MUNDIJONG NORTH

ENVIRONMENTAL ASSESSMENT REPORT

Prepared for:	Peet Mundijong Syndicate
Report Date:	24 April 2014
Version:	1
Report No.	2014-140

pgv ENVIRONMENTAL

CONTENTS

LIST OF ATTACHMENTS

Tables

Plates

Figures

Appendices

1 INTRODUCTION

1.1 Background

Peet Mundijong Syndicate is proposing to develop Lot 405 Bishop Road, Lots 29, 52, 9000 Taylor Road, Lot 2 and Lot 98 Mundijong (the site) for urban purposes in accordance with its zoning. The site is located in the Shire of Serpentine-Jarrahdale (the Shire) approximately 45km south east of the Perth Central Business District (Figure 1). The northern area of the site is owned by Wellstrand Pty Ltd and the southern area by Peet Limited.

The site is approximately 199ha in size and is bound by Soldiers Road to the east, Bishop Road to the north, the Tonkin Highway Reserve to the west and Manjedal Brook to the south with a smaller section to the south of Manjedal Brook bound by Taylor Road to the east and Scott Road to the south (Figure 2).

The site is zoned "Urban" under the Metropolitan Region Scheme and "Urban Development" in the Shire Town Planning Scheme No. 2 (WAPC, 1989).

1.2 Mundijong Whitby District Structure Plan

The Mundijong Whitby District Structure Plan (DSP) was approved by the Western Australian Planning Commission (WAPC) in April 2011 and it guides the future development of the Mundijong – Whitby area including the site. The Shire adopted the DSP in August 2011 and it provides overall guidance to the structure, vision and objectives for the planning and development of the Mundijong Whitby area. The DSP contains a number of Precincts and defines a framework by which urban development can occur in a coordinated manner. The Local Structure Plan (LSP) for the site is situated within Precinct E and G of the DSP (Figure 3).

The preparation of the more detailed LSP will use the DSP as a guide. The DSP predominantly dealt with district level issues such as:

- Biodiversity;
- Landscape Protection;
- Appropriate management of water quality and maintenance of hydrology;
- Efficient use and re-use of water;
- Responsive built form outcomes, sense of place, community identity and character;
- Providing for alternative modes of transport;
- Climate responsive design and energy efficiency;
- Economic prosperity ; and
- Community well-being.

SMEC (2009) prepared on behalf of the Shire an environmental study for the DSP. The environmental study of the Mundijong Whitby area identified a series of potential environmental impacts associated with the proposed development of the area, as well as a series of broad management recommendations.

1.3 Scope of Work

An LSP is being prepared by Peet Limited to further guide the development of the site. An Environmental Assessment Report (EAR) (this report) has been prepared in order to assist with the preparation of an environmentally responsible LSP and in keeping with the owner's vision for the site and the requirements of the DSP.

The majority of the environmental work undertaken for the Mundijong-Whitby DSP was based on desktop assessments. To assist in the preparation of the LSP for Mundijong North more detailed work was undertaken to identify any site specific environmental issues. The detailed work included the following:

- Level 2 Flora Survey:
    - Desktop search and review of the Department of Parks and Wildlife's (DPaW) Declared Rare and Priority Flora database and Threatened Ecological Communities database;
    - Examination of recent aerial photography and contour maps to provisionally identify vegetation types and condition;
    - Field survey in spring (September to October in this area) using plots or quadrats to record native and introduced species as well as a thorough site walkover of any areas of native vegetation;
    - Recording of any significant plant species using a hand-held GPS;
    - Description and mapping of vegetation types and vegetation condition;
    - Compilation of a flora list; and
    - Preparation of a stand-alone report.
- Level 1 Fauna Survey:
    - Desktop search and review of DPaW's Threatened Fauna database and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Listed Fauna;
    - Field survey to identify fauna habitat types and quality;
    - Assessment of the potential habitat value for the three species of Black Cockatoo (Carnaby's, Baudin's and Forest Red-tail), including searching for evidence of foraging, nesting and measurement of individual large trees for their diameter;
    - Description and mapping of fauna habitat and potential Black Cockatoo habitat areas; and
    - Preparation of a report.
- Fauna Survey of the Conservation Category Wetland.
- Preliminary Site Investigation (PRI) of Lot 2 Bishop Road and Lot 11 Taylor Road.

On completion of the field studies this EAR has been prepared to describe the environmental attributes, opportunities and constraints for the site and to assess the environmental impact of the LSP. Advice is also included on the potential impact of the Commonwealth EPBC Act.

2 EXISTING ENVIRONMENT

2.1 Land Use

The site has been cleared for pasture and used for farming purposes with two dwellings located on it (Plate 1). One is to the west of Taylor Road, north of Manjedal Brook, and one is to the east of Taylor Road near Bishop Road. The latter has been used as a dairy farm. Currently the site is mainly used for cattle grazing. A section of Manjedal Brook as well as a few wetlands are located on the site and these areas contain some native vegetation. There are some trees scattered through the site as well as a stand of planted trees in the central northern part of the site near Bishop Road.

Plate 1: Aerial Photography of the Site from 2013 (Landgate, 2014a)

2.2 Topography

The site slopes gently downwards from the east to the west ranging from 40m Australian Height Datum (AHD) in the north eastern corner to 24m AHD on the western side (DAFWA, 2014) (Figure 4). There is a small hill in the south western area where it rises to 30m AHD.

2.3 Landform and Soils

The site is located on the eastern side of the Swan Coastal Plain. The Swan Coastal Plain is generally flat and is approximately 20 to 30 kilometres wide, consisting of a series of geomorphic entities running parallel to the coastline.

The north western side of the site and continuing into the centre is situated within the Pinjarra System, with the south west corner and eastern side within the Bassendean System and a small section adjacent to Manjedal Brook near the east within the Forrestfield System (DAFWA, 2014) (Figure 5). The descriptions of these systems and related sub-soil phases are provided in Table 1.

Table 1: Soil Landscape Systems Found Within the Site

Reference	Description
Pinjarra System	Broad low relief plain west of the foothills, comprising predominantly Pleistocene fluvial sediments and some Holocene alluvium associated with major current drainage systems. Major soils are naturally poorly drained and many swamps occur.
Pinjarra P1d Phase (213Pj_P1d)	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and moderately susceptible to salinity.
Pinjarra P2 Phase (213Pj_P2)	Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay.
Pinjarra P3 Phase (213Pj_P3)	Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.
Pinjarra, B1 Phase (213Pj_B1)	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; Banksia dominant.
Bassendean System	Very low relief, leached, grey siliceous Pleistocene sand dunes, intervening sandy and clayey swamps and gently undulating plains. These occur immediately west of, and partly overlie, the Pinjarra Plain. Topography becomes more subdued from west to east.
Bassendean B1 Phase (212Bs_B1)	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2m; Banksia dominant.
Bassendean B2 Phase (212Bs_B2)	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.
Bassendean B2a Phase (212Bs_B2a)	Flat to very gently undulating sandplain with well to moderately well drained deep, bleached grey sands with an intensely coloured yellow B horizon that is usually well within 1 m of the surface.
Bassendean B6 Phase (212Bs_B6)	Imperfectly drained sandplain and broad extremely low rises. Deep or very deep grey siliceous sands.
Bassendean wet, swamp Phase (212BsW_SWAMP)	Wet soils with pale, deep sands and peaty sands.
Forrestfield System	Undulating foot slopes of the Darling and Whicher Scarps. The soil consists of duplex sandy gravels, pale deep sands and grey deep sandy duplexes. It contains woodlands of *E. marginata, calophylla* and wandoo and some *B. grandis*.
Forrestfield F3 Phase (213Fo_F3)	1-3% foot slopes with deep, imperfectly drained yellow and, less commonly, acidic gley duplex soils.

2.4 Acid Sulphate Soils

Acid Sulphate Soils (ASS) are naturally occurring soils and sediments containing sulphide minerals, predominantly pyrite (an iron sulphide). When undisturbed below the water table these soils are benign and not acidic (potential acid sulphate soils). However if the soils are drained, excavated or

exposed by lowering of the water table the sulphides will react with oxygen to form sulphuric acid (EPA, 2008).

The majority of the site is mapped in the Department of Environment Regulation (DER) *Acid Sulphate Risk Map for the Swan Coastal Plain* as having a low to moderate risk of ASS, however the wetland areas in the eastern section are mapped as having high to moderate risks (Landgate, 2014b) (Figure 6).

2.5 Contaminated Sites

The DSP report identified a potential contaminated site within the LSP area. The dairy located on the site is listed and is classified as intensive agriculture. The possible contaminants are listed as nutrients, pesticides and nitrates.

Aurora Environmental (Aurora) conducted a Preliminary Site Investigation (PSI) on Lot 2 Bishop Road and Lot 11 Taylor Road, the two lots on the site that are associated with the dairy (Aurora, 2014a). Lot 2 comprises land that is used for dairy pasture, while Lot 11 comprises the main dairy farm and associated infrastructure and buildings (Aurora, 2014a). There were a number of potential sources of contamination identified during a site walkover conducted by Aurora (2014a) that included a variety of contaminants. Aurora conducted targeted soil sampling during the walkover that found elevated levels of certain contaminants and therefore Aurora provides a number of recommendations that are summarised below in Section 5.3 (Aurora, 2014a).

2.6 Hydrology

2.6.1 Groundwater

The groundwater generally follows the topography, flowing from east to west across the region. The Perth Groundwater Atlas shows the groundwater levels at the site, as measured in May 2003, to range from 30m AHD in the east to 24m AHD in the west (DoW, 2014). These levels are an indication of low groundwater levels, having been measured following the dry season.

Brown Geotechnical and Environmental (BGE) have conducted groundwater bore monitoring with eleven bores being located on the site.

The results from the bores are consistent with the Perth Groundwater Atlas with the five bores located in the eastern section of the site ranging between 30.062 and 34.764m AHD in April 2009 following the dry season and the six bores located in the western section ranging between 23.957 and 26.424m AHD (BGE, 2009).

The bore results from September 2009 show that the groundwater level on the site increased by between 0.78 and 2.05m following the wet season, ranging between 31.091 and 35.984m AHD in the eastern section of the site and between 25.507 and 28.461m AHD in the western section (BGE, 2009).

2.6.2 Surface Water

There are three areas on the site that contain seasonal surface water. These areas consist of Manjedal Brook and two sumpland wetlands. Manjedal Brook is a narrow creek with seasonal east to west surface water flow through the site following winter rains. One of the sumplands (described further in Section 2.7 Wetlands) contains permanent above ground water, while the other sumpland

contains seasonal above ground water and dries out in summer and autumn. Both sumplands are connected by man-made open drains to Manjedal Brook.

2.7 Wetlands

2.7.1 Geomorphic Wetlands

The majority of the site is mapped in the DPaW *Geomorphic Wetlands of the Swan Coastal Plain* dataset as Multiple Use Wetlands (MUWs) (Landgate, 2014b) (Figure 7). Three Conservation Category Wetlands (CCWs) occur on the site, two of which are associated with Manjedal Brook and one with a sumpland. Table 2 describes the wetlands located on the site.

Table 2: The Wetlands Located on the Site

Wetland Classification	Wetland Type	UFI Number	Location
Conservation Category	Palusplain	14945	Manjedal Brook (west end).
Conservation Category	Palusplain	15446	Manjedal Brook (east end) plus a small section between the Conservation Category Sumpland and Soldiers Road.
Conservation Category	Sumpland	7835	On the south eastern side of the site.
Multiple Use	Sumpland	7834	On the south eastern side to the west of the Conservation Category Sumpland.
Multiple Use	Palusplain	15448	A small area near the south-eastern corner of the site.
Multiple Use	Palusplain	15447	A small area in the south-east corner.
Multiple Use	Palusplain	15785	Located over the majority of the site.

As shown in Table 2 Manjedal Brook has been mapped as a palusplain, however, it is actually a creek wetland and not a palusplain (Plate 2). In addition, the Conservation Category sumpland contains permanent water and is therefore more accurately classified as a lake. Below are the descriptions for the above mentioned wetland types:

- Lake: permanently inundated basin;
- Sumpland: seasonally inundated basin;
- Palusplain: seasonally waterlogged flat; and
- Creek: seasonally inundated channel.

Plate 2: A Section of Manjedal Brook Located on the Site

The definitions of the wetland management categories are outlined below in Table 3.

Table 3: Management Categories for Wetlands

Management Category	**General Description (Wetlands of the Swan Coastal Plan Volume 2b: Hill *et al.*, 1996)**	**Management Objectives (Wetlands of the Swan Coastal Plan Volume 2b: Hill *et al.*, 1996)**	**EPA Management Objectives (Guidance Statement 33; EPA, 2008)**
Conservation Category Wetland (CCW)	Wetlands which support high levels of attributes and functions.	To preserve wetland attributes and functions through reservation in national parks, crown reserves, state owned land and protection under environmental protection policies.	Highest priority wetlands. Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including: • reservation in national parks, • crown reserves and State owned land, • protection under Environmental Protection Policies, and • wetland covenanting by landowners. No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
Resource Enhancement Wetland (REW)	Wetlands which may have been partially modified but still support substantial ecological attributes and functions.	Priority wetlands. Ultimate objective is for management, restoration and protection towards improving their conservation value. These wetlands have the potential to be restored to conservation category. This can be achieved by restoring wetland structure, function and biodiversity. Protection is recommended through a number of mechanisms.	Priority wetlands. Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity. Protection is recommended through a number of mechanisms.

Management Category	General Description (Wetlands of the Swan Coastal Plan Volume 2b: Hill *et al*., 1996)	Management Objectives (Wetlands of the Swan Coastal Plan Volume 2b: Hill *et al*., 1996)	EPA Management Objectives (Guidance Statement 33; EPA, 2008)
Multiple Use Wetland (MUW)	Wetlands with few attributes which still provide important wetland functions	Use development and management should be considered in the context of water (catchment/strategic drainage planning), town (land use) and environmental planning through landcare.	Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

Plate 3 and 4 show the Conservation Category Sumpland and Multiple Use Sumpland located on the south eastern part of the site.

Plate 3: The Conservation Category Sumpland Located on the Site

Plate 4: The Multiple Use Sumpland Located on the Site

The wetlands on the site are not listed under the *Environmental Protection (Swan Coastal Plain Lakes) Policy 1992* (EPP lakes) (EPA, 1992).

2.7.2 Peel-Harvey Estuary

The site is located within the Peel-Harvey Estuary catchment area. The Estuary is a valuable water resource that is under stress from nutrients, phosphorus in particular, draining into it from the catchment area. Phosphorus is considered to be the critical nutrient for eutrophication in the Peel-Harvey Estuary, causing algal blooms. The current average nutrient input for the Peel-Harvey Estuary is estimated at a rate of 15kg of phosphorus/ha per annum and 150kg of nitrogen/ha per annum (Peel-Harvey WSUD Local Planning Policy, 2006). The Estuary has a long history of nutrient enrichment and algal blooms which are a major environmental concern in the region.

2.8 Vegetation and Flora

A Level 2 Flora and Vegetation Survey of the site was conducted by PGV Environmental from 30 September to 1 November 2011. The Level 2 Flora and Vegetation Survey was undertaken in accordance with Guidance Statement 51: *Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia.* A Flora and Vegetation Survey Report was compiled by Dr Paul van der Moezel from PGV Environmental (2012). Below is a summary of the findings.

A total of 71 flora species were recorded, consisting of 29 native species and 42 introduced species. The high percentage of introduced species (59%) reflects the largely cleared condition of the site for cattle grazing as well as the degraded creek line. The eastern CCWs and adjacent area contained the largest number of species with a total of 39 species of which 18 are introduced. In Manjedal Brook and along the top of the creek bank a total of 31 species were recorded, however, only 5 of these species were native.

Manjedal Brook and the eastern wetlands are the only sections of the site that contain areas of intact native vegetation. There is no intact dryland vegetation that occurs on the site. Only seven native tree and shrub species were recorded on dryland soils in small pockets of degraded vegetation. These dryland species were either in close proximity to the eastern wetlands on elevated dunes or located as remnant trees in the paddocks.

A dense stand of planted trees is located near the dairy and include River Red Gum (*Eucalyptus camaldulensis*), Pines (*Pinus radiata*), Sheoak (*Casuarina cunninghamiana*) and Tasmanian Blue Gum (*Eucalyptus globulus*).

The site contains eleven mapped vegetation associations. Most are associated with the wetlands and creek (Figure 8). These vegetation associations are described in Table 4.

Table 4: Vegetation Associations Mapped on the Site

Vegetation Type	Area	Description
CcMp	Wetland	*Corymbia calophylla* (Marri)/ *Melaleuca preissiana* (Paperbark) Low Woodland over *Lepidosperma longitudinale* Sedgeland.
AlBa	Wetland	*Agonis linearifolia* Tall Shrubland over *Baumea articulata* Closed Sedgeland.
BaLl	Wetland	*Baumea articulata/Lepidosperma longitudinale* Closed Sedgeland.
Ba	Wetland	*Baumea articulata* Closed Sedgeland.
MpAlBaLl	Wetland	*Melaleuca preissiana* Low Woodland over *Agonis linearifolia* Tall Open Scrub over *Baumea articulata/Lepidosperma longitudinale* Open Sedgeland
MpAlLl	Wetland	*Melaleuca preissiana* Low Woodland over *Agonis linearifolia* Tall Open Scrub over *Lepidosperma longitudinale* Open Sedgeland
Ll	Wetland	*Lepidosperma longitudinale* Closed Sedgeland
Jp	Wetland	*Juncus pallidus* Sedgeland
JfAf	Wetland	*Jacksonia furcellata/Astartea fascicularis* Tall Shrubland
ErMr	Creek Line	*Eucalyptus rudis/Melaleuca rhaphiophylla* Low Open Forest
ErCcMr	Creek Line	*Eucalyptus rudis/Corymbia calophylla/Melaleuca rhaphiophylla* Open Forest

2.8.1 Vegetation Condition

The vegetation condition over the site is mostly Completely Degraded due to the high amount of clearing for agricultural purposes. The remaining vegetation is rated as follows:

- The remnant vegetation along Manjedal Brook is all rated as Degraded due to the very high degree of disturbance of the understorey by clearing and grazing.
- The Conservation Category Sumpland on the eastern boundary of the site contains a range of conditions but is mostly in Very Good to Excellent condition.
- The vegetation around the perimeter of the Conservation Category Sumpland rapidly changes to Good and Degraded due to the clearing of the overstorey and understorey species extending down to the wetland boundary.
- The vegetation within the CCW palusplain, linking to the eastern vegetation in the Soldiers Road reserve, has been retained in better condition and is rated as Good to Very Good.
- The condition of the vegetation on the eastern side of the Multiple Use Sumpland ranges from Good to Degraded. The vegetation in this area occurs on land that appears to have been significantly earth-worked in the past and most likely represents regrowth vegetation.

Table 5 gives the descriptions for the vegetation conditions.

Table 5: Vegetation Condition Rating Scale

Condition	Description
Pristine	Pristine or nearly so, no obvious signs of disturbance.
Excellent	Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
Very Good	Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
Good	Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
Degraded	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
Completely Degraded	The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Source: Government of Western Australia, 2000.

Given the permanent water-body of the Conservation Category Sumpland the complete absence of introduced Bulrush (*Typha orientalis*) is surprising. *Typha orientalis* is an aggressive coloniser of wetlands and can outcompete the native Jointed Twig Rush (*Baumea articulata*) which tolerates the same level of inundation. Maintaining the CCWs free of Bulrush is an important management target for the wetlands.

Manjedal Brook contains a short section of approximately 100m which contains dense Blackberry (*Rubus ulmifolius*). However, Blackberry is completely absent from the remainder of the Brook on the site. The very low abundance of Arum Lily (*Zantedeschia aethiopica*) and absence of Watsonia (*Watsonia meriana* var. *bulbillifera)* from the Brook is encouraging. These two species can become dominant weeds in creek lines and require considerable resources to eradicate the plants. Maintaining the Brook free of Arum Lily and Watsonia is an important management target for the Brook.

2.8.2 Conservation Significant Flora

None of the plant species recorded are Threatened (Declared Rare) or Priority listed flora. *Dielsia stenostachya* is a sedge species listed as significant in Bush Forever as it is endemic to the Swan Coastal Plain and occurs in wetlands. A small stand of this species occurs in the Marri/Paperbark woodland fringing the northern boundary of the Conservation Category Sumpland.

No species listed under the Commonwealth EPBC Act occur on the site.

2.8.3 Conservation Significant Vegetation

The vegetation of Manjedal Brook belongs to both the Guildford and Forrestfield Complexes while the vegetation of the eastern CCWs and MUW is part of the Forrestfield Complex. Only 5% of the original extent of the Guildford Complex and 17.5% of the Forrestfield Complex remains on the Swan Coastal Plain (EPA, 2006). Only a very small percentage of the original extent is contained in secure reserves, with 0.2 and 0.3% for the Guildford and Forrestfield Complexes, respectively.

The Environmental Protection Authority (EPA) considers that vegetation complexes with less than 10% remaining are regionally significant and that for these complexes there is a presumption that all areas of remnant native vegetation where less than 10% remains will be retained and conserved. The 5% retention amount for the Guildford Complex is below the target and the 17.5% for the Forrestfield Complex is slightly above this target. Despite the low figures for retention and reservation of the two vegetation complexes on the site, none of the remnant vegetation was listed as regionally significant according to the State Government's Bush Forever process (Government of Western Australia, 2000).

Within the Shire, only 3% of the original extent of the Guildford Vegetation Complex that occurred in the Shire and 2% of the Forrestfield Complex remains. As a result, the Shire of Serpentine-Jarrahdale Stage 1 Local Biodiversity Strategy (Ironbark Environmental and Sustainable Development, 2007) recommends the protection of all Local Natural Areas (LNAs) that contain the Guildford and Forrestdale Vegetation Complexes. LNAs are natural areas that are outside DPaW managed reserves, regional parks and Bush Forever sites. The vegetation in Manjedal Brook and the eastern CCWs would be considered LNAs.

The vegetation on the site is considered to be representative of Floristic Community Types (FCTs) 11 and 13. Neither FCT is a Threatened or Priority Ecological Community at the State level or listed under the Commonwealth EPBC Act.

According to the DSP Environmental Study (SMEC, 2009) all remnant vegetation, regardless of condition, is significant due to the very high extent of clearing (88.7%) in the Whitby/Mundijong area.

The Soldiers Road Reserve adjacent to the eastern part of the site, which is part of the Byford to Serpentine Rail/Road Reserves, contains regionally significant vegetation which is identified as Bush Forever Site 350. The Reserves contain several Threatened Ecological Communities (TECs) and Declared Rare and Priority Flora.

2.9 Fauna

A Level 1 Fauna Risk Assessment of the site was undertaken by Terrestrial Ecosystems. The purpose of the assessment was to provide information to assess the potential impact of vegetation clearing on the fauna assemblages located on the site.

The methodology broadly followed that described in the EPA Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA, 2002), Guidance Statement No. 56*: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA, 2004) and

the EPA/DPaW *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (Hyder *et al*. 2010).

A Level 1 Fauna Assessment Report was compiled by Terrestrial Ecosystems (2011) and is summarised below.

2.9.1 Fauna Habitat

The site contains four habitat types as described below by Terrestrial Ecosystems (2011):

- Fenced highly disturbed pasture, housing, a dairy and an area containing planted trees in the northern paddock that is used for burying deceased cattle;
- A creek that runs east-west through the project area that supports mature Flooded Gums (*Eucalyptus rudis*), Paperbark (*Melaleuca rhaphiophylla*) and a small number of Marri (*Corymbia calophylla*) trees;
- A CCW and a MUW (both sumplands) in the south-east corner; and
- Road side verges that support Flooded Gums (*Eucalyptus rudis*) and Marri (*Corymbia calophylla*) trees.

2.9.2 Conservation Significant Fauna

Out of the Conservation Significant species that are identified under the EPBC Act, the WA *Wildlife Conservation Act 1950* (WC Act) and on DPaW's Priority Fauna List to occur in the Mundijong area there are 16 species that may occur on the site as listed by Terrestrial Ecosystems (2011) (Table 6).

Table 6: Conservation Significant Fauna Species that may occur on the Site

Species	**Status under the *Wildlife Conservation Act 1950***	**Status under the *EPBC Act 1999***	**Comment on potential impact that vegetation clearing will have on conservation significant species**
Calyptorhynchus latirotris Carnaby's Black Cockatoo	Schedule 1	Endangered	Likely to be found in the project area. Low potential impact.
Botaurus poiciloptilus Australasian Bittern	Schedule 1	Endangered	Seen in the project area. Low potential impact.
Calyptorhynchus banksii naso Forest Red-tailed Black Cockatoo	Schedule 1	Vulnerable	Seen in the project area. Low potential impact.
Calyptorhynchus baudinii Baudin's Black Cockatoo	Schedule 1	Vulnerable	Seen in the project area. Low potential impact.
Apus pacificus Fork-tailed Swift	Schedule 3	Migratory	May be found in the vicinity of the project area. Low potential impact.
Haliaeetus leucogaster White-bellied Sea-eagle	Schedule 3	Migratory	May infrequently fly over the project area. Low potential impact.
Merops ornatus Rainbow Bee-eater	Schedule 3	Migratory	May be found in the vicinity of the project area. Low potential impact.

Species	Status under the *Wildlife Conservation Act 1950*	Status under the *EPBC Act 1999*	Comment on potential impact that vegetation clearing will have on conservation significant species
Calidris acuminata Sharp-tailed Sandpiper	Schedule 3	Migratory Wetland	May infrequently be seen in the project area. Low potential impact.
Ardea alba Great Egret	Schedule 3	Migratory Wetland	May infrequently be seen in the project area. Low potential impact.
Ardea ibis Cattle Egret	Schedule 3	Migratory Wetland	May infrequently be seen in the project area. Low potential impact.
Tringa glareola Wood Sandpiper	Schedule 3	Migratory Wetland	May infrequently be seen in the project area. Low potential impact.
Tringa stagnatilis Marsh Sandpiper	Schedule 3	Migratory Wetland	May infrequently be seen in the project area. Low potential impact.
Falco peregrinus Peregrine Falcon	Schedule 4		May infrequently fly over the project area. Low potential impact.
Hydromys chrysogaster Water Rat	Priority 4		May be found in the project area, particularly around the wetland. Low potential impact.
Acanthorhynchus superciliosus Western Spinebill	Priority 4		May be in the project area. Low potential impact.
Isoodon obesulus fusciventer Southern Brown Bandicoot	Priority 5		May be found in the project area, particularly around the wetland. Low potential impact.

The Level 1 fauna survey included a targeted survey for habitat of the three conservation significant Black Cockatoo species (Terrestrial Ecosystems, 2011). The survey identified 317 potential breeding trees with a trunk diameter of 500mm or greater at breast height. Twelve of the trees may have contained a hollow. Several of the hollow-containing trees were used for nesting by Australian Ringneck Parrots and Galahs and one contained a nest of a Nankeen Kestrel. No evidence of nesting by any Black Cockatoos was observed. No known breeding sites for Black Cockatoos are known from the site.

Quality foraging habitat was identified by Terrestrial Ecosystems (2011) in the Marri trees along Manjedal Brook.

The proposed development of the site is determined to have a low potential impact on all of the significant species due to the clearing of highly disturbed pasture and the retention of Manjedal Brook and the CCWs and their respective buffers.

Following the Level 1 Fauna Risk Assessment Terrestrial Ecosystems undertook a targeted fauna trapping program (6-10 May 2012) and avian survey (25 and 29 April 2012) of the Conservation Category Sumpland. It was confirmed that Southern Brown Bandicoots are present on the site in the eastern CCW area, particularly in the vegetation to the east of the Conservation Category Sumpland

(Terrestrial Ecosystems, 2012). No Water Rats or conservation significant avian species were recorded, however evidence was found to suggest that a small population of Water Rats may possibly occur in the Conservation Category Sumpland area (Terrestrial Ecosystems, 2012).

A large number of Long-necked Turtles (*Chelodina oblonga*) were captured during the trapping program indicating that the Conservation Category Sumpland supports a large population of this species (Terrestrial Ecosystems, 2012). The Long-necked Turtle is not a significant species, however the turtles on the site are likely relying on both of the sumplands for survival as well as on the higher sandy area between the sumplands for laying their eggs (Terrestrial Ecosystems, 2012).

2.9.3 Biodiversity Value

The areas of the site that have been cleared for farming purposes have almost no ecological value for native fauna (Terrestrial Ecosystems, 2011). There are areas of the site, however, that have some value for native fauna as described by Terrestrial Ecosystems (2011). These areas are listed below.

- The eastern Conservation Category Sumpland is in Very Good to Excellent condition and is used by a number of aquatic birds and amphibians. Long-necked Turtles and Southern Brown Bandicoots are present in the Conservation Category Sumpland area (Terrestrial Ecosystems, 2012). Western Pygmy Perch, Nightfish and Water Rats were not captured in the Conservation Category Sumpland area, however they may be present.
- The fenced section of the Manjedal Brook which excludes cattle consists of reasonable habitat for fauna species, especially for avian fauna. The creek may support Western Pygmy Perch, Western Minnows and Nightfish. These species are not threatened species.
- There are a number of significant mature trees on the site, the majority occurring along Manjedal Brook and surrounding the eastern wetlands, with some currently being used by Galahs, Australian Ringneck Parrots and Nankeen Kestrels as nesting sites.

2.9.4 Ecological Linkages

Manjedal Brook is identified in the DSP as a Local Ecological Linkage. Local Ecological Linkages in the Shire are predominantly associated with waterways and are proposed to be rehabilitated to facilitate the movement of wildlife through the area.

The site abuts a Regional Ecological Linkage that runs north-south within the Soldiers Road Reserve. The road reserve contains regionally significant vegetation which is identified as Bush Forever Site 350. The vegetation in the road reserve links to other important Bush Forever sites within Wright Road to the south of Mundijong, Mundijong Road, and parcels of Bush Forever adjacent to Soldiers Road within the Shire.

The Regional Ecological Linkage adjacent to the site would regularly be used by avian fauna to travel through the surrounding areas of bushland (Terrestrial Ecosystems, 2011). The vegetation located on the site in and around the eastern CCWs is not part of Bush Forever Site 350 but is contiguous with the vegetation in the road reserve and the CCW palusplain extends into this area. The CCWs and the section of Manjedal Brook located on the site are therefore important ecological linkages for fauna species and the eastern part of the site should be considered part of the north-south Regional Ecological Linkage. As a result the eastern part of the site consisting of the wetland areas and Manjedal Brook should be preserved.

2.9.5 Potential Pest Species

There are a number of wetlands on the site and in the surrounding area that contain permanent and semi-permanent areas of water, therefore mosquitoes and midges may pose a potential risk to future residents on the site.

Feral cats may pose a potential threat to the native fauna in the Manjedal Brook and CCW areas on the site, especially once there are more residential housing. Foxes are also a pest species and their presence on the site has been confirmed (Terrestrial Ecosystems, 2012). These two pest species would prey on the native species, reducing their numbers.

Rabbits are a potential issue and will cause damage to native vegetation and limit the rehabilitation of native flora.

2.10 Heritage

2.10.1 Aboriginal Heritage

An archaeological assessment was conducted on the majority of the site by Thomson Cultural Heritage Management (Thomson and Neuweger, 2013) as commissioned by Ethnosciences in March 2012.

Below is a summary of the methodology used for the archaeological survey and assessment. For more detail refer to the report by Thomson and Neuweger (2013).

- Prior to conducting the archaeological survey and assessment a desktop review of a number of resources was carried out to determine the appropriate methodology;
- Research questions were posed to guide the field investigations and assessment of archaeological significance;
- A purposive sampling methodology was used, based on the predictive model developed for the local Pinjarra Plains geomorphic unit;
- Sample areas were selected using the site distribution model as a guide as well as using aerial photography and environmental and soils maps. Several control sample areas were also selected;
- The surface survey consisted of intensive pedestrian survey with parallel transects spaced between 5-10m;
- All archaeological sites located during the survey were recorded to Section 18 level in order to provide sufficient information about each archaeological site. Specific information that was to be recorded is outlined by Thomson and Neuweger (2013);
- Specific artefact analyses methods were employed based on the research questions;
- To assess the extent of and type of artefacts occurring in the subsurface of sites MJ-01, MJ-02, MJ-04 and MJ-05 a variety of excavation methods were used consisting of test pits, probe holes and mechanically excavated trenches;
- The artefacts were recorded and catalogued following the research questions. The classification and lithology of the artefacts are outlined by Thomson and Neuweger (2013);
- Soil analysis was carried out on soil obtained from the mechanically excavated trenches;
- Carbon dating was carried out on four carbon samples;
- Taphonomic analysis was carried out; and

- Archaeological sites found during the survey and assessment were assessed for archaeological significance.

The archaeological survey was conducted between 14 March and 16 May 2012. The site contains one Aboriginal Site that has been recorded previously (DAA Id 3648 Soldiers Road Mundijong, an artefact scatter with archaeological deposit) and five new archaeological sites that were recorded during the survey (Figure 9). The new sites include four artefact scatters (MJ-01, MJ-02, MJ-03 and MJ-04) and one modified tree (MJ-08). An extension to DAA Id 3648 was also recorded (MJ-05) as well as fourteen isolated artefacts. All of the artefacts were located on higher white Bassendean dune sands, following the predictive model.

To determine the significance of the archaeological sites for a Section 18 application an understanding of the subsurface content was required and a Section 16 permit was applied for and received in October 2012 (Permit Number 527). Test excavations were carried out at four of the archaeological sites (MJ-01, MJ-02, MJ-04 and MJ-05) between 4 and 23 January 2013. The excavations confirmed that all of the artefact scatters had subsurface components. Table 7 summarises the findings and significance of the archaeological sites.

Table 7: A Summary of the Findings at the Archaeological Sites Located on the Site and their Significance

Site	Artefact Type	Approximate Size (sq m)	Artefact Density	Raw Material Diversity	Site Use	Significance
MJ-01	Large open stone scatter with subsurface deposit.	16580	High	Medium	Occupation site for task-specific activity such as core reduction, tool trimming and re-sharpening.	Important and significant at a regional level.
MJ-02	Medium sized artefact scatter with subsurface deposit.	9354	High	Medium	Short term camp for trimming, re-sharpening tools and core reduction activities.	Important and significant at a local level.
MJ-03	Small stone artefact scatter with potential archaeological deposit (only surface component recorded).	663	Low	Medium	Based on surface component only. Task-specific activity area for core reduction and tool maintenance activities or a short-term or infrequently used occupation site.	Important and significant at a local level.
MJ-04	Small sized artefact scatter with subsurface deposit.	303 (surface) 1342 (subsurface)	Low	Medium	Occupation site visited only occasionally for activities including core reduction, tool trimming and re-sharpening.	Important and significant at a local level.

Site	Artefact Type	Approximate Size (sq m)	Artefact Density	Raw Material Diversity	Site Use	Significance
DAA Id 3648 and MJ-05	Extensive open stone artefact scatter with grinding material and dated subsurface archaeological deposit.	149900	Low to medium	Medium	Long term base camp used by family groups, with a wide variety of activities conducted including the making and maintenance of tools and the consumption of fauna and flora.	Important and significant at a regional and state level.
MJ-08	Modified tree (*Eucalyptus marginata)*	N/A	N/A	N/A	The use of bark for making artefacts, for example; a shield or container.	Important and significant at a local level.

The Preliminary Draft LSP developed by Peet Limited will result in four of the archaeological sites being impacted upon from proposed residential development (Thomson and Neuweger, 2013). These sites consist of MJ-01, MJ-02, MJ-04 and MJ-05. The modified tree (MJ-08) may also be impacted upon by a proposed road reserve.

2.10.2 Cultural Heritage

The following sources were used to determine the presence of actual or potential sites or features of cultural heritage significance at federal, state and local government level within the site:

- World Heritage Sites;
- National Heritage Sites;
- Commonwealth Heritage Sites;
- Sites on the register of the National Estate; and
- Sites listed in the Shire of Serpentine-Jarrahdale Municipal Heritage Inventory List.

The search of these sources revealed that there are no listed cultural heritage sites within the site (Landgate, 2014b; Heritage Council of Western Australia, 2014; DoE, 2014; SSJ, 2014).

2.11 Noise and Odour

2.11.1 Noise

The site is impacted by two current noise emitting sources and one future potential source. The current sources consist of the dairy located to the east of Taylor Road in the northern part of the site and the railway. The dairy is likely to be closed down before subdivision and construction works commence and will therefore not be an issue. A freight railway currently runs along the northern and eastern boundaries of the site opposite Bishop Road and Soldiers Road. The unmade Tonkin Highway Reserve is located adjacent to the western boundary of the site. The highway is likely to result in future transport noise impacts.

Environmental noise from the current railway and the future Tonkin Highway is likely to impact on the amenity of the lots on the site. Vibration from the railway is also likely to have an impact on future residents. Under State Planning Policy No. 5.4 *Road and Rail Transport Noise and Freight Considerations in Land Use Planning* (SPP 5.4) (WAPC, 2009) transport noise from within major transport corridors, including freight routes, and its impact on noise sensitive land uses must be investigated.

A primary school is located to the north east of the site on the opposite side of the railway. Noise emissions will need to be managed during the subdivision or development application process pursuant to the *Environmental Protection (Noise) Regulations 1997.*

2.11.2 Odour

The DSP identified the dairy on the site as an odour emitting source that impacts on the site. As identified in section 2.11.1 the dairy is likely to be shut down and will not be an issue when development commences.

There is, however, a wastewater pump station proposed to be developed close to the south-western corner of the site to the south of Scott Road. The wastewater pump station will require a buffer to odour sensitive land uses such as residential dwellings (refer to section 5.12).

3 LEGISLATION, POLICY AND GUIDELINES

The environmental assessment of this site has taken into consideration the following legislation, policy and guidelines and these will guide the required and expected management outcomes from the Commonwealth, State and Local government agencies.

3.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Australian Government's central piece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important heritage places, ecological communities, flora and fauna that are defined in the Act as matters of national environmental significance.

The EPBC Act applies to the following seven matters of national environmental significance:

- World heritage sites;
- National heritage places;
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed);
- Nationally threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions.

A significant impact, under the EPBC Act, is determined by the value, quality and sensitivity of the environment which is to be impacted and the magnitude, duration, intensity and geographic extent of the impacts (DoE, 2013). *The Matters of National Environmental Significance. Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999* (DoE, 2013) provides a guide for determining the significance of an impact. Proposed actions that are deemed to have a significant impact should be referred to the Minister.

The EPBC Act applies to 'actions' which:

- Have a 'significant impact' on 'matters of national environmental significance';
- Are undertaken by Commonwealth government agencies and have a significant impact on the environment anywhere in the world; or
- Are undertaken by any person and have a significant impact on Commonwealth land (even if the activity is not actually carried out on the Commonwealth land).

According to the Significant Impact Guidelines 1.1 an action is likely to have a significant impact on an endangered and vulnerable species if there is a possibility that it will trigger any one of nine criteria as listed in Table 8 and 9.

Table 8: Significant Impact Criteria for Endangered Species

Criteria	Carnaby's Black Cockatoo
Lead to a long-term decrease in the size of a population	No
Reduce the area of occupancy of the species	No
Fragment an existing population into two or more populations	No
Adversely affect habitat critical to the survival of a species	No
Disrupt the breeding cycle of a population	No
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	No
Introduce disease that may cause the species to decline	No
Interfere with the recovery of the species	No

Table 9: Significant Impact Criteria for Vulnerable Species

Criteria	Baudin's Black Cockatoo	Forest Red-tail Black Cockatoo
Lead to a long-term decrease in the size of an important population of a species	No	No
Reduce the area of occupancy of an important population	No	No
Fragment an existing important population into two or more populations	No	No
Adversely affect habitat critical to the survival of a species	No	No
Disrupt the breeding cycle of an important population	No	No
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	No	No
Result in invasive species that are harmful to a vulnerable species becoming established in the Vulnerable species' habitat	No	No
Introduce disease that may cause the species to decline	No	No
Interfere substantially with the recovery of the species.	No	No

3.2 State Legislation

3.2.1 Environmental Protection Act 1986

The EPA considered the Draft South East Corridor Structure Plan, Metropolitan Scheme Amendment No. 966/13 and Stormwater Management Strategy and Plans for New Urban Development at Byford and Mundijong. The EPA then provided advice in EPA Bulletin 798 (1995) as a Strategic Environmental Assessment, which is not a formal environmental impact assessment under Part IV of the *Environmental Protection Act 1986* (EP Act).

It was concluded by the EPA that the Draft South East Corridor Structure Plan, Metropolitan Scheme Amendment No. 966/13 and Stormwater Management Strategy and Plans for New Urban Development at Byford and Mundijong could be made environmentally acceptable. The following main environmental objectives were identified by the EPA that need to be met by the proposal:

- Avoid and minimise environmental damage to wetlands of local and regional significance;
- Reserve land that has been identified in the System 6 Report as having conservation and recreation value;
- Protect remnant bushland communities identified in the system 6 review;
- Ensure changes to land use within the catchment to the Peel Harvey estuarine system are controlled so as to avoid and minimise environmental damage particularly in terms of nutrient export; and
- Ensure suitable transport strategies have been adopted to ensure that air quality and greenhouse gas emissions in the South East Corridor meet health and environmental standards.

During the structural planning process for the Mundijong Whitby DSP these environmental objectives were taken into consideration.

Under the EP Act, clearing of native vegetation requires a permit from the DER unless there is an exemption under the *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. Proposals that have approval by means of a Ministerial Statement and which are implemented in accordance with that Statement are exempt from requiring a clearing permit to clear native vegetation. Clearing in accordance with an approved subdivision is also exempt.

It is likely that any clearing that will be required for the development will be considered at the subdivision stage by the DER and is likely to be exempt from the requirements of a clearing permit.

3.2.2 Wildlife Conservation Act 1950

The WC Act protects all native species unless declared otherwise and they cannot be captured or killed without a license. There are certain fauna species that are also determined to require special protection and therefore additional consideration is given for the protection and conservation of these species. The lists of species under the WC Act are regularly updated and maintained by DPaW.

All flora species are protected by the WC Act, specifically Declared Rare Flora. It is an offence to take rare flora from sites without written consent.

3.2.3 Aboriginal Heritage Act 1972

The AHA protects all Aboriginal sites whether or not they are known and registered under the AHA. The site contains six Aboriginal sites and the management strategies for the site are summarised in section 5.10 and addressed in detail in the Aboriginal Heritage Report for the site (Thomson and Neuweger, 2013).

3.3 State Policy

3.3.1 State Planning Policy No. 2.1 The Peel-Harvey Coastal Plain Catchment (SPP 2.1)

SPP 2.1 was developed to ensure that land use changes within the Peel-Harvey Estuary System that are likely to cause environmental damage are brought under planning control and are prevented (WAPC, 2003). Generally the policy states that any development, including the construction of buildings, should aim to:

- Reduce the nutrient load discharging into the Peel-Harvey Estuary catchment;
- Encourage the retention and rehabilitation of existing remnant vegetation;
- Have subdivision maximising consumption and retention of drainage on site; and
- Consider the treatment of soils within open space with nutrient retention soil amendment, particularly in areas where phosphorus retention is low.

The site is located within the Peel-Harvey Coastal Plain Catchment and as such the considerations and requirements of this policy have been considered as part of this EAR.

3.3.2 State Planning Policy No. 2.8 Bushland Policy for the Perth Metropolitan Region

SPP 2.8 in conjunction with Bush Forever (Government of Western Australia, 2000) seeks to ensure the protection of at least 10 per cent of the original extent of each vegetation complex within the Perth Metropolitan Region. SPP 2.8 was developed to ensure that bushland protection and management issues are appropriately addressed and integrated as a part of future land use. Bush Forever identified approximately 51,200 hectares of regionally significant vegetation for retention. The management of these areas include reservation and acquisition by the State government, negotiated planning solutions with owners who are seeking urban and/or industrial development and advice, assistance and incentive programs to support private conservation.

Bush Forever Site 350 'Byford to Serpentine Rail/Road Reserves and Adjacent Bushland' is located adjacent to the eastern part of the site in the Soldiers Road Reserve. Bush Forever Site 350 contains regionally significant vegetation consisting of several TECs and Declared Rare and Priority Flora (Government of Western Australia, 2000; SMEC, 2009).

3.3.3 State Planning Policy No. 2.9 Water Resources

SPP 2.9 aims to ensure the protection and appropriate management of water resources in line with state guidelines as included within the planning framework. The broad aims of this policy are to:

- Protect, conserve and enhance water resources;
- Assist in ensuring the availability of suitable water resources to maintain essential requirements for human and other biological life and to maintain or improve the quality and quantity of water resources; and

- Promote and assist in the management and sustainable use of water resources.

As a part of implementing this policy, the Better Urban Water Management framework was developed (WAPC, 2008). The framework provides detail on how water resources should be considered at each stage of planning by identifying the various actions and investigations required with regard to regional and local planning strategies, town planning schemes, structure plans, subdivisions, strata subdivision and development applications (WAPC, 2008).

3.3.4 State Planning Policy No. 5.4 Road and Rail Transport Noise and Freight Considerations in Land Use Planning

SPP 5.4 addresses transport noise from within major transport corridors, including freight routes, and its impact on noise sensitive land uses. The policy aims to:

- Protect people from unreasonable levels of transport noise by establishing a standardised set of criteria to be used in the assessment of proposals;
- Protect major transport corridors and freight operations from incompatible urban encroachment;
- Encourage best-practice design and construction standards for new development proposals and new or redeveloped transport infrastructure proposals;
- Facilitate the development and operation of an efficient freight network; and
- Facilitate the strategic co-location of freight handling facilities.

Major transport (road) corridors are defined as:

- State roads and national highways;
- Urban primary distributors as described on the metropolitan functional road hierarchy (MRWA, local government) network;
- Other urban roads carrying more than 20,000 vehicles per day;
- Primary freight roads (Perth metropolitan region);
- Primary freight roads (South-West region); and
- Primary freight roads (State-wide).

The Tonkin Highway Reserve which will be a future extension of the current Tonkin Highway is adjacent to the western boundary of the site. The Tonkin Highway is defined as a State Road by Main Roads Western Australia (2014) and therefore the requirements of SPP 5.4 have been considered as part of this assessment. There is also a railway that runs along the northern and eastern boundaries of the site.

The noise criteria outlined in SPP 5.4 is applied to the outdoor areas of sensitive premises and describes the level of noise which must be met. The noise criteria are provided below in Table 10. The noise target is the level of noise in which, when this target or lower is achieved, no further mitigation of noise is required. The noise limit represents an acceptable margin for compliance, in which a range of noise mitigation methods can be utilised to reach the noise target. In the Policy it states that in Greenfield developments there is an expectation that the design of the proposal will be consistent with achieving the target level.

Table 10: Noise Criteria

Time of Day Noise	Noise Target	Noise Limit
Day (6am – 10pm)	LAeq(Day) = 55dB (A)	LAeq(Day) = 60dB(A)
Night (10pm – 6am)	LAeq(Night) = 50dB(A)	LAeq(Day) = 55dB(A)

The noise criteria can be met through a variety of mitigation measures. An acoustic assessment at the subdivision stage of planning will need to be undertaken by the developer.

3.3.5 Wetlands Conservation Policy for Western Australia

The *Wetland Conservation Policy for Western Australia* (Government of Western Australia, 1997) outlines the State government's commitment to identify, maintain and manage the State's wetland resources which include lakes, swamps, marshes, springs, damplands, impoundments, intertidal flats and mangroves.

The objectives of the Policy are to:

- Prevent further loss or degradation of valuable wetlands and wetland types;
- Include viable representation of all major wetland types within the conservation reserve;
- Maintain viable wild populations which include the species and genetic diversity of wetland dependant flora and fauna; and
- Increase community awareness and appreciation for wetlands.

The site contains three CCWs, including Manjedal Brook. The objectives of the Wetland Conservation Policy have been considered in this assessment. A Wetland Management Plan for the retained wetlands and a Foreshore Management Plan for Manjedal Brook will need to be completed for the development.

3.3.6 Environmental Protection Authority Position Statement No. 4 Environmental Protection of Wetlands

EPA Position Statement No. 4 *Environmental Protection of Wetlands* defines the important wetland values and functions of wetlands. It provides the EPA's position on protecting these values by establishing principles for wetland protection. The EPA recognises that the continued degradation and loss of wetland habitat in Western Australia, particularly on the Swan Coastal Plain, is a threat to conservation of wetlands and wetland biodiversity therefore maintaining that the remaining wetlands are important and require protection.

The key environmental values and functions of wetlands include:

- Primary production – provide nourishment for a variety of organisms;
- Recreational and landscape amenity – provide a refuge for wildlife and humans and have an intrinsic natural beauty;
- Hydrological balance – provide important flood control and stormwater detention function;
- Water quality protection – remove pollutants such as sediments, nutrients, organic and inorganic matter and some pathogens; and
- Wildlife habitat – provides a multitude of ecological niches and supports a variety of flora and fauna.

The principles the EPA will consider in determining potential impact on wetlands include:

- Protect, sustain and where possible restore biological diversity of wetland habitats;
- Protect the quality of wetlands through the application of ecological sustainable development and "wise-use". The term "wise-use" is taken from the Ramsar Convention and is taken to mean the sustainable utilisation for the benefit of humankind in a way compatible with the natural properties of the ecosystem, in which human use of wetland is undertaken in such a way that it may yield the greatest continual benefit for all; and
- That there is no net loss of wetland values and functions (aspirational goal).

There are three wetlands of conservation significance located on the site and they will need to be considered in terms of:

- Retention of wetlands;
- Management of wetlands to retain values and attributes; and
- Provision and management of buffers.

3.3.7 Environmental Protection Authority Guidance Statement No. 33 Environmental Guidance for Planning and Development

The purpose of EPA Guidance Statement No. 33 *Environmental Guidance for Planning and Development* (EPA, 2008) is to outline the significance of environmental factors and to provide the key definitions associated with the environmental factors. Ensuring that environmental factors are considered in line with the EPA's principals and objectives and within the planning framework is what this EAR is primarily targeted at. In particular, EPA Guidance Statement No. 33 aims to:

- Provide an overview to environmental protection processes and information;
- Describe the referral and environmental impact assessment process under Part IV of the EP Act; and
- Provide the EPA's position and advice on a range of environmental factors, outlining how to protect, conserve and enhance the environmental values.

3.4 Shire of Serpentine-Jarrahdale

The Shire has a number of Local Planning Policies (LPPs) that detail the Shire's expectations with regard to planning and development as well as the factors that need to be considered throughout the planning process. Key LPPs applicable to the site and the environmental values within the site are outlined below:

- LPP No. 4 *Revegetation Strategy*;
- LPP No. 6 *Water Sensitive Design*;
- LPP No. 22 *Water Sensitive Urban Design*;
- LPP No. 26 *Biodiversity Planning*; and
- LPP No. 28 *Street Trees*.

4 LOCAL STRUCTURE PLAN

A Preliminary Draft LSP has been prepared by Peet Limited for the Mundijong North site (Figure 10). The Preliminary Draft LSP includes the following aspects:

- The majority of the site will be developed as Residential R20 lots with R30 lots adjoining green spaces;
- A number of Residential R10 lots are proposed to be situated in the areas of the site more likely to be impacted by transport noise and to an extent act as buffers to the smaller lots;
- Two primary schools;
- Retention of the Conservation Category Wetland and Multiple Use Wetland in Public Open Space;
- A community activity node within the Wetland POS area;
- Retention of Manjedal Brook and a 50m buffer in Public Open Space;
- A Public Open Space network that provides for active recreation and drainage. The POS system includes a major east-west multiple use corridor with north-south connecting links to Manjedal Brook; and
- A service corridor located adjacent to the western boundary of the site.

5 ENVIRONMENTAL ASSESSMENT

5.1 Landform and Soils

The site is mostly flat with only a slight slope, apart from a small hill in the south western corner. Landform is unlikely to pose a significant constraint to the development. The low-lying nature of a large part of the site will require filling to construct lots with the appropriate separation from groundwater.

The following management measures are proposed to minimise the potential for soil erosion to occur:

- Ground disturbing activities will be kept to a minimum and carried out 'as required' (in stages) immediately prior to lots being released for sale as part of a 'staged' development of the site;
- Landscaping/stabilising/dust suppression of areas where ground disturbance has occurred will be scheduled to occur immediately after clearing and/or infrastructure construction has been completed; and
- Clearing activities have the potential to add clay 'fines' into Manjedal Brook and the eastern wetlands creating turbid water and therefore the installation of temporary drop-out basins to capture and aid in the settling of clay fines should be considered.

5.2 Acid Sulphate Soils

The site has been classified as mostly having a moderate to low risk of ASS occurring within 3m of the natural soil surface.

The wetland areas in the eastern section of the site have been classified as having a moderate to high risk of ASS, however, these areas are located in proposed POS and do not necessarily pose an ASS risk to development.

A preliminary ASS investigation will be required as part of the subdivision planning process to determine if ASS are present in the proposed development areas of the site. If required an ASS and De-watering Management Plan for these areas will need to be prepared for the site in accordance with the DER (2011) guidelines.

Any construction or excavation occurring in the Multiple Use Sumpland will require an ASS Management Plan to be developed due to the moderate to high risk of ASS in this area.

5.3 Contaminated Sites

A number of recommendations regarding the potential contamination of Lots 2 and 11 have been made (Aurora, 2014a). Below is a summary of these recommendations:

- Buildings constructed before 1990 should undergo a hazardous materials assessment prior to any demolition works;

- Aurora recommends that the structures on the site are demolished/decommissioned prior to further environmental investigations to enable access;
- Appropriate management plans should be prepared to guide the subcontractor during the demolition process to prevent cross contamination; and
- Aurora anticipates that a Western Australian accredited Contaminated Site Auditor will be required to be appointed and a Mandatory Auditor Report submitted to the DER.

A Sampling and Analysis Plan was developed by Aurora following the PSI to guide the Detailed Site Investigation (DSI) that is required for the site prior to development commencing (Aurora, 2014b).

5.4 Drainage and Stormwater Management

5.4.1 Design

The majority of the areas on the site consisting of the Pinjarra System are mapped as having a 70-100% moderate to very high hazard for waterlogging (DAFWA, 2014). As a result, the site will need to be drained and filled to facilitate urban development in accordance with the draft LSP.

Management measures will be required to control runoff from roads, car parking areas, roofs of buildings and lawn/landscape areas to ensure that runoff does not impact on Manjedal Brook or the CCW by way of excess water or nutrient enrichment.

A Local Water Management Strategy (LWMS) is currently being prepared by Wave International to support the LSP. The drainage design will maintain the pre-development flow paths as much as possible, following the site's natural topography.

In acknowledgment of the Shire's LPP No. 6: *Water Sensitive Design* the water quality on the site will be protected by specific design principles, as will be outlined in the LWMS.

The POS system contains a major east-west Multiple Use Corridor (MUC) that will function as a recreational corridor as well as to convey and treat drainage. A series of smaller north-south MUCs connect the main POS corridor with Manjedal Brook.

The POS areas will contain storage basins and swales to reduce post-development runoff, also ensuring that the runoff is within pre-development flow rates. Downstream landholdings will be protected from flooding by these storage basins and swales. The MUCs will contain open drainage swales traversing the site from east to west with the north-south MUCs terminating at bio-retention basins located in the buffer of Manjedal Brook (Appendix 1). Stormwater from the roadways will flow in pipes to the bio-retention basins located within the POS for treatment. The attenuation basins located within the Manjedal Brook buffer will consist of shallow bunded areas that hold water from storm events up to the one year ARI, allowing overtopping of larger events into the Brook. This approach has been supported by the Department of Water.

5.4.2 Nutrient Management

To ensure nutrient rich runoff (and other potential sources of contamination) does not directly enter Manjedal Brook or the Conservation Category Sumpland each POS area will contain bio-retention treatment basins and swales to manage the surface water quality. These areas will contain amended soil and will be planted with appropriate plant species to maximise nutrient uptake from

the stormwater runoff, which will be directed into the treatment basins and swales. The Conservation Category Sumpland will not receive any stormwater runoff, while one of the north-south open drains will enter the Multiple Use Sumpland and exit via an existing open drain to Manjedal Brook. To protect the Brook from nutrient rich runoff a bio-retention basin will be located within the Multiple Use Sumpland to treat the water prior to it entering the Brook. Wave International is also investigating using a floating treatment island to treat the water in the MUW area prior to it entering the Brook. The MUW will need to be excavated to create permanent water to enable the floating treatment island to function.

Providing new landowners with landscaping packages will guarantee that suitable native species with minimal fertiliser requirements are planted in gardens. During the subdivision of the site new landowners will be provided with educational material informing them about appropriate fertiliser use to minimise the quantity of fertiliser entering the stormwater drainage network.

These management strategies will acknowledge the Shire's LPP No. 22: *Water Sensitive Urban Design* with the management of the Peel-Harvey catchment.

It is also recommended that lawn areas that require fertiliser, pesticide and/or herbicide application will be minimised in areas of POS adjacent to watercourses.

5.5 Wetlands

The site contains CCWs consisting of Manjedal Brook and a Conservation Category sumpland in the south-eastern corner. The Preliminary Draft LSP retains these wetlands within POS and applies a minimum 50m buffer around the CCWs. The very thin section of Multiple Use sumpland adjacent to the eastern side of the Conservation Category sumpland and connecting to the Bush Forever vegetation in the Soldiers Road reserve is also proposed to be retained and enhanced through weed management and rehabilitation.

The Multiple Use wetland to be retained currently dries out in summer and autumn contains above-ground water in winter and spring. The LSP proposes to include a community activity node on the southern side of the MU wetland. The activity node could include playgrounds, a picnic area and a café. Investigations should be undertaken to enhance the MU wetland by excavating to create a permanent water body year round. The permanent water body would have increased ecological wetland functions, be more aesthetically pleasing in summer and autumn and could be done with minimal to no impact on existing vegetation and fauna. Management of potential Acid Sulphate Soils will need to be carefully done if excavation were considered an option.

The management of the retained sumplands will be guided by a Wetland Management Plan to be prepared prior to subdivision approval. The management of Manjedal Brook and its buffer will be guided by a Foreshore Management Plan also to be prepared prior to subdivision approval. The Management Plans will outline the protection and management of the primary values and functions of the wetlands. The objectives of the Management Plans will include the following:

Conservation Category and Multiple Use Sumplands

- Protect native vegetation in the wetlands;
- Protect and enhance the fauna habitat values of the area;

- Maintain the existing hydrology of the wetlands;
- Maintain the water quality within the wetlands;
- Consider drainage construction surrounding the wetlands to protect them from runoff;
- Control invasive weeds in the wetlands;
- Rehabilitate degraded areas to enhance the amenity of the wetlands particularly the area between the Multiple Use Sumpland and the Conservation Category Sumpland and also between the Conservation Category Sumpland and Manjedal Brook;
- Maintain the view of the Conservation Category Sumpland by keeping the bank facing the community area open;
- Provide landscaped areas for passive recreation opportunities;
- Identify appropriate levels of public access in and around the wetlands to enable people to interact with the environment while maintaining the wetland values;
- Manage construction to minimise impacts on the wetlands; and
- Include future residents in the management of the wetlands to ensure the wetlands are valued as part of the development.

Manjedal Brook

- Protect native vegetation along the Brook;
- Protect and enhance the fauna habitat values of the area;
- Protect the flood plain of the Brook;
- Maintain the existing flow of the Brook;
- Maintain the water quality within the Brook;
- Design drainage basins in the buffer of the Brook to protect the Brook from erosion and contamination;
- Design the south eastern entry road that crosses over the Brook so that it does not impede flow at peak flow times and impact on the vegetation and water quality;
- Control invasive weeds along the Brook;
- Rehabilitate degraded areas to enhance the amenity of the Brook;
- Provide concepts for the buffer and additional POS to be rehabilitated with areas to be landscaped to provide passive recreation opportunities;
- Identify appropriate levels of public access around the Brook to enable people to interact with the environment while maintaining the values of the Brook;
- Manage construction to minimise impacts on the Brook; and
- Include future residents in the management of the Brook to ensure it is valued as part of the development.

5.6 Vegetation

The proposed development areas of the site contain no intact native remnant vegetation. The native vegetation as well as the majority of the large significant trees on the site will be retained within Manjedal Brook and the Conservation Category Sumpland and their buffer areas. The network of Multiple Use POS Corridors will retain a number of mature native trees.

The development will provide the opportunity to enhance the value of the vegetation surrounding Manjedal Brook and the CCW Sumpland through additional planting of native vegetation within the currently cleared buffers.

The Conservation Category Sumpland currently remains free from invasion by the aggressive Bulrush and maintaining it in this condition should be a priority in the management of the wetlands on the site. Manjedal Brook and the Multiple Use Sumpland on the site contains vegetation in conditions ranging from Degraded along the Brook and Good to Degraded around the MUW. These areas have the potential to be rehabilitated to a much better condition through weed management, revegetation and implementation of the 50m buffer along the Brook. Eradicating the dense Blackberry from the Brook and maintaining it free of Arum Lily and Watsonia should also be a priority in the management of the Brook. Rehabilitating these areas of the site will enhance their value as an ecological link in the area and will also comply with the Shire's LPP No. 4: *Revegetation*. The protection of the vegetation on the site will also satisfy the requirements of the Shire's LPP No. 26: *Biodiversity Planning.*

Bush Forever Site 350 is located adjacent to the eastern side of the site and contains regionally significant vegetation. The location of the proposed entry road at the eastern end of the development needs to cross through the Bush Forever site within the western side of the Soldiers Road road reserve. The site of the entry road should have as minimal impact as possible on native vegetation.

The above actions and management strategies would meet the EPA's objectives of maintaining the abundance, diversity, geographic distribution and productivity of flora at species and ecosystem levels through the avoidance or management of adverse impacts and improvement in knowledge.

5.7 Fauna

Three conservation significant Black Cockatoo species (Carnaby's, Forest Red-tail and Baudin's) were identified by Terrestrial Ecosystems (2011) as likely to visit the site. These three species are protected under the Western Australian *Wildlife Conservation Act 1950* and the Commonwealth EPBC Act.

The Black Cockatoo habitat includes approximately 300 potential breeding trees. The majority of these trees occur along the Manjedal Brook and will therefore be retained. There are no records of Black Cockatoos breeding in the area with the closest nesting site located on the Darling Scarp to the east (Johnstone and Kirkby, 2011).

Development of the site will retain foraging habitat within the buffers of Manjedal Brook and the CCW. Only a small amount of foraging habitat in the form of less than twenty isolated Marri and Jarrah trees in paddocks is likely to be lost due to development. According to the Significant Impact Guidelines 1.1 the impact is not considered to be significant.

The retention of Manjedal Brook, the eastern CCW and their respective buffers results in a low impact on the other fauna species that may be found on the site or infrequently visit the site.

The revegetation of the wetland and Brook buffers and POS areas will include the planting of Marri seedlings to enhance the value of the area for Black Cockatoos and other vegetation that will

enhance the overall fauna habitat, including that of the Long-neck Tortoise and Southern Brown Bandicoot that occur on the site.

5.8 Feral Animal Management

The management of feral or pest fauna will need to be undertaken as part of the overall management of the wetland POS area and Manjedal Brook. Evidence of foxes and feral cats will need to be reported and trapping and baiting carried out where required.

Material outlining the importance of responsible pet ownership should be presented as pamphlets at open day and in the sales office.

5.9 Mosquito Management

Mosquitoes could impact on future residents from the wetlands on the site and potentially from inappropriately designed stormwater management structures within the development.

A Mosquito Management Plan should be prepared for the site in accordance with guidance from the Department of Health.

The Plan should include details of each of the following issues in relation to how their understanding and management implications can be utilised to minimise the risk of mosquitoes impacting on the wellbeing and amenity of prospective residents:

- Baseline larval and adult mosquito monitoring of on-site and off-site locations;
- Stormwater management and water sensitive urban design issues;
- Requirements for wetland buffers to minimise adult mosquito dispersal into development areas;
- Stakeholder consultation;
- Wetland maintenance and management; and
- Assessment of integrated mosquito management options.

5.10 Heritage Management

There are six Aboriginal Sites listed to occur on the site (Thomson and Neuweger, 2013). It has been recommended by Thomson and Neuweger (2013) that all six Aboriginal Sites may meet the requirements of section 5 of the AHA and should not be impacted on in any way. It is also recommended that Site MJ-08, the modified tree, should have a 30m buffer around it.

As a result of these recommendations applications will need to be made under section 18 of the AHA for consent to use the land at Aboriginal Sites MJ-02, MJ-04, MJ-05 and MJ-08 for the current Preliminary Draft LSP to be put into place.

The modified tree (MJ-08) is located near the entry point in the south eastern section of the site and currently the road reserve encroaches on the 30m buffer. It should be investigated whether the road reserve could be altered slightly to avoid the 30m buffer.

Refer to the Aboriginal Heritage Report by Thomson and Neuweger (2013) for more detail regarding the recommendations for management of the Aboriginal Sites located on the site.

5.11 Noise Management

There are two sources of noise that may require management including:

- The future Tonkin Highway Reserve adjacent to the west of the site; and
- The current railway adjacent to the north and east of the site (or the possible realignment to the west of the site).

There are a variety of measures available to mitigate transport noise such as walls and bunds, which can be tested using acoustic modelling. A noise assessment will need to be undertaken at the site prior to subdivision.

The vibration impact from the railway will also need to be taken into account.

There is a possibility of a realignment of the railway to the western side of the site adjacent to the Tonkin Highway Reserve. As a result noise and vibration from the rail would likely cease to be an issue for the Mundijong North development

Noise from the current dairy is unlikely to be an issue as it is planned to be decommissioned prior to any development.

5.12 Odour Management

The wastewater pump station proposed to be developed close to the south western corner of the site may be an odour emitting source that could impact on the south western section of the site. The EPA Guidance Statement No. 3 *Separation Distances Between Industrial and Sensitive Land Uses* (EPA, 2005) lists wastewater pump stations as an industrial land use.

Residential development is considered to be a sensitive land use and the EPA's preferred method for determining buffers to sensitive land uses involves site-specific technical studies, however, EPA Guidance Statement No. 3 *Separation Distances Between Industrial and Sensitive Land Uses* (EPA, 2005) does provide generic separation distances. Site-specific studies are only required if a reduction of the buffer is needed.

The generic buffer distance required for wastewater pump stations, as listed in the EPA Guidance Statement No. 3, varies from 10m to 150m depending on the size of the pump station (EPA, 2005).

In the Preliminary Draft LSP for the site a buffer of 150m is proposed around the future wastewater pump station. The south western corner of the site occurring within this buffer is proposed to consist of POS and road reserve.

In accordance with the EPA the proposed buffer of 150m will be sufficient as it is the maximum buffer distance required for a wastewater pump station. Therefore site-specific technical studies will not be required.

5.13 Fire Management

A Fire Management Plan will need to be developed for the site.

6 CONCLUSIONS AND RECOMMENDATIONS

The Environmental Factors that were studied in this EAR were:

- Land Use
- Topography
- Landform and Soils
- Acid Sulphate Soils
- Contaminated Sites
- Groundwater and Surface Water
- Wetlands
- Vegetation and Flora
- Fauna
- Heritage
- Noise and Odour

The Environmental Assessment resulted in the following conclusions and recommendations:

- The site has been largely cleared of native vegetation for farming purposes, mainly cattle grazing, therefore not much clearing is required for development.
- The site is generally flat, sloping only slightly, which will benefit development.
- A large area of the site is located on the Pinjarra System with naturally poorly drained soils that becomes seasonally inundated and this will need to be drained and filled to enable development.
- A preliminary ASS investigation will be required as part of the subdivision planning process. An ASS Management Plan may be required.
- A PSI was conducted on the site by Aurora (2014a) that identified potential sources of contamination and elevated levels of certain contaminants. Aurora made a number of recommendations within the PSI and developed a Sampling and Analysis Plan (Aurora, 2014b) to guide the DSI that is required for the site prior to development.
- An LWMS is currently being prepared by Wave International outlining the drainage strategy and proposed nutrient management. The drainage strategy includes open swales and bio-retention basins to be located within Multiple Use Corridors on the site as well as attenuation basins to be located within the Manjedal Brook buffer. The bio-retention basins will ensure that no excess nutrients enter the Manjedal Brook. The Conservation Category Sumpland will not receive any stormwater runoff. The management of stormwater by sumps and bio-retention swales could potentially improve the current unmanaged rural runoff entering Manjedal Brook and exiting the site.
- The site contains three CCWs; two within Manjedal Brook, and a sumpland on the eastern side of the site. A small area of CCW connects the sumpland with the vegetation in the adjoining Soldiers Road road reserve. Manjedal Brook and the Conservation Category Sumpland will be retained and protected with minimum 50m buffers. In addition the Multiple Use Sumpland to the west of the Conservation Category Sumpland will be retained in POS.

- A Wetland Management Plan for the two retained sumplands and a Foreshore Management Plan for Manjedal Brook will be prepared prior to subdivision. The Management Plans will outline specific actions to protect and enhance the wetlands.
- The Multiple Use Sumpland has the potential to have an increased environmental significance and visual amenity. Investigations should be undertaken on the potential to excavate the Multiple Use Sumpland to make it a permanent water body.
- The site is located within the Peel-Harvey Estuary which is a valuable water resource that is under stress from nutrient enrichment. Therefore stormwater runoff and other nutrient sources will need to be carefully managed.
- A total of 71 flora species were recorded on the site consisting of only 29 native species as a result of the largely cleared area for cattle grazing and the degraded creek line. There are no Threatened (Declared Rare) or Priority listed flora on the site. *Dielsia stenostachya* which is listed as significant in Bush Forever occurs in the eastern CCW buffer which will be retained. Therefore future development of the site will not result in the loss of conservation significant flora.
- There is no intact native vegetation in the areas of the site proposed for development. All of the intact native vegetation occurs in Manjedal Brook and the eastern wetlands which will be retained, therefore no clearing of native vegetation is required. Isolated trees within paddocks are likely to be cleared to enable development.
- Bush Forever Site 350 occurs in the Soldiers Road road reserve adjacent to the eastern boundary of the site. The location and construction of the south eastern entry road which is required to cross the Bush Forever site will need to have minimal impact on the vegetation in the road reserve.
- Development of the site will retain most of the potential breeding trees and foraging habitat trees on the site within the Manjedal Brook and wetland POS areas. Development will result in only a small loss of foraging habitat for the Black Cockatoos in the form of isolated Marri and Jarrah trees in paddocks. The clearing is considered to be not significant according to the EPBC Act Significant Impact Guidelines 1.1. Revegetation of the Manjedal Book and wetland buffers will include the planting of Marri and Jarrah seedlings resulting in an overall likely net gain in Black Cockatoo habitat on the site.
- The development will result in an increase in fauna habitat for other fauna species due to the retention and enhancement of native vegetation within the Manjedal Brook and wetland POS areas.
- Feral animals (including rabbits, foxes and feral cats) will need to be managed. Pamphlets outlining the importance of responsible pet ownership should be presented at open day and in the sales office.
- A Mosquito Management Plan will need to be prepared in accordance with the Department of Health.
- Six Aboriginal Sites occur on the site and each of these may meet the requirements of section 5 of the AHA and should not be impacted on in any way without applications made under section 18 of the AHA for consent (Thomson and Neuweger, 2013). The current Preliminary Draft LSP impacts on four of the Aboriginal Sites (MJ-02, MJ-04, MJ-05 and MJ-08). Without approval from the AHA following a section 18 application the modified tree (MJ-08) requires a 30m buffer (Thomson and Neuweger, 2013).

- No listed cultural heritage sites occur within the site therefore this does not constrain development.
- There are two sources of noise that could impact on the site; the railway that currently runs along the northern and eastern sides of the site and the proposed Tonkin Highway Reserve adjacent to the western boundary of the site. It should be noted that there is a possibility of a realignment of the railway to the western side of the site adjacent to the Tonkin Highway Reserve. A noise assessment will need to be undertaken at the site prior to subdivision. The vibration impact from the railway will also need to be considered.
- There is one odour emitting source in the vicinity of the site, the proposed wastewater pump station. The Preliminary Draft LSP proposes a 150m buffer surrounding this wastewater pump station. In accordance with the EPA guidelines this distance is sufficient. Therefore site-specific technical studies will not be required.
- The dairy that is currently located on the site will be shut down prior to development and therefore will not be a noise and odour emitting source.
- A Fire Management Plan will need to be developed for the site.

This Environmental Assessment Report concludes that development of the Mundijong North site in accordance with the Draft Local Structure Plan and the associated management measures outlined in this report should have a positive environmental outcome, particularly in the areas of a net gain in native vegetation and associated fauna habitat, and water quality exiting the site.

7 REFERENCES

Aurora Environmental (Aurora) (2014a) *Preliminary Site Investigation Lot 2 Bishop Road & Lot 11 Taylor Road, Mundijong Western Australia*. Prepared for PGV Environmental. Perth, Western Australia.

Aurora Environmental (Aurora) (2014b) *Sampling and Analysis Plan Lot 2 Bishop Road & Lot 11 Taylor Road, Mundijong Western Australia.* Prepared for PGV Environmental. Perth, Western Australia.

Brown Geotechnical and Environmental (BGE) (2009) Groundwater Monitoring Data. Results supplied by BGE. Perth, Western Australia.

Department of Agriculture and Food Western Australia (DAFWA) (2014) Natural Resource Management Shared Land Information Platform. Accessed February 2014 http://spatial.agric.wa.gov.au/slip/products_view.asp Government of Western Australia, Perth.

Department of the Environment (DoE) (2013) *Matters of National Environmental Significance. Significant Impact Guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999.* Commonwealth of Australia.

Department of the Environment (DoE) (2014) *Australian Heritage Database.* Accessed February 2014 http://www.environment.gov.au/cgi-bin/ahdb/search.pl Commonwealth of Australia.

Department of Water (DoW) (2014) *Perth Groundwater Atlas.* Government of Western Australia, Perth.

Environmental Protection Authority (EPA) (1992) *Environmental Protection (Swan Coastal Plain Lakes) Policy (EPP) 1992* Perth, Western Australia.

Environmental Protection Authority (EPA) (1995) Bulletin No. 798. *Draft South East Corridor Structure Plan; South East Corridor Metropolitan Region Scheme Amendment No. 966/13; and Stormwater Management Strategy and plans for new urban development at Byford and Mundijong*. Perth, Western Australia.

Environmental Protection Authority (EPA) (2002) *Terrestrial Biological Surveys as an Element of Biodiversity Protection,* Position Statement No. 3. Perth, Western Australia.

Environmental Protection Authority (EPA) (2004) *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia,* Guidance Statement No. 56. Perth, Western Australia.

Environmental Protection Authority (EPA) (2005) *Guidance for Assessment of Environmental Factors: Separation Distances Between Industrial and Sensitive Land Uses,* Guidance Statement No. 3. Perth, Western Australia.

Environmental Protection Authority (EPA) (2006) *Guidance for the Assessment of Environmental Factors: Level of Assessment for Proposals Affecting Natural Areas Within the System 6 Region and Swan Coastal Plain Portion of the System 1 Region,* Guidance Statement No. 10. Perth, Western Australia.

Environmental Protection Authority (EPA) (2008) *Environmental Guidance for Planning and Development,* Guidance Statement No. 33. Perth, Western Australia.

Government of Western Australia (1997) *Wetlands Conservation Policy for Western Australia.* Perth, Western Australia.

Government of Western Australia (2000) *Bush Forever - Keeping the Bush in the City. Volume 1: Policies Principles and Processes.* Western Australian Planning Commission, Perth, Western Australia.

Heritage Council of Western Australia (2014) State Register of Heritage Places. Accessed February 2014 http://register.heritage.wa.gov.au/search_results.html?offset=100 Government of Western Australia, Perth.

Hill, A.L., Semeniuk, C.A., Semeniuk, V. and Del Marco, A. (1996) *Wetlands of the Swan Coastal Plain*, Vol. 2B Wetland Mapping, Classification and Evaluation. Wetland Atlas.

Hyder, B.M., Dell, J. and Cowan, M.A. (2010) *Technical Guide Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment.* Technical report of the Environmental Protection Authority and the Department of Environment and Conservation. Government of Western Australia, Perth.

Ironbark Environmental and Sustainable Development (2007) *Serpentine Jarrahdale Shire Stage One: Local Biodiversity Strategy, Technical Version.* South West Biodiversity Project. Western Australia.

Johnstone, R. E. C. and Kirkby, T. (2011) *Carnaby's Cockatoo (Calyptorhynchus latirostris), Baudin's Cockatoo (Calyptorhynchus baudinii) and the Forest Red-tailed Black Cockatoo (Calyptorhynchus banksii naso) on the Swan Coastal Plain (Lancelin–Dunsborough), Western Australia. Studies on distribution, status, breeding, food, movements and historical changes.* Report for the Department of Planning, Perth, Western Australia.

Landgate (2014a) Historical Aerial Photography. Accessed February 2014 https://www.landgate.wa.gov.au/bmvf/app/mapviewer/ Government of Western Australia, Perth.

Landgate (2014b) WA Atlas Shared Land Information Platform. Accessed February 2014 https://www2.landgate.wa.gov.au/bmvf/app/waatlas/ Government of Western Australia, Perth.

Main Roads Western Australia (2014) Road Information Mapping System. Accessed March 2014 https://www.mainroads.wa.gov.au/OurRoads/Facts/Pages/Facts.aspx Government of Western Australia, Perth.

Peel Harvey Commission (2006) *Peel-Harvey WSUD Local Planning Policy.* Perth, Western Australia.

PGV Environmental (2012) *Mundijong North Flora and Vegetation Survey*. Prepared for Peet Mundijong Syndicate Pty Ltd. Perth, Western Australia.

Shire of Serpentine-Jarrahdale (SSJ) (2014) Municipal Inventory. Accessed February 2014 http://www.sjshire.wa.gov.au/home/ Perth, Western Australia.

SMEC Australia Ltd (SMEC) (2009) Environmental Study for Mundijong/Whitby District Structure Plan. Prepared for the Shire of Serpentine-Jarrahdale, Perth, Western Australia.

Terrestrial Ecosystems (2011) Level 1 Fauna Assessment of Precinct G, Northern Site. Unpublished report for PGV Environmental. Perth, Western Australia.

Terrestrial Ecosystems (2012) Fauna Survey of the Conservation Category Wetland – Peet landholding at Mundijong. Unpublished report for PGV Environmental. Perth, Western Australia.

Thomson, J. and Neuweger, D. (2013) Interim report on an Indigenous archaeological assessment and section 16 test excavations for a proposed residential land development, Lots 37, 98 and 9000 Bishop Road, Mundijong, Perth Metropolitan Area, Western Australia. Prepared for Peet Limited. Perth, Western Australia.

Western Australian Planning Commission (WAPC) (1989) *Shire of Serpentine-Jarrahdale Town Planning Scheme No. 2.* Government of Western Australia, Perth.

Western Australian Planning Commission (WAPC) (2003) State Planning Policy No. 2.1. *The Peel-Harvey Coastal Plain Catchment.* Government of Western Australia, Perth.

Western Australian Planning Commission (WAPC) (2008) *Better Urban Water Management*. Government of Western Australia, Perth.

Western Australian Planning Commission (WAPC) (2009) State Planning Policy No. 5.4. *Road and Rail Transport Noise and Freight Considerations in Land Use Planning.* Government of Western Australia, Perth.

FIGURES

PINPOINT CARTOGRAPHICS (08) 9562 7136 2014-140-f01.dgn

pgv ENVIRONMENTAL

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward	Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140	Revision: A

SITE LOCATION

Figure 1

N

0 50 100 150 200m

SCALE 1 : 6 000 at A3 (MGA)

Legend

Site Boundary

Cadastral Boundary

403 500mE
404 000mE
404 500mE
405 000mE

BISHOP ROAD

ROAD

ROAD

SOLDIERS ROAD

TAYLOR ROAD

LANG ROAD

Manjedal Brook

10
11
2
37
98
98
9000

6 429 000mN
6 428 500mN
6 428 000mN

BASE SOURCE: Taylor Burrell Barnett.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.

2014-140-f02.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

pgv ENVIRONMENTAL

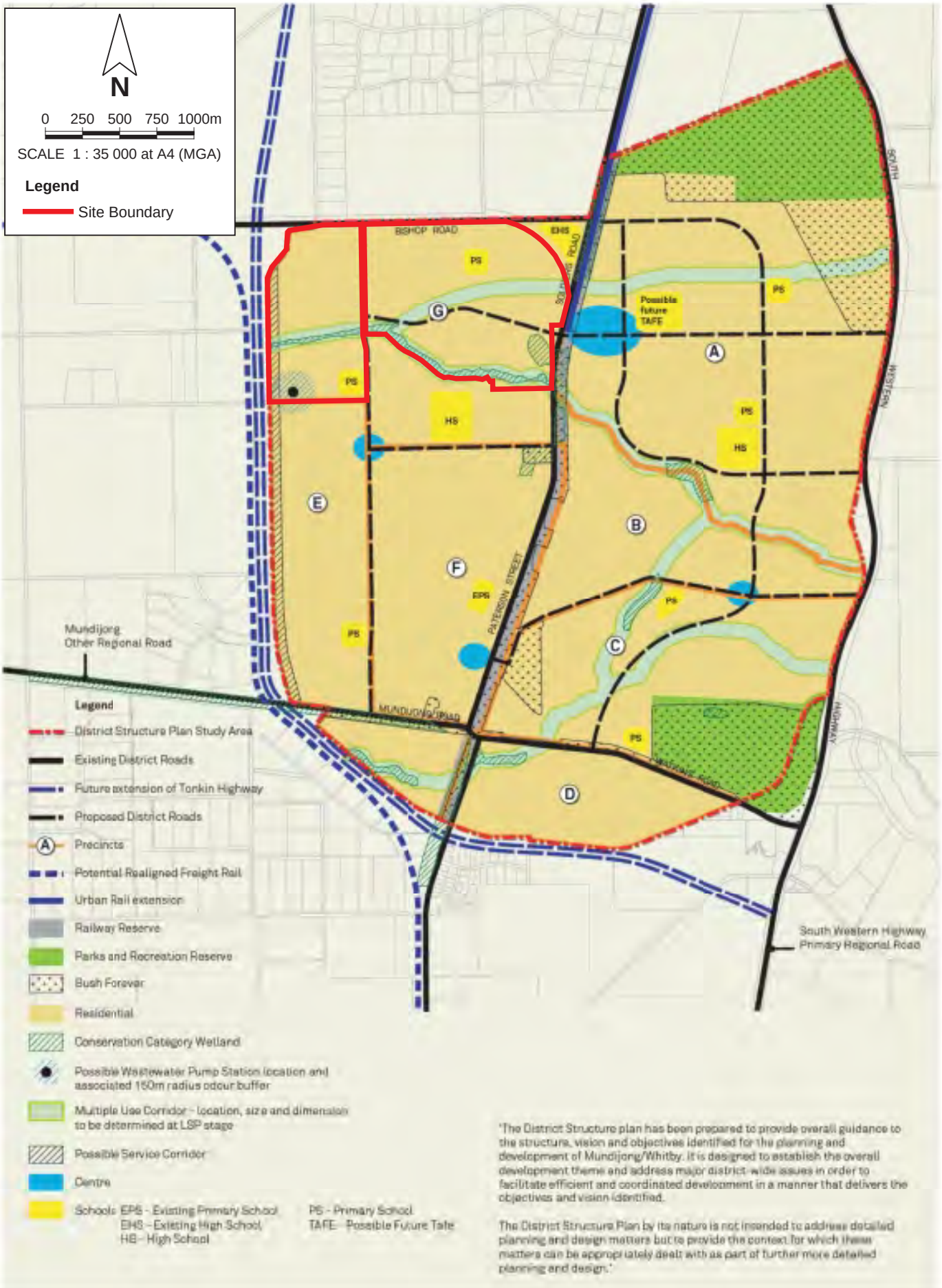
Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward | Date: 18 Mar 2014

Job: 10054 Rpt: 2014-140 | Revision: A

SITE BOUNDARY

Figure 2



PINPOINT CARTOGRAPHICS (08) 9562 7136 2014-140-f03.dgn

pgv ENVIRONMENTAL

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward | Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140 | Revision: A

MUNDIJONG WHITBY DISTRICT STRUCTURE PLAN

Figure 3

N

0 50 100 150 200m

SCALE 1 : 6 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour

403 500mE
404 000mE
404 500mE
405 000mE

6 429 000mN
6 428 500mN
6 428 000mN

BISHOP ROAD
ROAD
TAYLOR ROAD
LANG ROAD
SOLDIERS ROAD

Manjedal Brook

37
10
11
2
98
98
35
40
50
9000

BASE SOURCE: Taylor Burrell Barnett.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.

2014-140-f04.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

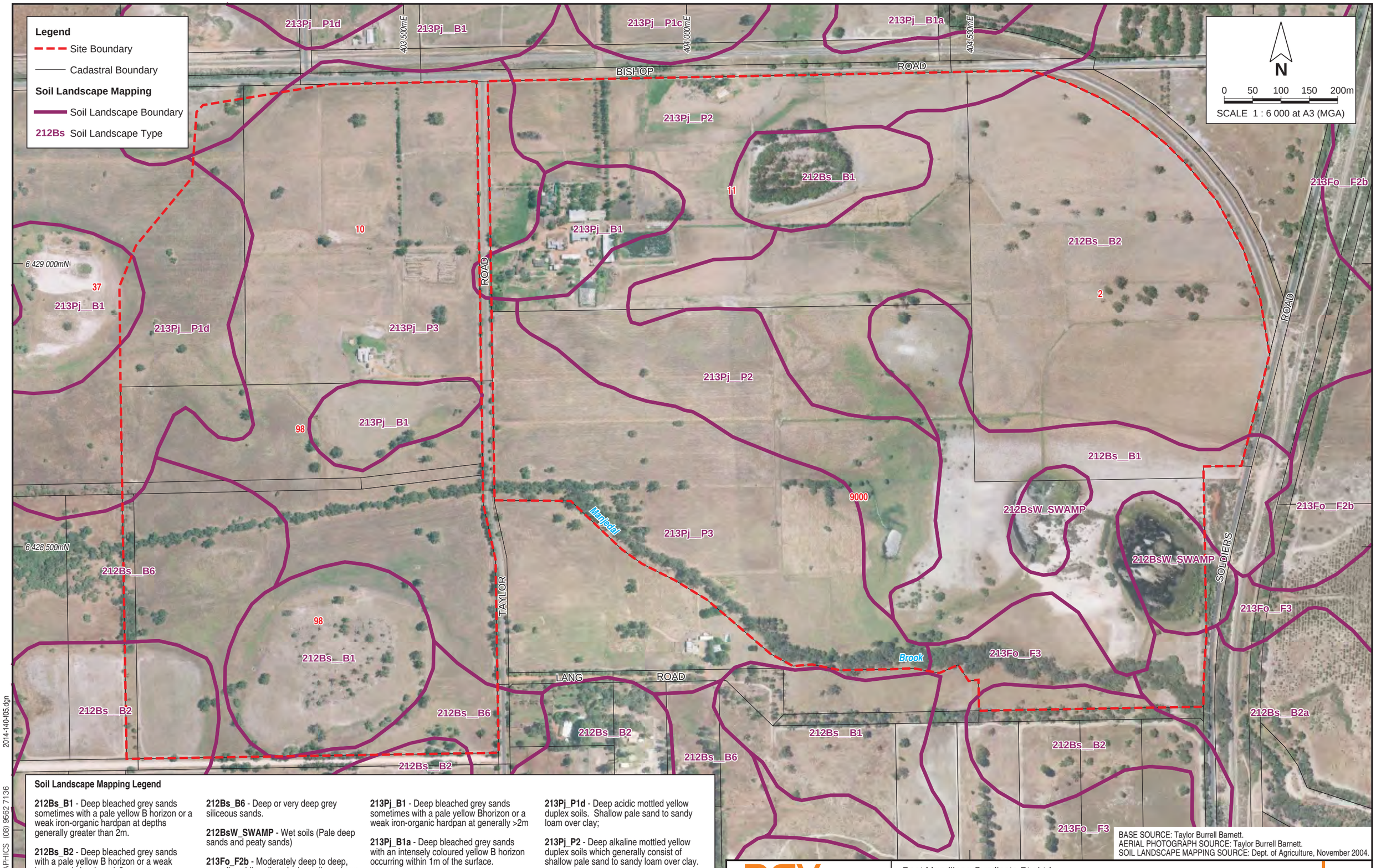
pgv ENVIRONMENTAL

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward | Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140 | Revision: A

TOPOGRAPHY

Figure 4



BASE SOURCE: Taylor Burrell Barnett.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.
SOIL LANDSCAPE MAPPING SOURCE: Dept. of Agriculture, November 2004.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2014-140-f05.dgn

pgv ENVIRONMENTAL

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward | Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140 | Revision: A

SOIL LANDSCAPE SYSTEMS AND SUB-SOIL PHASES

Figure 5

Legend

- Site Boundary
- Cadastral Boundary

Acid Sulfate Soil Risk

- High to Moderate Risk
- Moderate to Low Risk

N

0 50 100 150 200m

SCALE 1 : 6 000 at A3 (MGA)

403 500mE

404 000mE

404 500mE

6 429 000mN

6 428 500mN

6 428 000mN

BISHOP ROAD

TAYLOR ROAD

LANG ROAD

SOLDIERS ROAD

Manjedal Brook

37

98

10

11

2

9000

ASS SOURCE: DEC, January 2010.
BASE SOURCE: Taylor Burrell Barnett.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2014-140-f06.dgn

pgv ENVIRONMENTAL

Drawn: J-M. Ward	Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140	Revision: A

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

ACID SULPHATE SOILS

Figure 6

Legend

- Site Boundary
- Cadastral Boundary
- Bush Forever Site

Geomorphic Wetlands

- Conservation Category
- Multiple Use
- 7835 Wetland UFI

N

0 50 100 150 200m

SCALE 1 : 6 000 at A3 (MGA)

403 500mE

404 000mE

404 500mE

6 429 000mN

6 428 500mN

6 428 000mN

BISHOP ROAD

ROAD

TAYLOR ROAD

LANG ROAD

SOLDIERS ROAD

Maylead Brook

10

11

2

37

98

98

9000

15785

15785

15785

15785

15785

15462

15461

15463

350

14945

7834

7835

15448

15447

15446

15446

BASE SOURCE: Taylor Burrell Barnett.
WETLANDS SOURCE: DER, November 2013.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.
BUSH FOREVER SOURCE: Department of Planning, 2007.

2014-140-f07.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

pgv ENVIRONMENTAL

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward | Date: 18 Mar 2014

Job: 10054 Rpt: 2014-140 | Revision: A

WETLAND MAPPING AND BUSH FOREVER SITE

Figure 7

N

0 10 20 30 40 50m

SCALE 1 : 1 500 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour
- Conservation Category Wetland
- 50m Wetland Buffer
- 7835 Wetland UFI
- Quadrat Location
- Vegetation Type Boundary
- Er Vegetation Type

404 600mE 404 700mE 404 800mE 404 900mE 405 000mE

6 428 400mN 6 428 300mN 6 428 200mN

MpAlLl MpAlLl Cc Er Er Jf Mp PM8 JfAf JfAf JfAf Cc Jp Cc Cc Jf PM7 Jp Ex Ex Ex Jp Ex C C C C C C 40 40 40

Ba Ba Ba Ba Ba Ba Ba Ba Cc Cc Clumps of Ba 7835 CcMp PM1 PM2 BaLi PM3 AlBa AlBa PM4 PM5 PM6 MpAlBaLl MpAlLl ROAD

PM9 ErMr Manjedal 15446 PM10 ErMr Brook PM11 ErCcMr SOLDIERS

Vegetation Types

CcMp	*Corymbia calophylla* (Marri)/*Melaleuca presissiana* Low Woodland over *Lepidosperma longitudinale* Sedgeland
AlBa	*Agonis linearifolia* Tall Shrubland over *Baumea articulata* Closed Sedgeland
BaLl	*Baumea articulata/Lepidosperma longitudinale* Closed Sedgeland
Ba	*Baumea articulata* Closed Sedgeland
MpAlBaLl	*Melaleuca preissiana* Low Woodland over *Agonis linearifolia* Tall Open Scrub over *Baumea articulata/Lepidosperma longitudinale* Open Sedgeland
MpAlLl	*Melaleuca preissiana* Low Woodland over *Agonis linearifolia* Tall Open Scrub over *Lepidosperma longitudinale* Open Sedgeland
Ll	*Lepidosperma longitudinale* Closed Sedgeland
Jp	*Juncus pallidus* Sedgeland
JfAf	*Jacksonia furcellata/Astartea fascicularis* Tall Shrubland
ErMr	*Eucalyptus rudis/Melaleuca rhaphiophylla* Low Open Forest
ErCcMr	*Eucalyptus rudis/Corymbia calophylla/Melaleuca rhaphiophylla* Open Forest
Cc	Individual *Corymbia calophylla* (Marri) trees
Er	Individual *Eucalyptus rudis* (Flooded Gum) trees
Mp	Individual *Melaleuca preissiana* trees
Ex	Exotic trees
C	Cleared Pasture

BASE SOURCE: Taylor Burrell Barnett.
WETLANDS SOURCE: DER, November 2013.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.

2014-140-108a.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

pgv ENVIRONMENTAL

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward | Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140 | Revision: A

VEGETATION TYPE - CCW AND MU WETLANDS AND MANJEDAL BROOK (EAST)

Figure 8a

Legend

- Site Boundary
- Cadastral Boundary
- Topographic Contour
- Quadrat Location
- Vegetation Type Boundary
- Er — Vegetation Type (See Figure 8a for Legend)

N

0 50 100 150 200m

SCALE 1 : 6 000 at A3 (MGA)

403 500mE 404 000mE 404 500mE

6 429 000mN 6 428 500mN 6 428 000mN

BISHOP ROAD

ROAD TAYLOR SOLDIERS

LANG ROAD

Extent of Vegetation Survey

See Figure 8a for Detail

Brook

Manjedal

PM12 PM13

MpAILI

ErMr

9000

2014-140-f08b.dgn

PINPOINT CARTOGRAPHICS (08) 9562 7136

BASE SOURCE: Taylor Burrell Barnett.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.

pgv ENVIRONMENTAL

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

Drawn: J-M. Ward | Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140 | Revision: A

VEGETATION TYPE - BALANCE OF LAND

Figure 8b

N

0 50 100 150 200m

SCALE 1 : 6 000 at A3 (MGA)

Legend

- Site Boundary
- Cadastral Boundary
- Aboriginal Heritage Site

403 500mE
404 000mE
404 500mE
405 000mE

6 429 000mN
6 428 500mN
6 428 000mN

BISHOP ROAD
ROAD
TAYLOR ROAD
LANG ROAD
SOLDIERS ROAD

Manjedal Brook

37
10
11
2
98
98
9000

DIA Id 450
MJ-01
MJ-02
MJ-03
MJ-04
MJ-08
DAA Id 3648 and MJ-05 extension

BASE SOURCE: Taylor Burrell Barnett.
AERIAL PHOTOGRAPH SOURCE: Taylor Burrell Barnett.
HERITAGE SITES SOURCE: Taylor Burrell Barnett, Plan No. 06_066_014F, 28-10-2013.

PINPOINT CARTOGRAPHICS (08) 9562 7136 2014-140-f09.dgn

pgv ENVIRONMENTAL

Drawn: J-M. Ward | Date: 18 Mar 2014
Job: 10054 Rpt: 2014-140 | Revision: A

Peet Mundijong Syndicate Pty Ltd
ENVIRONMENTAL ASSESSMENT REPORT
MUNDIJONG NORTH

ABORIGINAL HERITAGE SITES

Figure 9

N

0 50 100 150 200m

SCALE 1 : 6 000 at A3 (MGA)

HOPKINSON ROAD

BISHOP STREET

TONKIN HIGHWAY RESERVE

SERVICE CORRIDOR (60m)

ROBERTSON ROAD

DAMS ROAD

PRIMARY SCHOOL

PRIMARY SCHOOL

MJ-01

MJ-02

MJ-03

MJ-04

MJ-05

DAA Id 3648 and MJ-05 extension

DIA Id 450

LANDUSE SUMMARY

Landuse	Residential Landholding	Non Landholding	Total
Residential R10	4.4737Ha	2.6772Ha	7.1749Ha
Residential R20	45.4854Ha	30.2172Ha	75.7126Ha
Residential R30	4.0459Ha	10.3598Ha	14.4057Ha
Primary School	3.5841Ha	4.0459Ha	7.5584Ha
Community	-	0.5644Ha	0.5644Ha
Public Open Space	11.1158Ha	11.9485Ha	23.0641Ha
Foreshore	-	17.4653Ha	17.4653Ha
Wetland (Core)	-	2.4057Ha	2.4057Ha
Wetland (Buffer)	-	2.9188Ha	2.9188Ha
Service Corridor	-	7.1910Ha	7.1910Ha
Multiple Use Wetland	0.0473Ha	1.0892Ha	1.1365Ha
Road Reserve	19.1621Ha	20.5947Ha	39.7567Ha
Total	87.7883Ha	111.4758Ha	199.2640Ha

Legend

TOTAL SITE BOUNDARY AREA

MANGEUP BROOK BUFFER (50m)

ABORIGINAL HERITAGE SITES

PROPOSED PUMP STATIONS

10m PUMP STATION ODOUR BUFFER

SOURCE: Taylor Burrell Barnett, Plan No. 06_066_014F, 28-10-2013

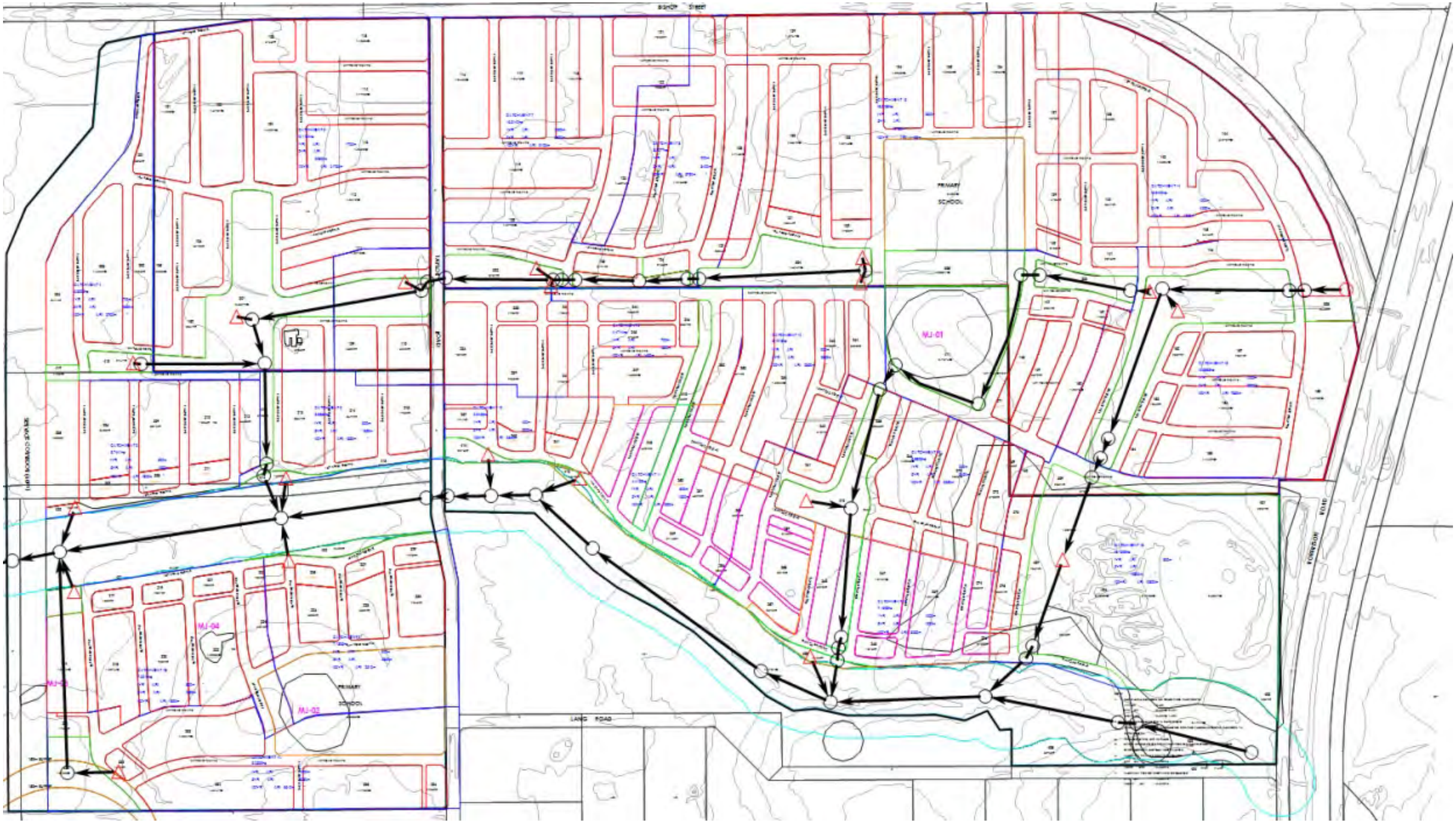
DRAFT

pgv ENVIRONMENTAL	Peet Mundijong Syndicate Pty Ltd ENVIRONMENTAL ASSESSMENT REPORT MUNDIJONG NORTH
Drawn: J-M Ward / Date: 18 Mar 2014	**PRELIMINARY DRAFT LOCAL STRUCTURE PLAN**
Job: 10054 Rpt: 2014-140 / Revision: A	Figure 10

PINPOINT CARTOGRAPHICS (08) 9562 7136 2014-140-f10.dgn

APPENDIX 1

Proposed Drainage (Wave International)


PRIMARY SCHOOL
MJ-01
MJ-04
MJ-03
PRIMARY SCHOOL
LANG ROAD