u>Threatened Flora – (Declared Rare Flora – Extant)</u> Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection, and have been gazetted as such.
X	<u>Presumed Extinct – (Declared rare Flora-Extinct)</u> Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
1	<u>Priority One - Poorly known Taxa</u> Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
2	<u>Priority Two - Poorly Known Taxa</u> Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but are in urgent need of further survey.
3	<u>Priority Three - Poorly Known Taxa</u> Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
4	<u>Priority Four - Rare Taxa</u> Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years.

Searches of DPaW's Threatened (Declared Rare) and Priority Flora database, the Western Australian Herbarium Specimen database and Threatened and Priority Flora List were undertaken in March 2014 within a 5 km radius of the site. DPaW's records showed no species nominated were located within or within a 5 km radius to the site.

1.1.3.3 Environment Protection and Biodiversity Conservation Act Protected Matters

Under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) threatened species and ecological community areas are afforded protection as matters of National Environmental Significance. These threatened species are listed in categories defined in Section 179 of the EPBC Act. Any action that is likely to have a significant impact on listed threatened species and ecological communities under the EPBC Act must be referred to the Minister and undergo an environmental assessment and approval process.

Searches of the Department of Environment Nationally Significant Environmental Matters database and DPaW NatureMap online database were undertaken in March 2014. Results indicated that no threatened or priority flora species were located within the site, and within 5 km of the site.

1.1.4 Fauna

Any native fauna identified to be under threat of extinction, rare, or in need of special protection is provided protection for under the Wildlife Conservation Act 1950. Native fauna protected under the Wildlife Conservation Act 1950 is classified as 'threatened' (DPaW, 2014). DPaW maintains a database to help protect and conserve these species and communities which lists taxa that are threatened with extinction as well as taxa that are rare and threatened.

The results of the DPaW Threatened Fauna database search indicated that there were no records of Threatened and Priority Fauna within the site. A broader search was conducted which identified seven land based fauna located within a 10 km radius of the site. The species and their conservation code are provided in Table 1-4.

Table 1-4 Threatened Land Based Fauna Within a 10 km Radius of the Site According to the DPaW Threatened Fauna database, 2014

Species name	Common name	Conservation Code ¹
<i>Ctenotus angusticeps</i>	Airlie Island Ctenotus, Airlie Island Skink	T
<i>Dasyercus cristicauda</i>	Crest-tailed Mulgara	T
<i>Dasyurus hallucatus</i>	Northern Quoll	T
<i>Dasyercus blythi</i>	Brush-tailed Mulgara, Ampurta	4
<i>Mormopterus loriae subsp. cobourgiana</i>	Little North-western Mastiff Bat	1
<i>Aspidites ramsayi</i>	Woma	S
<i>Natator depressus</i>	Flatback Turtle	T

A search of the DPaW NatureMap online database indicated that two additional threatened land based fauna species are likely to occur within the site and within a 5 km radius of the site.

Table 1-5 Threatened Land Based Fauna Within a Five Kilometre Radius of the Site According to the DPaW Threatened NatureMap database, 2014

Species name	Common name	Conservation Code ¹
<i>Lagostrophus fasciatus subsp. fasciatus</i>	Bernier Is. Banded Hare-wallaby, Mernine	T
<i>Pogona minor subsp. minima</i>	Dwarf Bearded Dragon (Houtman Abrolhos Is.	T

A search of the Department of Environment Nationally Significant Environmental Matters database indicated that four threatened species and three vulnerable species are likely to occur within the site, and within a 5 km radius of the site. Table 1-6 shows the species name, common name, status and the potential for the species to occur within the site.

¹ Table 1-3

Table 1-6 Threatened Fauna Species Potentially Located Within 5 km of the site According To The Department of Environment Nationally Significant Environmental Matters Database.

Species	Common name	Status	Presence
Birds			
<i>Rostratula australis</i>	Australian Painted Snipe	Endangered	Species or species habitat may occur within area
Mammals			
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered	Species or species habitat likely to occur within area
<i>Macrotis lagotis</i>	Greater Bilby	Vulnerable	Species or species habitat likely to occur within area
<i>Notoryctes caurinus</i>	Karkarratul, Northern Marsupial Mole	Endangered	Species or species habitat likely to occur within area
<i>Rhinonictis aurantia (Pilbara form)</i>	Pilbara Leaf-nosed Bat	Vulnerable	Species or species habitat likely to occur within area
Reptiles			
<i>Ctenotus angusticeps</i>	Airlie Island Ctenotus	Vulnerable	Species or species habitat likely to occur within area
Migratory Marine Birds			
<i>Apus pacificus</i>	Fork-tailed Swift		Species or species habitat likely to occur within area
<i>Fregata ariel</i>	Lesser Frigatebird, Least Frigatebird		Species or species habitat likely to occur within area
Migratory Terrestrial Species			
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		Species or species habitat likely to occur within area
<i>Hirundo rustica</i>	Barn Swallow		Species or species habitat likely to occur within area
<i>Merops ornatus</i>	Rainbow Bee-eater		Species or species habitat likely to occur within area
Migratory Wetlands Species			
<i>Ardea alba</i>	Great Egret, White Egret		Species or species habitat likely to occur within area
<i>Ardea ibis</i>	Cattle Egret		Species or species habitat likely to occur within area
<i>Charadrius veredus</i>	Oriental Plover, Oriental Dotterel		Species or species habitat likely to occur within area
<i>Glareola maldivarum</i>	Oriental Pratincole		Species or species habitat likely to occur within area
<i>Rostratula benghalensis (sensu lato)</i>	Painted Snipe	Endangered	Species or species habitat likely to occur within area

(Department of Environment, 2014)

As the remnant vegetation on site is degraded, it is highly unlikely any species listed in Table 1-6 would be present. Given that the site has been historically cleared and the remnant vegetation has been identified as being mainly degraded, it would be unlikely to provide a significant habitat for fauna.

1.2 Landform and Soils

Geomorphic classification for the area, presented in the mapping titled Port Hedland Geological Survey of Western Australia, 1:50,000 Urban Geology Series, (Department of Lands and Surveys (DLS), 1983)

indicates that the generic stratigraphic units at and around the site are unconsolidated sediments of clayey calcareous conglomerate and clayey calcareous sandstone which are overlain by clayey sands and sandy clays.

The Port Hedland area is situated within the Pilbara Craton, a metamorphosed basement of granitoid rocks and gneiss. Overlying this geologic unit is the late-Achaean volcano-sedimentary sequence identified as the Hamersley Basin. The Hamersley Basin is characterised as basal basic lavas overlain with clastic sedimentary sequences and banded iron formations.

Overlaying the Tertiary deposits of the Hamersley Basin are Quaternary sedimentary units. Due to the depositional complexity of coastal environments, only general descriptions of the Quaternary sedimentary units in the Port Hedland area, and more specifically the site, are provided.

The Quaternary sediments of the Pleistocene age are generally identified as clastic rocks and sediments forming cemented clayey sandstones and conglomerates. Upper parts of the Pleistocene deposits exhibit red coloration as a result of limonite cementing. The prominent younger Holocene geologic superficial units in and around Port Hedland as described in Port Hedland - Bedout Island, Geological Survey of Western Australia, 1:250,000 Geological Series, (Department of Industry and Resources (DIR), 2006) are detailed below.

1.2.1 Soil Types

Port Hedland Geological Survey of Western Australia, 1:50,000 Urban Geology Series, (Department of Lands and Surveys (DLS), 1983) indicates that shallow sub-surface conditions comprise shelly silty sand and possibly overlain by former mud flats. Strong gravelly and cemented layers occur within the silty sand. This silty sand is known in the Pilbara Region as Pindan Sand and is typical of semi-arid environments. Pindan Sand is a collapsible silty-sand or clayey-sand soil, typically red in colour. Although collapsible, many Pindan Sands display a self-cementation property on drying (Sand-clay Pindan Material in Pavements as a Structural Layer, Emery. S.J, et al, 2003).

The digital database titled Geology Mapping Series of Western Australia, 1:250,000, (DMP, 2008) indicates that the site is within an area of floodplain deposits comprising; sand, silt, clay and gravel adjacent to main drainage channels.

1.2.2 Topography

Topographical data supplied by Landgate showed that the site's highest point is in the south east corner at a height of 16.1 m Australian Height Datum (AHD). There is a gentle slope throughout the site to the north east corner where the lowest point is 11.9 mAHD.

1.2.3 Acid Sulfate Soils

Acid Sulfate Soils (ASS) are naturally occurring soils that contain iron sulphide (iron pyrite) minerals. If disturbed by dewatering, drainage or soil excavation, the pyrites can oxidise thereby releasing iron compounds and sulphuric acid. These soils can result in environmental harm and damage to infrastructure. ASS that have been oxidised and resulted in the creation of acidic conditions are termed Actual ASS, and those that have acid generating potential but remain in naturally anaerobic conditions are termed Potential ASS.

ASS are predominantly found in WA's coastal regions in low-lying wetlands and tidal flats and have also been identified inland within WA's South West Region. The potential for ASS to occur within the site may be assessed by examining the type of soil present and the depth to groundwater. These soils may occur in a variety of waterlogged soils such as dark organic rich soils and muds, peaty wetland soils, some pale grey sands, "coffee rock" (cemented iron and/or organic rich sands) found below the water table and pyritic soils (Department of Environment and Conservation (DEC), n.d.)

The Landgate WA Atlas provides broad-scale risk maps for several coastal regions of WA. The ASS map showed that there is an extremely low probability of ASS occurrence has been identified. Figure 1-1 shows

the ASS mapping for the surrounding area of the site, confirming that the site is not within an area of ASS. The mapping database indicates that the nearest mapped area to the site is 5.3km to the north, and is classified '*high risk to moderate of ASS occurring within three metres of the natural soil surface*'. The regional ASS risk map is presented in Figure 1-1.



Figure 1-1 ASS Risk Map

1.2.4 Contaminated Land

Cardno has reviewed the Department of Environment Regulation (DER) online Contaminated Sites database (accessed XXX 2014) and has obtained a Basic Summary of records from the DER (received 24 March 2014). The database and Basic Summary of Records indicate that the site is not currently classified under the Contaminated Sites Act 2003. The Basic Summary of Records does however indicate that the DER holds information relating to the site and that classification will be made once the DER receive a final environmental report.

1.2.5 Geotechnical

Geotechnical investigation is provided by Cardno Lane Piper in a separate document.

1.3 Groundwater and Surface Water

1.3.1 Regional Groundwater Quality

The Department of Water (DoW) Hydrogeological Atlas (<http://www.water.wa.gov.au/idelve/hydroatlas/>), accessed 4 March 2014, indicates that the hydrogeology beneath the site comprises superficial sediments with the Pilbara Coastal Saline deposits overlying Pilbara Alluvial deposits which are typically 'brackish'. The Atlas also indicates that the total dissolved solids (TDS) of the groundwater beneath the site is in the range between 1,000 mg/L and 3,000 mg/L, which corresponds to between 'fresh' and 'brackish'. However, these values are based on the Generalised State Salinity mapping which is broad scale and may not be accurate at a local scale. A search of DoW boreholes indicated that the groundwater within boreholes ARMY C51 (5 km north) and ARMY C48 (4.5 km south-east) had TDS levels of 5,720 mg/L and 4,468 mg/L respectively, corresponding to 'saline' and 'brackish'. The borehole locations are presented in Figure 1-2.

1.3.2 Site Groundwater Quality

A search of the DoW Water Information Reporting (WIR) database found one groundwater borehole on site. However, there was no relevant data for this borehole.

1.3.3 Regional Groundwater Levels

A search of the DoW WIR database gave no groundwater levels in nine established boreholes within a 5 km radius of the site in the last 50 years.

1.3.4 Site Groundwater Levels

A survey (Parsons Binckerhoff, 2012) undertaken in October 2011 completed a geotechnical investigation, excavating a total of 40 test pits (spread throughout the site) with an approximate depth of 3.0 m. No groundwater was found within the pits.

1.3.5 Groundwater Use

The DoW WIR database for registered boreholes indicates that there are two groundwater boreholes within a 5 km radius of the site that are used for livestock watering. Baynes Well approximately 3.6 km to the east of the site, and another bore approximately 5 km to the north west of the Site. Bore water is reportedly used for garden irrigation. The borehole locations are presented in Figure 1-2.



Figure 1-2 Borehole Locations

1.3.6 Public Drinking Water Source Area

To protect the State's drinking water resources, the DoW has defined certain areas of the State as Public Drinking Water Source Areas (PDWSA). These areas are given one of the following classifications:

- Priority 1 - managed with the principle of risk avoidance to ensure there is no degradation of the water resource. These cover land where the prime land use value is providing the highest quality drinking water.
- Priority 2 - managed with the principle of risk minimisation to ensure that there is no increase in the risk of pollution to the resource. These are declared over land where low intensity development (such as rural development) already exists.
- Priority 3 - managed to limit the risk of pollution to the water source. These are declared over land where water supply sources need to co-exist with other land uses.

The register of drinking water catchments within the Town of Port Hedland local government area, presented in the document titled Public Drinking Water Source Areas of Western Australia, Water Quality Protection Note (WA DoW, 2008), indicated that the site is not located within a PDWSA.

There is a PDWSA within 10 km to the south-west of the site which has not been assigned a 'Priority' classification. This is the Turner River Water Reserve which has no risk avoidance, minimisation or management plan associated with it. This PDWSA is up-gradient of the site and therefore the site will not impact this PDWSA.

1.3.7 Surface Water

There are many existing interlinking drainage channels throughout South Hedland. As South Hedland is generally flat with a gentle slope toward the north west and north east divided by a low ridge running north south through the centre of the town. The ridge is an extension of naturally higher land south of the town and varying between 13 m and 16 mAHD. Throughout most parts of the town, lots drain overland to adjacent road reserves and roads are graded to direct stormwater to a network of open channels. The open drainage channels convey stormwater through culverts and small bridges to the natural drainage line immediately west of the South Hedland and to a large infiltration/evaporation basin east of North Circular Road. A recent flood study (GHD, 2011) for the town of South Hedland produced flood maps of the area. The flood extent shows that the current drainage system for the town (as of 2010) does not inundate the site.

A review of aerial photography and a site visit (6th March 2014) was used to identify surface water bodies within and surrounding the site. A man-made drainage channel (Plate 1) traversing the site has recently been constructed. This channel connects with existing drainage channels along the North Circular Road and flows north. A drainage assessment (Parsons Brinckerhoff, 2012) was completed for the Ospreys housing development located to the west of the site. The drainage assessment uses the site to transfer runoff through the man-made constructed drainage channel. This assessment also proposed a number of drainage channels and Public Open Space's (Figure 1-3) to convey flows. The report recommends that the site utilises POS areas for flood storage in the 100yr Average Recurrence Interval storm event to provide flood protection for the new developments. Until a completed drainage assessment of the proposed development has been undertaken it is unclear whether these channels and POS areas for flood attenuation are needed.



Plate 1 Constructed Drainage Channel

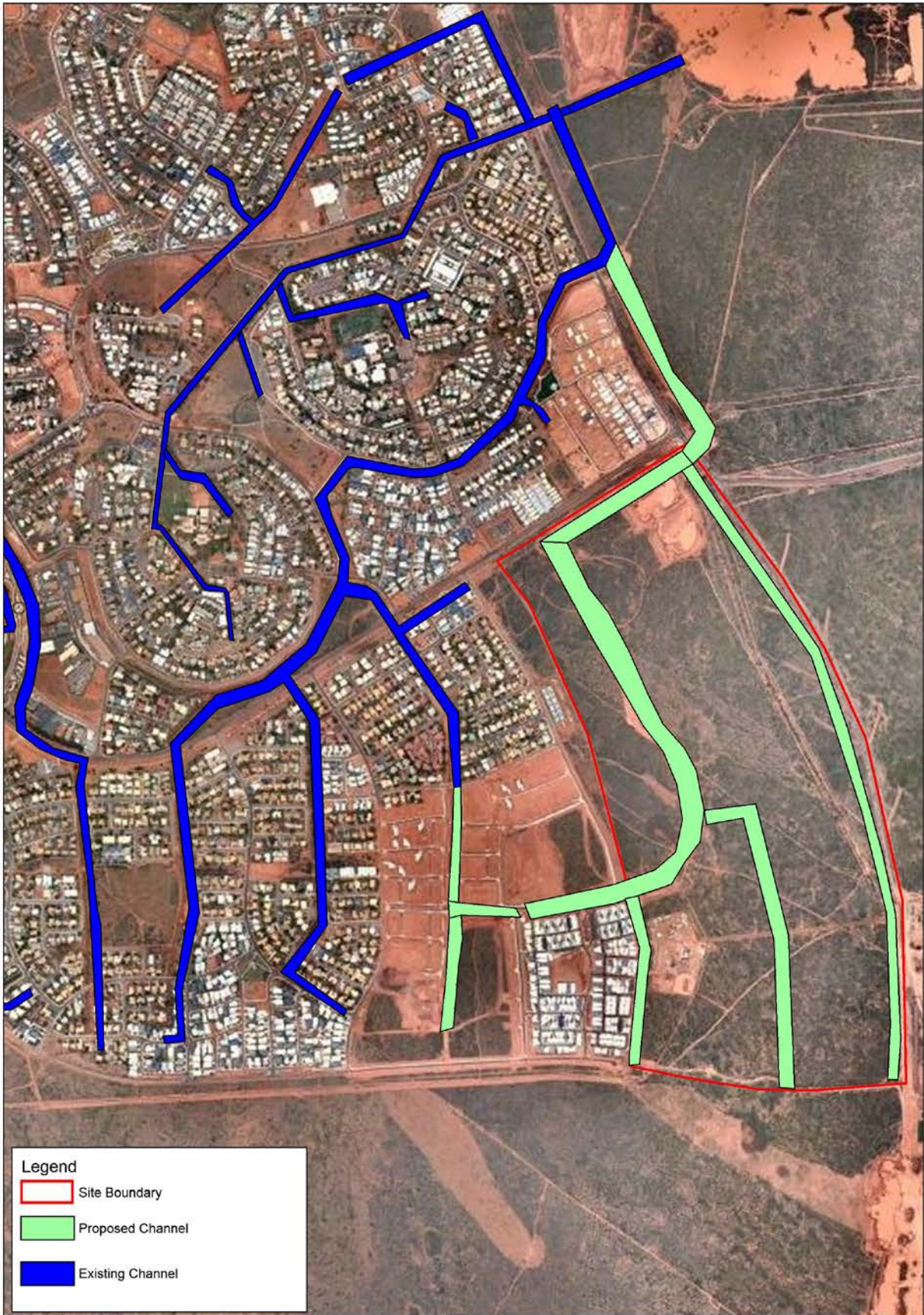


Figure 1-3 Drainage Channels

1.3.8 Wetlands

A review of the Landgate WA Atlas indicates that there are no geomorphic wetlands of any classification on or in a 10 km radius of the site.

1.4 Bushfire Hazard

No bushfire risk has been evaluated as part of the environmental studies conducted over the Structure Plan area.

One of the main principles of the Planning for Bushfire Protection Guidelines, 2010 ('Guideline') states that Local Governments have to identify bushfire hazard levels in the structure plans based on the bushfire hazard assessment methodology outlined in the Guideline. Structure plans with a moderate to extreme bush fire hazard level need to be supported by a more detailed assessment of the bushfire risk and be compliant with the performance criteria and acceptable solutions set out in the Guideline.

Much of the site has been cleared and the condition of remnant vegetation is degraded. The requirement to undertake bulk earthworks will result in clearing of all other parts of the site. Ultimate development will be urban, with only the usual domestic gardens and site landscaping the adjacent land consists of shrubland therefore presents a low bushfire risk, although the vegetation may burn from time to time. The bushfire hazard within Lot 555 is therefore minimal.

1.5 Heritage

1.5.1 Aboriginal Heritage

A search of the Department of Aboriginal Affairs (DAA) Aboriginal Heritage Inquiry System (AHIS) (DAA, 2014) indicated that there are no registered Aboriginal Heritage sites within the site.

1.5.2 European Heritage

A search was conducted on the Heritage Council of WA's online database inherit (2014) for European heritage places within the vicinity of the site. One site was as detailed in Table 1-7.

Table 1-7 Table 1 - European Heritage Places Listed by the Heritage Council WA

Site name	Site No
South Hedland town concept	18423

The Structure planning process should take all European heritage sites into consideration and any proposed impact on these sites should be consulted with the Shire.

Indigenous and Non Indigenous Heritage surveys will be completed by AHMS.

2 References

- Bureau of Meteorology, 2007, Climate of Port Hedland
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