JWA PTY LTD
Ecological Consultants
ABN 18 862 767 739

LAND BASED ENVIRONMENTAL MANAGEMENT PLAN – SUB-PLAN 03

North East Business Park
Residential West Area – Phase 2

A Report Prepared for
North East Business Park Pty Ltd

AS AMENDED
JULY 2015

QUEENSLAND
Office 28, 115 Wickham Street
Fortitude Valley QLD 4006
p 07 3257 2703 f 07 3257 2708
e brisbane@jwaec.com.au

NEW SOUTH WALES
105 Tamar Street
PO Box 1465, Ballina NSW 2478
p 02 6686 3858 f 02 6681 1659
e ballina@jwaec.com.au

www.jwaec.com.au

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by North East Business Park Pty Ltd to complete a Land Based Environmental Management Plan Sub-Plan for Phase 2 of the North East Business Park (NEBP) development (i.e. Sub-Plan 03), including associated earthworks, constructed wetland A and adjacent compensatory cut and restoration areas.

North East Business Park is a multi-use business park that will combine residential, commercial, industrial, and marine development, with heritage and recreational greenspace precincts. The NEBP development is the subject of a Commonwealth approval under the provisions of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In accordance with Condition 9 of the EPBC Approval (Ref: EPBC 2006/2912) the NEBP development is to be undertaken in accordance with the provisions of a Land Based Environmental Management Plan (LBEMP), approved by the Commonwealth Minister for the Environment, so as to ensure potential impacts to Matters of National Environmental Significance (MNES) are appropriately managed.

The following LBEMPs have previously been prepared for the NEBP and approved by the Commonwealth Minister for the Environment:

- *North East Business Park – Land Based Environmental Management Plan for Matters of National Environmental Significance (Version 2)* prepared by Cardno and dated 31 January 2014 (LBEMP for MNES v2 (Cardno, 2014)), which comprises the overarching LBEMP for the NEBP development and provides specifications for the preparation of LBEMP Sub-Plans for specific programs of approved works that are to be undertaken as part of the orderly and staged establishment of the NEBP development – approved on 17th February 2014;
- *North East Business Park – LBEMP Sub-Plan 01 (Version 2)* prepared by Cardno and dated 31 January 2014 (LBEMP Sub-Plan 01), which comprises an LBEMP Sub-Plan prepared in accordance with the specifications of the LBEMP for MNES v2 (Cardno 2014) and addressing the works program associated with preliminary works within part of the Mixed Industry and Business Area (MIBA) – approved on 17th February 2014; and
- *North East Business Park – LBEMP Sub-Plan* prepared by Future-Plus Environmental and dated 22 August 2014 (LBEMP Sub-Plan 02), which comprises as LBEMP Sub-Plan prepared in accordance with the specifications of the LBEMP v2 (Cardno 2014) and addressing the works program associated with preliminary works within Phase 1 of the Residential West Area (RWA) – approved on 25th August 2014.

1.2 Site Assessment

A site assessment of vegetation within Phase 2 and adjacent areas of the RWA was conducted by two (2) JWA scientists on the 11th March and the 15th and 16th April 2015. The site assessment included assessment of vegetation types, weeds present, and habitat values for threatened flora and fauna.

1.3 Subject Site

Phase 2 of the RWA contains the second phase of residential development within the overall NEBP project (**FIGURE 1**), and is located on a hillside extending north into the site from the southern boundary, encompassing an anabranch of Raff Creek. Specifically, the works site (subject site) encompassed by this LBEMP Sub-Plan 03 is part of Lot 2 on SP266287 (formerly part of Lot 10 on SP130251) and includes Phase 2 residential lots and associated earthworks, constructed wetland A, and compensatory cut and restoration areas (**FIGURE 2**).

1.4 Scope and Objectives

This LBEMP Sub-Plan 03 provides a structured management plan with the objective of minimising the impacts of the approved works program on MNES within Phase 2 of the NEBP. This LBEMP Sub-Plan 03 sits below the overarching LBEMP for MNES v2 (Cardno 2014) and has been prepared in accordance with the specifications of the LBEMP for MNES v2 (Cardno 2014).

Specifically, this LBEMP Sub-Plan 03 addresses the works program associated with Phase 2 of the Residential West Area (RWA) that is scheduled to commence in June 2015 once all necessary approvals have been received. This LBEMP Sub-Plan 03 provides:

- An overview of the location and nature of an approved program of works that is the subject of LBEMP Sub-Plan 03;
- An assessment of the likelihood of occurrence of MNES within or adjacent to the works site;
- An assessment of the risk that the works program represents to relevant MNES; and
- Environmental management specifications for those aspects of the works program that are associated with a Medium to Extreme risk of harm to one or more MNES.

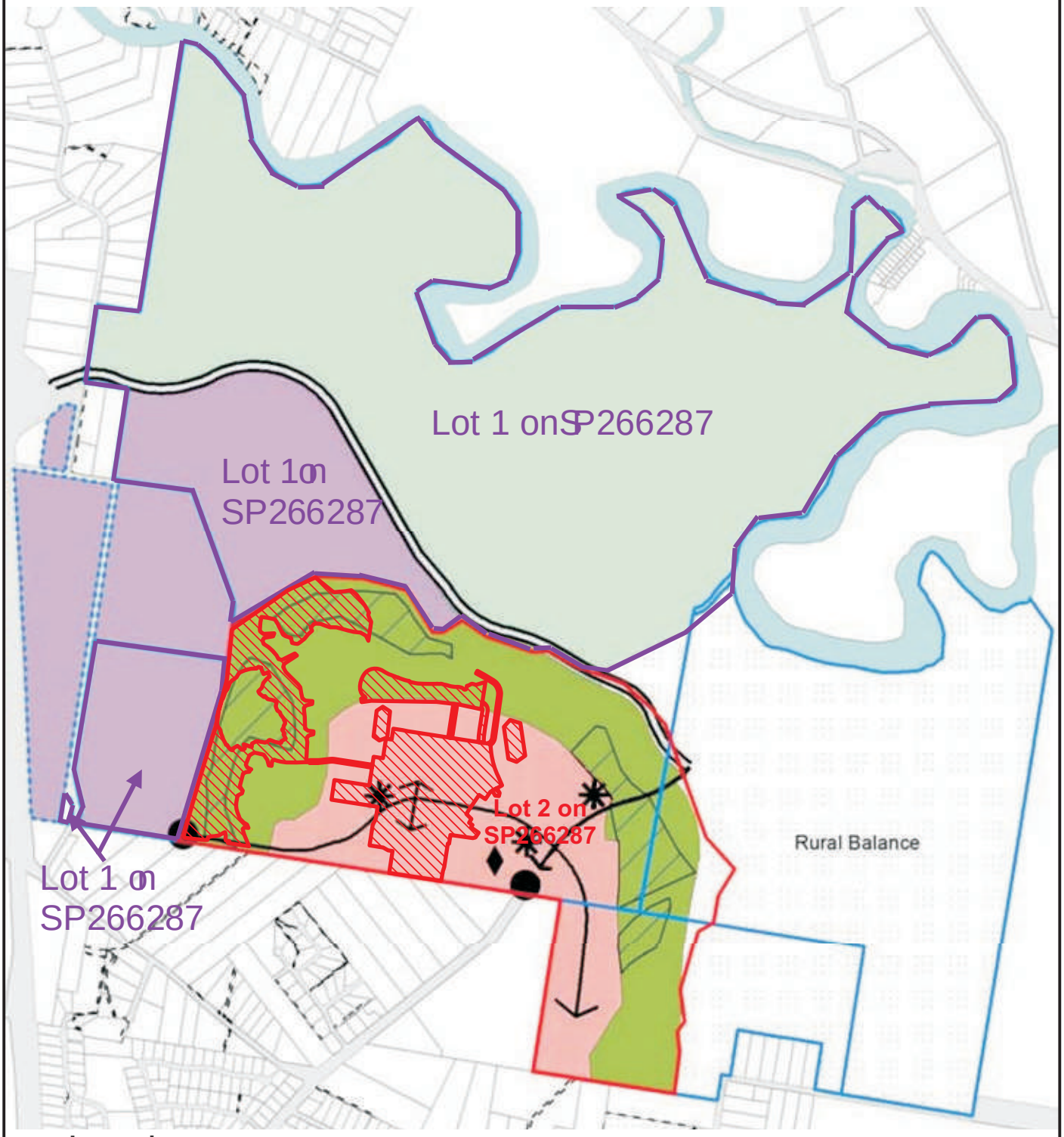
1.5 Roles and Responsibilities

It is the responsibility of North East Business Park Pty Ltd (the Developer) to ensure that all tasks described in this LBEMP Sub-Plan 3 are completed within the specified timeframes.

The Developer is to ensure that all employees and contractors involved in the NEBP development works are aware of, and contractually required to comply with, the requirements of the overarching LBEMP for MNES v2 and this LBEMP Sub-Plan 03.

In the preparation of this LBEMP Sub-Plan 03, the services of an appropriately qualified and experienced ecologist have been engaged for the purposes of determining:

- The risk of negative impacts on MNES within Phase 2; and
- Environmental management measures required to minimise to the greatest extent practicable, any adverse impacts on MNES.



Legend

- Lot 2 Extent
- Phase2 Extent
- Current Lots
- Extent of NEBP
- MIBA
- RWA
- MIBA Open Space
- RWA Open Space
- Rural Balance
- Compensatory Flood
- Arterial
- Sub-Arterial
- Collector
- Education Node
- Community Node
- Load Limited Threshold

N

0 500m

SOURCE: RPS 2014 Preliminary Approval Structure Plans

SCALE: 1 : 20 000 @ A4

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PROJECT
Land Based Environmental Management Plan Sub-Plan 03; NEBP RWA Phase 2; Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

FIGURE 1

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Phase 2 (2).cdr

TITLE
LOCATION OF PHASE 2 WITHIN APPROVED STRUCTURE PLAN FOR RWA

Legend

- Constructed (SWQI) Wetland Zone
- Parkland Zone
- Habitat Protection Zone
- Habitat Restoration Zone
- Regional Road Corridor
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- Open Space Precinct
- RWA Boundary
- NEBP Boundary

N

0 100m 200m

1 : 8000

SOURCE: JWA; Cardno 2014 NEBP RWA Raff Creek RCP; Design Flow (SURF4270_DESIGN_v2010.dwg); KNPL (15-110-MCU_STG2B.dwg & 15-110-MCU.dwg)

SCALE: 1 : 8000 @ A3

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PROJECT
Land Based Environmental Management Plan
Sub-Plan 03; NEBP RWA Phase 2
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

FIGURE 2

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Open Space Zone.cdr

TITLE

RWA OPEN SPACE ZONES

2 DESCRIPTION OF APPROVED WORKS PROGRAM

2.1 Description of Works Site

The extent of the works site is shown in **FIGURE 2** and comprises a total area of 40.2 hectares. The location of Phase 2 within the context of the approved structure plan for RWA is shown in **FIGURE 1**. As shown in **FIGURE 2**, the RWA contains approximately 87 hectares (or 50%) of open space, comprising:

- 8 hectares of land to be developed as formal parklands, generally located above the Q100 flood level (the Parkland Zone);
- 3 hectares of land that is to be maintained in its current condition to accommodate a potential regional road corridor;
- 11 hectares of land that will accommodate a total of seven (7) constructed wetlands that are proposed as part of the NEBP RWA development's stormwater treatment train (the Constructed Wetland Zone);
- 27 hectares of existing native vegetation and fauna habitats associated with Raff Creek that are to be retained and managed primarily for environmental purposes (the Habitat Protection Zone); and
- 41 hectares of land that is to be re-profiled to provide the required flood storage offsets and subsequently rehabilitated to a natural condition and managed for environmental purposes (the Habitat Restoration Zone).

The works site has been largely cleared of native vegetation, with the exception of *Melaleuca quinquenervia* (Broad-leaved Paperbark) and *Eucalyptus tereticornis* (Queensland Blue Gum) fringing Raff Creek and a small number of *E. tereticornis* scattered across paddocks. This remaining vegetation is not mapped as any remnant regional ecosystems. The majority of the works site (all of the Phase 2 area) is currently used for cattle grazing, with vegetation dominated by a range of native and introduced pasture grasses. Weed species include *Sporobolus africanus* (Parramatta Grass), *Lantana camara* (Lantana), *Baccharis halimifolia* (Groundsel bush) and *Schinus terebinthifolius* (Broad-Leaved Pepper Tree). Weed control is being actively managed as part of the grazing of the property.

More elevated areas within the works site are consistent with the description of disturbed terrestrial grassland/woodland as described in the Ecological Assessment Report prepared by JWA for the NEBP - RWA Phase 2 (JWA 2015) (**APPENDIX A**). Low-lying areas within the works site are consistent with the description of herb swamp, mangrove and casuarina wetland and disturbed wet-terrestrial grassland/sedgeland mosaic.

The Raff Creek anabranch in the northern portion of Phase 2 is consistent with the description of floodplain tree swamp. The majority of mature trees within Stage 2 are associated with this creek including large *Eucalyptus tereticornis* along the banks and adjacent floodplain, and *Melaleuca quinquenervia* communities within the channel.

Overall, the works site has experienced substantial disturbance as a result of previous land uses, which has severely degraded the ecological values of this land. Prior to being used for grazing, the works site was used for plantation forestry and other agricultural uses since the late 1800s.The works site does not contain any areas of mapped remnant vegetation or essential habitat.

The location of various vegetation communities and habitat types identified within the works site is shown on the Vegetation Clearance Plan included in **APPENDIX B**.

2.2 Description of Works Program

The works program is subject to the following development application:

- Development Permit for Reconfiguring a Lot – Residential West - Phase 2 – Stages 7 to 12 (199 Lots) lodged on 16th June 2014.

The works program covered by this LBEMP Sub-Plan 03 involves:

- Constructed wetland A to treat stormwater from Phase 1 and subsequent phases including Phase 2;
- Creation of a total of 199 lots over six (6) stages;
- Bulk earthworks involving 285,000m^3 of earthworks cut to fill; and
- Internal roadworks, water and sewerage networks, and stormwater infrastructure servicing new lots within Phase 2.

Although the entire works site will be cleared and grubbed as part of the works program, the clearance of native vegetation as defined in EPBC Approval 2006/2092 that is covered by this LBEMP Sub-Plan 03 is limited to the removal of approximately 2.3 hectares of remnant and regrowth Floodplain tree swamps, and regrowth Mangroves and Casuarina estuarine wetlands associated with Raff Creek. This vegetation is described in the EA Report (JWA 2015).

2.3 Summary of Works Program

A summary of the works site and works program covered by this LBEMP Sub-Plan 03 is provided in Table 2-1.

TABLE 2-1: DESCRIPTION OF APPROVED WORKS PROGRAM ASPECT DESCRIPTION

Aspect	Description	Figure/Plan Reference
Works Site Description	Residential West Area – Phase 2 Part of Lot 2 on SP266287 (formerly part of Lot 10 on SP130251)	Refer to **FIGURE 2**
Works Site Area	40.2 hectares	**FIGURE 2**
Vegetation (Habitat) Types within Works Site	Floodplain Tree Swamps – 2.0 ha Mangrove and Casuarina Wetlands – 0.3 ha	Refer to **APPENDIX B – Vegetation Clearance Plan.**
Nature and Extent of Vegetation Clearance Works	Approximately 2.3 hectares of Floodplain Tree Swamps and Mangrove and Casuarina Estuarine Wetlands will be cleared as part of the works program. The clearance of non-remnant vegetation will be subject to the same controls as outlined in the EPBC approval.	Refer to **APPENDIX B – Vegetation Clearance Plan**.
Nature and Extent of Bulk Earthworks	Bulk earthworks include approximately 285,000m^3 of cut to fill for construction of	Refer to **FIGURE 2** and **APPENDIX C –**

Aspect	Description	Figure/Plan Reference
	the residential lots. In addition, minor excavation works will be required for construction of stormwater drainage, sewerage and water supply infrastructure, and temporary sediment basins.	**Bulk Earthworks Drawings**.
Nature and Extent of Road Works	Construction of 2,200 metres of new internal road.	Refer to **APPENDIX D – Subdivision Layout Plans**.
Nature and Extent of Infrastructure and Building Works	Approximately 1,600 metres of sewer rising main, approximately 2,500 metres of sewer gravity main and a new sewerage pump station connecting the residential lots to existing trunk infrastructure in Coach Road via Nolan Drive. Construction of approximately 2,200 metres of trunk water main connecting residential lots to Coach Road via Buckley Road. Construction of two (2) temporary sediment basins and associated swales discharging to Raff Creek. These sediment basins will remain in place until permanent stormwater quality and quantity infrastructure, primarily constructed wetlands, are constructed within the Open Space precinct in future phases.	Refer to **FIGURE 2** and **APPENDIX C – Bulk Earthworks Drawings**.
Nature and Extent of Landscaping Works	Landscaping works include street scaping and entry works.	
Nature and Extent of Restoration Works	Rehabilitation of sections of the Raff Creek floodplain within the Open Space Precinct.	Refer to **APPENDIX E – Raff Creek Restoration Concept Plan**
Relevant State and Local Government Approvals	MCU-2004-1420 – Preliminary Approval for Material Change of Use for Residential West Area issued by Moreton Bay Regional Council on 28th June 2013. DA/28493/2013 – Development Permit for Reconfiguring a Lot (creation of three (3) management lots, including Lot 2 on SP266287) issued by Moreton Bay Regional Council on 13th March 2014.	N/A
Timing and Duration of Approved Works Program	**Commence:** June 2015 **Complete:** March 2016 to June 2016	N/A

A Vegetation Clearance Plan, illustrating various vegetation communities / habitat types to be cleared, is provided in **APPENDIX B.** Bulk earthworks drawings, including erosion and sediment control plans, are provided in **APPENDIX C**. Subdivision layout plans

showing proposed residential lots and internal road works are provided in **APPENDIX D.** The Raff Creek Restoration Concept Plan is provided in **APPENDIX E**.

3 MNES RISK ASSESSMENT

3.1 Introduction

For each works program forming part of the NEBP development, the approved overarching LBEMP for MNES v2 (Cardno 2014) requires a risk assessment of potential adverse impacts of the works program on MNES. Table 3-2 of Section 3.3 of the LBEMP for MNES v2 (Cardno 2014) specifies the MNES that are to be considered by the LBEMP.

This MNES Risk Assessment for the works program the subject of this LBEMP Sub-Plan 03 has been completed based on consideration of:

- The likelihood of occurrence of specific MNES within or adjacent to the approved works site; and
- The risk assessment framework contained within Section 4 of the LBEMP for MNES v2 (Cardno 2014).

3.2 Likelihood of Occurrence Assessment

The likelihood of occurrence of MNES presented in **TABLE 3-1** is generally based on the assessments presented in Table 3-2 of the LBEMP for MNES v2 (Cardno 2014). The assessment was amended to specifically reflect the nature of vegetation and habitat types present within and adjacent to Phase 2 of the RWA.

The nature of vegetation and habitat types present within and adjacent to the approved works site has been based primarily on the Ecological Assessment Report – NEBP Residential West RoL dated 12th June 2014 and prepared to support the development applications for reconfiguring a lot and operational works lodged with Moreton Bay Regional Council in relation to the works program subject of this LBEMP Sub-Plan 03.

The likelihood of occurrence of MNES was also based on the site assessment completed on 11th March 2015.

TABLE 3-1: ASSESSMENT OF LIKELIHOOD OF OCCURRENCE

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
Acacia attenuata	Attenuate Wattle	Low lying, high rainfall heathland or open eucalypt forest within coastal regions.	**Moderate**. This species has not previously been recorded in the RWA but may occur within and adjacent to patches of *Melaleuca* tree swamps and eucalypt woodland / open forest on the works site and adjoining land.
Arthraxon hispidus	Hairy Joint Grass	Moisture and shade-loving grass, found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps. Dependence on persistent and reliable groundwater.	**Low / Moderate**. This species has not previously been recorded in the RWA but may occur within and adjacent to patches of *Melaleuca* tree swamps and eucalypt woodland / open forest on the works site and adjoining land. Low across remainder of works site.
Cryptostylis hunteriana	Leafless Tongue Orchid	Variety of heath, sedge and forested communities usually on moist sandy soil or clay loam below 1000m altitude. Detection is only possible during flowering which tends to occur in the August-January period in SEQ and northern NSW.	**Low / Moderate.** This species has not previously been recorded in the RWA but areas of *Melaleuca* tree swamps and eucalypt woodland / open forest on and adjoining the works site provide potential habitat for this species. Low across remainder of works site.
Phaius australis	Lesser Swamp Orchid	Swamps and low lying depressions within forests requires full shade, often associated with *Melaleuca* quinquenervia wetlands.	**Low / Moderate.** This species has not previously been recorded in the RWA but areas of *Melaleuca* tree swamps and upslope fringes of eucalypt woodland / open forest on and adjoining the works site provide potential habitat for this species. Low across remainder of works site.
Pteropus poliocephalus	Grey-headed Flying Fox	Tropical and temperate wet and dry sclerophyll forest and mangroves. Roosts in trees beside water, feeds on flowering trees.	**Moderate.** This species has not previously been recorded and no roosting sites are known to occur within the RWA. Flowering eucalypts and *Melaleuca* trees within and adjoining the works site provide potential feeding resources for this species.
Xeromys	Water Mouse[#]	Foraging and nesting habitat restricted to	**Low.** Areas of coastal and sub-coastal swamps on

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
myoides		mangrove and saltmarsh communities.	site and downstream of the works site, including saline saltmarsh habitats and non-saline tree swamps provide potential habitat for this species, although the quality of this habitat is substantially reduced by livestock disturbance.
Phascolarctos cinereus	Koala[#]	Open eucalypt forest and woodland at lower altitude in undulating country on relatively deep and usually high nutrient soil.	**Moderate / High.** Evidence of koala activity has previously been recorded within the scribbly gum open forest and adjacent *Melaleuca* / eucalypt woodlands that occur on and adjoining the works site. *Eucalyptus tereticornis* associated with the Raff Creek corridor, and scribbly gum open forest south of the works site provide the most suitable areas of habitat for this species (High likelihood of occurrence). However, scattered *E. tereticornis* within the residential lot area may also provide occasional habitat for this species (Moderate likelihood of occurrence).
Erythrotriorchis radiatus	Red Goshawk	Various habitat types including coastal & sub-coastal tall open forest, tropical savannah adjacent to wooded or forested rivers, and rainforest edges are utilised with a preference for a mosaic of vegetation types near to a permanent watercourse.	**Moderate.** Woodland and open forest areas within and adjoining the works site provide potential foraging habitat for this species. However this species may also utilise scattered eucalypts within grazed areas to search for prey.
Rostratula australis	Australian Painted Snipe	Shallow and vegetated wetland areas are considered important habitat types for this species.	**Low.** This species has not previously been recorded in the RWA. Wet grassland areas within the works site provide some potential habitat for this species. However, the level of grazing and slashing that occurs across these areas has substantially reduced the quality of this potential habitat.
Lathamus	Swift Parrot	Preferences of habitat for the swift parrot, in	**Low / Moderate**. Areas of *Melaleuca* / eucalypt

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
discolour		Queensland, include eucalypts such as narrow leaved ironbark, yellow box forests and forest red gum. Larger trees are believed to be preferred by the species.	woodland within and adjoining the works site provide potential habitat for this species. Moderate likelihood within Buckley Road and Nolan Drive, and along section of trunk sewer crossing drainage line.
Xanthomyza phrygia	Regent Honey-eater	Eucalypt forest and woodland are considered critical habitat for this species.	**Low / Moderate**. Areas of scribbly gum open forest and *Melaleuca* / eucalypt woodland within and adjoining the works site provide potential habitat for this species, particularly areas of remnant scribbly gum open forest located on adjoining land to the south. Moderate likelihood within Buckley Road and Nolan Drive, and along section of trunk sewer crossing drainage line. Low across remainder of works site.
Cyclopsitta diophthalma coxenii	Coxen's Fig-parrot	The presence of fruiting trees, particularly fig trees, seems to be of importance in habitat preference of the Coxen's Fig- parrot. No single habitat type has been identified as critical.	**Low / Moderate.** Areas of scribbly gum open forest and *Melaleuca* / eucalypt woodland within and adjoining the works site provide potential habitat for this species, particularly areas of remnant scribbly gum open forest located on adjoining land near Nolan Drive. A large fig tree occurs within the Buckley Road extension. Moderate likelihood within Buckley Road and Nolan Drive, and along section of trunk sewer crossing drainage line. Low across remainder of works site.
Litoria olongburensis	Wallum Sedge Frog[#]	Low pH, wallum habitats which support emergent vegetation including sedges, grasses and reeds. Sensitive to disturbance.	**Low.** Areas of *Melaleuca* tree swamps, eucalypt woodland and wet grasslands areas within and adjoining the works site may provide potential habitat for this species, however habitat quality is low due to disturbance from cattle.
Pseudomugil	Honey Blue-eye	This species is typically found in the coastal	**Low.** Potential habitat for this species is

MNES		Habitat Requirements	Likelihood of Occurrence
Scientific Name	**Common Name**		
mellis		lowland "wallum" ecosystem. Not previously recorded in the Caboolture River system. May occur in freshwater sections of Raff Creek upstream of the works site.	associated with denser patches of sedges within the freshwater reaches of Raff Creek adjoining the works site.
Caretta caretta	Loggerhead Turtle	Marine species known to inhabit but not nest within Moreton Bay.	**Very Low.** This species is known from Moreton Bay, which is located approximately 12 kilometres downstream of the works site.
Chelonia mydas	Green Turtle	Marine species known to inhabit but not nest within Moreton Bay.	**Very Low.** This species is known from Moreton Bay, which is located approximately 12 kilometres downstream of the works site.
Lepidochelys olivacea	Pacific Ridley Turtle	Marine species known to inhabit but not nest within Moreton Bay.	**Very Low.** This species is known from Moreton Bay, which is located approximately 12 kilometres downstream of the works site.
Lepidochelys imbricate	Hawksbill Turtle	Marine species known to inhabit but not nest within Moreton Bay.	**Very Low.** This species is known from Moreton Bay, which is located approximately 12 kilometres downstream of the works site.
Argyreus hyberbius inconstans	Australian Fritillary*	The larval food plant, Native Violet (*Viola betonicifolia*), is vital for the breeding efforts of this species. As such, Long- leaved Matrush and Blady Grass are also considered important habitat resources for this species.	**Low / Moderate.** Potential habitat for this species may be found within the freshwater reaches of Raff Creek adjacent to and upstream of the works site. The highest likelihood of occurrence is associated with sewer works along Nolan Drive and the southern boundary of the NEBP site.

Notes:
MNES species not listed in EPBC Approval but known or considered likely to occur in or adjacent to the NEBP site and therefore considered in the LBEMP Sub-Plans.
* Species listed in the EPBC Approval but not currently listed as an MNES pursuant to the EPBC Act and therefore not subject to further consideration in this LBEMP Sub-Plan.

3.3 MNES Risk Assessment

To manage the risk of adverse impacts on MNES and comply with the duty of care as defined by the *Environmental Protection Act 1994*, the following is required:

- Identification of the potential environmental hazards associated with the works program;
- Assessment environmental risks; and
- Development of controls to eliminate or minimise residual environmental risk.

In accordance with AS/NZS ISO 31000:2009 Risk management – Principles and Guidelines and Section 4 of the LBEMP for MNES v2 (Cardno 2014), a project hazard identification and risk assessment has been undertaken in order to identify and evaluate the risks posed to MNES by the various construction activities associated with the works program.

This risk assessment evaluates unmitigated project specific environmental hazards, including assigning likelihood and consequence levels, to determine a risk rating for each identified risk. The criteria for determining likelihood and consequence levels, and risk ratings for each identified risk are based on AS/NZS ISO 31000:2009 and are consistent with the criteria described in Tables 4-1 to 4-3 of Section 4 of the LBEMP for MNES v2 (Cardno 2014).

Likelihood and consequence criteria and the risk rating matrix adopted in this risk assessment are provided in **TABLES 3-2 to 3-4** of this LBEMP Sub-Plan 03. The results of the risk assessment are documented in **TABLE 3-5** of this LBEMP Sub-Plan 03. Note that in cases where the likelihood and consequence of risks relating to a particular hazard varied across the works site, the most conservative figure was adopted.

TABLE 3-2: LIKELIHOOD LEVELS

Level	Descriptor	Qualitative Description
A	Almost Certain	The event is expected to occur. The event will occur on an annual (or more frequent) basis.
B	Likely	It is probable the event will occur. The event has occurred several times before at similar developments.
C	Possible	The event may or may not occur. The event may occur once during the development.
D	Unlikely	The event may occur at some time but is unlikely. The event has been known to happen from time to time at similar developments.
E	Rare	The event may occur in exceptional circumstances. The event has not been heard of occurring at similar developments.

TABLE 3-3: CONSEQUENCE LEVELS

Level	Descriptor	Qualitative Description
1	Insignificant	**Environment:** No damaged detected. **People:** Event does not result in injury (i.e. no medical treatment required). **Property:** No damage to property. **Amenity:** No detectable impact on amenity.
2	Minor	**Environment:** Minor impact of short duration or short term

Level	Descriptor	Qualitative Description
		damage. **People:** Reversible injury or illness. **Property:** Minor damage to property (<$5,000 to repair). **Amenity:** Minor, localised and short term amenity impacts, no complaints.
3	Moderate	**Environment:** Short term damage, localised impact. **People:** Irreversible disability or impairment (30%) to one or more persons. **Property:** Moderate damage to property (<$50,000 to repair). **Amenity:** One (1) or two (2) complaints, impacts extending to several properties and/or lasting for several days.
4	Major	**Environment:** Significant impact locally and potential for offsite impacts. **People:** Severe injuries or impairment (60%) to one or more persons, single fatality. **Property:** Major damage to property (<$500,000 to repair). **Amenity:** Many complaints, impacts extensive and/or lasting for many days, up to five (5) properties rendered uninhabitable for more than one day.
5	Catastrophic	**Environment:** Significant impacts to regional ecosystems and threatened species, potential for widespread off site impacts. **People:** Multiple fatalities, or irreversible injuries/impairment (>60%). **Property:** Significant loss to property (>$1,000,000 to repair). **Amenity:** Multiple dwellings rendered uninhabitable for >1 day.

TABLE 3-4: RISK MATRIX CRITERIA

		Consequence				
		1 (Insignificant)	**2 (Minor)**	**3 (Moderate)**	**4 (Major)**	**5 (Catastrophic)**
Likelihood	**A (Almost Certain)**	Medium	High	High	Extreme	Extreme
	B (Likely)	Medium	Medium	High	High	Extreme
	C (Possible)	Low	Medium	High	High	High
	D (Unlikely)	Low	Low	Medium	Medium	High
	E (Rare)	Low	Low	Medium	Medium	High

The risk ratings presented in **TABLE 3-4** are to be interpreted as follows:

- **Low:** Risk can be adequately managed by routine procedures and work practices.

- **Medium:** Corrective action other than administrative controls is needed.
- **High:** Significant risk control measures need to be implemented before works commence.
- **Extreme:** Operations are not to be undertaken without extensive risk control and mitigation measures in place prior to the commencement of works.

The emphasis of this LBEMP Sub-Plan 03 is on the management of activities assessed as having a risk rating of 'Extreme', 'High' or 'Medium' for MNES that are known or considered likely to occur within (Moderate or High likelihood of occurrence) or adjacent to the works site the subject of the approved works program.

As such, for each hazard associated with the approved works program that has been assessed as having a 'Extreme', 'High' or 'Medium' level of risk to one or more MNES, applicable environmental management elements are specified in **TABLE 3-5** and associated detailed specifications are provided in **SECTION 4** of this LBEMP Sub-Plan 03.

TABLE 3-5: ENVIRONMENTAL RISK ASSESSMENT REGISTER

Hazard	Risk	MNES Potentially Impacted	Likelihood	Consequence	Risk Rating	Management Element Reference Section
Vegetation clearing and grubbing	Loss of MNES flora within areas to be cleared / grubbed.	All MNES flora.	D	3	Medium	3
	Damage to potential habitat for MNES flora and fauna intended to be retained.	All MNES flora and fauna.	C	3	High	2, 3
	Injury, death or displacement of MNES fauna.	All terrestrial MNES fauna.	C	3	High	2
	Removal of topsoil resulting in loss of seed bank / tubers of MNES flora.	*Acacia attenuata* Leafless Tongue Orchid Lesser Swamp Orchid	C	3	High	3
	Increased soil instability causing erosion and sedimentation of downstream waterways providing potential habitat for MNES.	Wallum Sedge Frog Honey Blue Eye Marine Turtles	C	4	High	5
Movement of construction plant and machinery, increased road traffic from construction vehicles.	Injury or death of MNES fauna utilising the works site or surrounding road network.	All terrestrial MNES fauna.	C	3	High	2
	Introduction and / or spread of weeds or pest animal / ant species causing degradation of	All MNES flora and fauna.	B	3	High	4

Hazard	Risk	MNES Potentially Impacted	Likelihood	Consequence	Risk Rating	Management Element Reference Section
	potential habitat for MNES potential or increased competition / predation on MNES.					
Construction personnel bringing dogs onto the works site.	Injury and harassment of MNES fauna.	All terrestrial MNES fauna.	B	2	Medium	2
Bulk earthworks, including filling and excavation, generally.	Erosion and discharge of sediment-laden runoff to downstream waterways impacting on water quality and habitat for MNES, including loss or reduction of seagrass and other benthic feeding grounds within Raff Creek, Caboolture River and Moreton Bay.	Wallum Sedge Frog Honey Blue Eye Marine Turtles	C	4	High	5
Bulk earthworks, including filling and excavation, below 5m AHD.	Disturbance of potential acid sulphate soils resulting in release of acidic discharge and other contaminants to soils and downstream waterways providing potential habitat for MNES.	Wallum Sedge Frog Honey Blue Eye Marine Turtles	B	4	High	6
Construction of roads, stormwater,	Runoff of sediment from disturbed work surfaces	Wallum Sedge Frog Honey Blue Eye	C	4	High	5

Hazard	Risk	MNES Potentially Impacted	Likelihood	Consequence	Risk Rating	Management Element Reference Section
sewerage and water supply infrastructure, and landscaping works.	and stockpiles causing sedimentation of downstream waterways, impacting on water quality and habitat for MNES.	Marine Turtles				
	Introduction or spread of weeds or pest animals / ants through importation of construction materials, plant and equipment.	All MNES flora and fauna.	B	3	High	4
Fire ignition caused by operation of construction plant or equipment, welding, personnel smoking or other construction activities.	Spread of uncontrolled fire resulting in loss or damage to retained vegetation providing potential habitat for MNES.	All terrestrial MNES flora and fauna.	D	2	Low	N/A

4 ENVIRONMENTAL MANAGEMENT ELEMENTS

Based on consideration of the risk assessment presented in **TABLE 3-5**, the following environmental management elements have been identified as applicable to the approved works program the subject of this LBEMP Sub-Plan 03:

- Element 1: LBEMP Sub-Plan Risk Assessment (refer **SECTION 3**);
- Element 2: Fauna;
- Element 3: Flora;
- Element 4: Weeds and Pests;
- Element 5: Soil Erosion, Sediment Loss and Water Quality; and
- Element 6: Acid Sulphate Soils.

Each of these environmental management elements consists of the following key components:

- **Rationale:** the reason(s) why this management element is, or is not, relevant to the specific works program the subject of this LBEMP Sub-Plan 03.
- **Objectives:** the objectives and targets to be achieved by implementing this management element.
- **Performance Indicators:** measurable indicators and standards set to assess the efficacy of management measures taken.
- **Tasks:** specific management and monitoring tasks that need to be undertaken, including:
    - Actions: details of the actions, including monitoring, to be undertaken; and
    - Timing: details concerning the timing and frequency for undertaking specific actions.

4.1 Element 1: LBEMP Sub-plan MNES Risk Assessment

SECTION 3 of this LBEMP Sub-Plan 03 details the MNES Risk Assessment undertaken for the approved works program in accordance with Element 1: LBEMP Sub-Plan MNES Risk Assessment.

4.2 Element 2: Fauna

Rationale
The approved works program involves the clearance of approximately 2.3 hectares of non-remnant native vegetation including areas of Floodplain Tree Swamps and Mangrove and Casuarina Estuarine Wetlands as well as a range of disturbed grassland communities providing habitat of low quality for a number of fauna species listed as MNES under the EPBC Act. The removal of vegetation has the potential to result in the direct loss of suitable habitat for terrestrial MNES fauna, particularly through the clearing of mature *Eucalyptus tereticornis*, as well as causing disturbance and possible displacement to MNES fauna utilising adjacent habitat to be retained due to increased construction noise and the possible introduction of domestic dogs on site by construction personnel. The removal of vegetation, including large mature trees and disturbed grassland areas, has the potential to increase sedimentation within downstream waterways indirectly

impacting suitable habitat for aquatic MNES further downstream along Raff Creek, the Caboolture River, and in Moreton Bay. Construction activities associated with the approved works program will involve increased movement of plant and equipment on site, and increased vehicular traffic on site and surrounding roads, which increases the risk of causing injury or harm to fauna utilising these areas.

Construction activities have the potential to introduce weeds and pest species that could degrade the quality of fauna habitat adjacent to the site. Vegetation clearance works are to be undertaken in a manner that protects habitats adjacent to the site, and encourages fauna to move out of the vegetation clearance zone and into adjacent areas of retained habitat.

Objective / Target

- Development of the NEBP is conducted in a manner that minimises impacts to fauna listed as MNES.
- Areas of fauna habitat that are to be retained are appropriately protected during the construction phase.
- Authorised fauna habitat disturbance is carried out in accordance with best practice environmental management measures, as well as the terms and conditions of relevant permits authorising such disturbance.
- Any tampering with animal breeding places or handling of native wildlife is undertaken only by persons holding the appropriate permits under the *Nature Conservation Act 1992*.
- Existing infestations of pest fauna species are controlled and no new pest species are introduced to or spread within the works site.

Performance Indicators

- Construction activities do not result in avoidable harm to any fauna listed as MNES.
- Compliance with project-specific conditions of approval relating to vegetation clearing or disturbance to native fauna.
- Vegetation clearing is limited to the approved clearance zones.
- Vegetation adjacent to the approved clearance zones is retained and protected at all times during the construction phase.

Management Measures		
Tasks	**Actions**	**Timing**
Identify and protect all vegetation and fauna habitats adjacent to the approved clearance zones.	Clearly define the limits of the approved clearance zones on all construction plans (refer to Vegetation Clearance Plan presented in **APPENDIX B**). The approved clearance zone is restricted to within the extent of the works site shown in **APPENDIX B** and **APPENDIX C**. Physically demarcate areas of vegetation and fauna habitat to be retained using high visibility temporary or permanent fencing prior to the commencement of development activities. Advise all construction personnel, including sub-contractors, of the approved clearance zones as part of the site induction.	Prior to the commencement of any vegetation clearance.

Management Measures		
Tasks	**Actions**	**Timing**
	Conduct regular inspections and maintenance of fencing protecting retained vegetation and habitat to maintain effectiveness.	
Conduct pre-clearance surveys of approved clearance zones.	Survey the defined approved clearance zone for the presence, or likely presence, of fauna listed as MNES by an appropriately qualified and experienced ecologist. Mark the location of any fauna MNES that were observed during the pre-clearance surveys with GPS and flagging tape.	Prior to the commencement of any vegetation clearance.
Engage an appropriately licensed DEHP licenced Fauna Spotter / Catcher.	An appropriately licenced Fauna Spotter / Catcher is to be engaged to supervise and direct vegetation clearance works and is to be present on site for the duration of clearing works. The appointed Fauna Spotter / Catcher is to inspect the approved clearance zone and the findings of the pre- clearance survey.	Prior to and during any vegetation clearance works.
Conduct vegetation clearing in a manner that ensures any native fauna living within or adjacent to the vegetation to be removed has time to move out of the areas of disturbance without human intervention.	The appointed Fauna Spotter / Catcher is to be authorised to issue relevant instructions to the vegetation clearance contractor to ensure: • vegetation clearance works comply with the procedures of Policy 6: Vegetation Clearing Practices of the Nature Conservation (Koala) Conservation Plan 2006, including: - limiting the extent of clearance to not more than 3 hectares of open forest in any single day; and - ensuring that for a period of at least 12 hours, extending from 6:00pm until 6:00am on the following day, no further vegetation clearance occurs on the site; • any vegetation occupied by native fauna is not cleared until the fauna moves out of the vegetation, or (with the exception of Koala) is relocated to a secure area of similar habitat by a licensed Fauna Spotter / Catcher; and • vegetation clearance is conducted in a sequential manner in order to direct native fauna away from threatening processes or hostile	During all vegetation clearance works.

Management Measures		
Tasks	**Actions**	**Timing**
	environments (e.g. roads) and towards any retained vegetation or habitat links. Unless directed by the appointed Fauna Spotter / Catcher, vegetation clearance works are to be carried out in accordance with the specifications provided in the Vegetation Clearance Plan (**APPENDIX B**).	
Domestic pets are excluded from the site during vegetation clearance works.	No domestic pets are to be brought into the site by contractors employed to undertake vegetation clearance works. Any contractors who ignore this management specification may, at the discretion of the Developer or its authorised representatives, be banned from the site.	During all vegetation clearance works.
Preparation of a post-clearance Fauna Management Report.	At the completion of vegetation clearance works, a brief post-clearance Fauna Management Report is to be completed and is to contain: • details on any incidents that occurred during the clearing; • details of any translocated fauna, such as species, location relocated; • an evaluation of the fauna management techniques; • a description of any additional future management measures; and • the name, licence reference number and contact details of the appointed Fauna Spotter / Catcher.	Following completion of vegetation clearance works.
Traffic management, and operation of construction vehicles, plant and equipment on site.	Construction planning is to make appropriate provision for the safe movement of native fauna, including the MNES listed Koala, through the NEBP site as is required by State Referral Agency Condition 7 of MCU-2004-1420. Vehicles attending and operating within the approved works site are to be operated in a manner that minimises the potential for harm to native fauna, including obeying all speed limits and utilising designated access roads as far as practicable.	Ongoing during the construction phase.
Trenches and excavations.	All open trenches and excavations are to be managed to minimise the potential for entrapment of native fauna by: • minimising as far as possible the period of time when	Ongoing during the construction phase.

Management Measures		
Tasks	**Actions**	**Timing**
	trenches/excavations with steep sides (i.e. all slopes greater than 1V:1H) are open and accessible to native fauna; • inspection of open trenches/excavation each morning to identify the presence of any fauna that have become trapped; • provision of assistance to entrapped native fauna, including engagement of the services of a licensed Fauna Spotter / Catcher if required; and • establishment of exclusion fencing around any steep-sided trenches or excavations (i.e. all slopes greater than 1V:1H) that are to remain open for extended periods of time (i.e. > 48 hours).	
Care of injured fauna.	Any fauna recovered during vegetation clearance works or construction works generally, will, immediately upon capture by the licensed Fauna Spotter / Catcher, be inspected for any signs of physical injury. If the fauna appears to be injured, it will be immediately transported to a suitably qualified and licensed veterinary surgeon or wildlife carer for appropriate treatment. Uninjured fauna will be relocated to suitable, habitat in the surrounding area as described above. The details for nearby, suitable wildlife care facilities are: • Royal Society for the Prevention of Cruelty to Animals (RSPCA) – Ph: 1300 264 625 • Queensland Department of Environment and Heritage Protection (DEHP) – Ph: 1300 130 372.	Ongoing during the construction phase.
Reporting of Incidents involving Threatened Fauna	Any incidents involving Commonwealth listed species will be reported in writing to the Department of Environment (Post Approvals Section, Compliance and Enforcement Branch) within ten (10) business days of the incident. Any incidents involving State listed species will be reported in writing to the Queensland Department of Environment and	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	Heritage Protection (DEHP) within ten (10) business days of the incident. The report will include the following details: • Time and date of the incident; • Details of the activity (i.e. vegetation clearance, earthworks etc.); • Details of the threatened species involved; • Impacts of the incident on the animal (i.e. deceased, injured, uninjured); • Immediate actions taken (i.e. transported for treatment, relocated etc.); • Corrective actions taken to prevent further incidents.	
Record Keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • photographic records of the establishment of required fencing; • the dates and locations of habitat clearance works are to be maintained; • the name, licence reference number and contact details of the licensed Fauna Spotter / Catcher that supervised the vegetation clearance works each day; • details concerning any native vertebrate fauna that were injured during the approved works program and the actions taken in respect thereof; and • post-clearance Fauna Management Report.	Ongoing
Corrective Actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 03. Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • cessation of vegetation clearance activities;	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	• restoration of fauna habitats subject to unauthorised disturbance; • establishment of fauna exclusion fencing around the works site; • reductions in vehicular speed limits within the works site; or • environmental awareness training of personnel.	

4.3 Element 3: Flora

Rationale
The approved works program involves the clearance of approximately 2.3 hectares of non-remnant native vegetation including areas of Floodplain Tree Swamps and Mangrove and Casuarina Esturaine Wetlands as well as a range of disturbed grassland communities providing habitat of variable quality for a number of fauna species listed as MNES under the EPBC Act.
Objective / Target
• Areas of native vegetation located outside of the approved clearance zone are to be retained and appropriately protected; • Authorised vegetation disturbance is carried out in accordance with best practice environmental management measures, as well as the terms and conditions of relevant permits authorising such disturbance; and • Existing weed infestations are controlled and no new weed species are introduced to, or spread within, the site.
Performance Indicators
• All necessary permits are obtained prior to commencing vegetation clearance activities, and vegetation clearance complies with all terms and conditions of applicable permits. • Native vegetation adjacent to the approved clearance zones is retained and protected at all times throughout the construction phase. • No loss or damage to native vegetation occurs outside of the approved clearance zone.

Management Measures		
Tasks	**Actions**	**Timing**
Identify and delineate areas of vegetation clearance and retention.	Clearly define the limits of approved clearance zones on all construction plans (refer to Vegetation Clearance Plan presented in **APPENDIX B**). The approved clearance zone is restricted to within the extent of the works site shown in **APPENDIX B** and **APPENDIX C**. Physically define areas of native vegetation to be retained, within or adjacent to the approved works site, using high visibility temporary or permanent fencing prior to the commencement of development activities.	Prior to the commencement of any vegetation clearance works.

Management Measures		
Tasks	**Actions**	**Timing**
	Advise all construction personnel, including sub- contractors, of the approved clearance zones as part of the site induction. Conduct regular inspections and maintenance of fencing protecting retained vegetation and habitat to maintain effectiveness.	
Conduct clearance of vegetation in a manner that minimises the potential for harm to native fauna.	Implement an appropriate program of controls based on Element 2 – Fauna of this LBEMP Sub-Plan 03.	Ongoing during vegetation clearance works.
Conduct pre-clearance surveys of all vegetation to be removed.	A pre-clearance survey of the approved clearance zone is to be undertaken by an appropriately qualified and experienced ecologist to identify the presence of any flora listed as MNES. Clearly demarcate in the field and record the location with GPS of any flora MNES observed during the pre- clearance survey.	Prior to the commencement of any vegetation clearance works.
Implement appropriate mitigation strategies for any MNES listed flora identified during the pre-clearance surveys.	Determine whether it is practicable to retain and sustain the ecological functionality of the identified MNES flora in-situ, taking into account the nature of the approved development (Note: the retention of small numbers of plants in an ecologically isolated patch of land surrounded by urban/industrial development is unlikely to maintain ecological functionality). If it is possible to achieve the above, incorporate the identified MNES flora into a vegetation protection zone and manage accordingly. For MNES flora that are able to be successfully translocated, obtain necessary permits under the *Nature Conservation Act 1992* (NC Act) from the Queensland Department of Environment and Heritage Protection (DEHP). MNES flora with the potential to occur in the NEBP that are able to be translocated, include: • *Arthraxon hispidus* (Hairy Joint	Prior to commencement of vegetation clearance works in areas supporting MNES flora.

Management Measures		
Tasks	**Actions**	**Timing**
	Grass); • *Cryptostylis hunteriana* (Leafless Tongue Orchid); • *Phaius australis* (Lesser Swamp Orchid); and • *Acacia attenuate* (Attenuate Wattle). Undertake MNES listed flora translocation works in accordance with the terms and condition of relevant permits under the NC Act.	
Monitor the condition of retained and transplanted vegetation.	Visually monitor the condition of retained/transplanted vegetation on a weekly basis for signs of stress or damage throughout the construction period. Undertake issue specific corrective actions in respect of any observed damage/stress to retained/transplanted vegetation. Monitor all MNES flora translocation works in accordance with the terms of the relevant permits issued by DEHP under the NC Act.	Ongoing during the construction phase and in accordance with permit conditions.
Appropriate management, reuse and disposal of cleared vegetation.	Locate any temporary stockpiles of cleared vegetation on-site in a manner that assists with the management of erosion and sediment loss processes (refer LBEMP Element 5). Manage cleared non-native vegetation in accordance with LBEMP Element 4. Reuse or dispose of cleared vegetation in accordance with local government requirements.	Ongoing during the construction phase.
Protect MNES flora during ecological restoration works.	Undertake restoration site preparation and revegetation in a manner that avoids removal or damage to MNES flora. Where ecological restoration works are to be undertaken in areas supporting MNES flora: • mark all MNES listed flora in the restoration area with flagging tape or conspicuous marker stakes; • carefully undertake weed management, soil preparation, and planting works so as to avoid physical or chemical disturbance to MNES flora; and • monitor and record the responses of MNES flora to the ecological	Ongoing during the construction phase.

Management Measures		
Tasks	**Actions**	**Timing**
	restoration works.	
Reporting of Incidents involving Threatened Flora	Any incidents involving Commonwealth listed species will be reported in writing to the Department of Environment (Post Approvals Section, Compliance and Enforcement Branch) within ten (10) business days of the incident. Any incidents involving State listed species will be reported in writing to the Queensland Department of Environment and Heritage Protection (DEHP) within ten (10) business days of the incident. The report will include the following details: • Time and date of the incident; • Details of the activity (i.e. vegetation clearance, earthworks etc.); • Details of the threatened species involved; • Impacts of the incident on the plant; • Immediate actions taken; • Corrective actions taken to prevent further incidents.	Ongoing
Record Keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • photographic records of the establishment of required temporary protection fencing and other exclusionary fencing or marking; • records of pre-clearance survey including location of any MNES flora identified; • records of all permits and approvals obtained for vegetation clearance works, including any translocation works; • the dates and locations of vegetation clearance works; and • results of monitoring condition of retained and translocated vegetation, and restoration works.	Ongoing
Corrective Actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	Sub-Plan 03. Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • cessation of vegetation clearance activities; • maintenance or reinstatement of exclusion fencing or marking; • restoration of vegetation subject to unauthorised clearing; or • environmental awareness training of personnel.	

4.4 Element 4: Weeds and Pests

Rationale

Construction activities, including vegetation clearance works, associated with the approved works program have the potential to:

- introduce weeds or pest animal species to the works site through the importation of construction materials or the use of vehicles, plant and equipment contaminated with pest material (e.g. weed seed, eggs, pest ants);
- further disperse pest species within and external to the works site through the movement of construction vehicles, plant and equipment between areas infested and not currently infested with pests; and
- further disperse pest species through the reuse of cleared vegetation containing weed material across the works site.

Surveys of the NEBP site undertaken for the NEBP EIS (refer Cardno 2008) recorded the presence of a number of Class 2 and Class 3 pest plant species pursuant to the *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act), as listed below:

Common Name	Scientific Name	Location on Site	LP Act Status
Groundsel Bush	*Baccharis halimifolia*	Scattered across site	Class 2
Lantana	*Lantana camara*	Scattered across site	Class 3
Broad-leaved Pepper Tree	*Schinus terebinthifolia*	Scattered across site and in disturbed riparian area	Class 3

In addition, a site inspection conducted to inform the preparation of this LBEMP Sub-Plan 03 confirmed the presence of exotic *Sporobolus spp.* (Giant Rat's Tail or Parramatta Grass), which is also a declared Class 2 pest under the LP Act.

The works site is not currently located within a National Red Imported Fire Ant Restricted Area.

Objective / Target

- Existing pest infestations are controlled prior to commencing the approved program of works.

• No new pest species are introduced to or spread within the works site as a result of the approved program of works. • No pest species are dispersed from the works site to the surrounding environment as a result of the approved program of works.
Performance Indicators
• No invasion / dispersal of weeds or pest animal species. • Weeds are treated in accordance with industry best practice and any relevant statutory requirements.

Management Measures		
Tasks	**Actions**	**Timing**
Identify specific areas of pest infestation.	Prior to commencing the approved program of works (i.e. vegetation clearing) conduct a survey of the works site and adjacent areas (where accessible) to identify and map the presence and location of pest infestations.	Prior to commencement of the construction phase.
Manage pest infestations within the works site.	In areas where vegetation clearance and earthworks are to occur: • clear and stockpile weed infested areas separately from weed free areas; and • dispose of, rather than reuse, weed infested material in accordance with local government requirements. Following vegetation clearance works, monitor the area for new weed infestations or reinfestation, and treat in accordance with: • Department of Agriculture, Forestry and Fisheries (DAFF) requirements and industry best practice as detailed in http://www.daff.qld.gov.au/plants/weeds-pest-animals-ants • LBEMP Element 2 - Fauna; and • LBEMP Element 3 - Fora. Preference should be given to the use of manual control measures near waterways adjacent to works site and any herbicides used in the control of weeds on site are to be suitable for use near waterways.	Prior to and during the construction phase.
Minimise the introduction and dispersal of pest species.	Ensure that all vehicles, plant and equipment brought onto the works site is weed and red imported fire ant free through the use of appropriate pest hygiene declarations and / or inspections. Ensure that all equipment (e.g. machinery, vehicles and clothing) used in weed-infested areas on the works site are cleaned of weed material, including soil potentially containing weed seed, before moving into weed-free areas of the works site or off-site. (Note that	Ongoing during the construction phase.

Management Measures		
Tasks	**Actions**	**Timing**
	the LP Act requires that written notice must be provided before supplying (including disposal to a licensed waste facility) any 'thing' (including gravel, machinery, mulch, packing material, sand, soil, vehicles etc.) that is, or could be, contaminated with certain declared Class 2 plants, including exotic *Sporobolus spp.*). Avoid any unnecessary movement of vehicles, plant and equipment, or personnel in areas of known weed infestation and in areas of retained vegetation. Ensure that all mulch and fill material imported to the site is certified as being weed and red imported fire ant free.	
Record Keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • records of pre-works weed surveys and treatment; • copies of pest hygiene declarations or other evidence that materials and equipment used on site are pest free (e.g. inspection records); • copies of any 'written notice' required to be provided under the LP Act; and • records of pest monitoring and treatment conducted throughout the construction phase.	Ongoing
Corrective Actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 03. Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • treatment of any new infestations or reinfestation in accordance with industry best practice measures; • review work practices to avoid unnecessary movement of people, plant or equipment into areas of known weed infestation or retained vegetation; • consider establishing a weed washdown	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	bay on site to clean down equipment prior to entry / exit from the site; and • environmental awareness training of personnel.	

4.5 Element 5: Soil Erosion, Sediment Loss and Water Quality

Rationale
The approved works program, including vegetation clearance works and bulk earthworks, has the potential to impact on water quality and potential habitat for MNES within downstream waterways and wetlands. Appropriate erosion and sedimentation controls must be implemented to minimise the release of sediment and other contaminants generated by construction activities into downstream waterways.
Objective / Target
• To minimise changes to water quality within receiving waters as a result of the approved works program. • To minimise sedimentation resulting in the loss or degradation of potential habitat for MNES within receiving waters as a result of the approved works program.
Performance Indicators
• Compliance with the requirements of relevant local and state government approvals that require the preparation and implementation of Water Quality Management Plans including, but not necessarily limited to, the following: - Residential West Area (refer MCU-2004-1420). • No physical evidence of on-site erosion leading to the off-site transport and deposition of sediment. • Progressive establishment of a vegetative ground cover as soon as practicable following completion of vegetation clearance and grubbing works within the works site.

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage development activities to maintain acceptable water quality levels within receiving waterways and wetlands.	Obtain approval for a SQMP Master Plan in accordance with Moreton Bay Regional Council Condition 18(a) of MCU-2004-1420, which has the effect of requiring that a Stormwater Quality Management Plan (SQMP) Master Plan be prepared and submitted for approval "prior to a Reconfiguring a Lot application being lodged for Stage 1".	Prior to a commencing construction of the approved works program.
	Obtain approval for a SBSMP in accordance with Moreton Bay Regional Council Condition 18(b) of MCU-2004-1420, which has the effect of requiring that the developer submit and obtain approval for "Site Based Stormwater Management Plans	Prior to a commencing construction of the approved works program.

Management Measures		
Tasks	**Actions**	**Timing**
	(SBSMP)" with each Reconfiguring a Lot or Material Change of Use development application (other than where there is no land disturbing development).	
	Obtain approval for a Water Quality Monitoring Plan (WQMP) in accordance with State Referral Agency Condition 3 of MCU-2004-1420, which requires that "prior to an application being lodged for Reconfiguring a Lot for Stage 1, submit to DEHP for review a Water Quality Monitoring Plan."	Prior to a commencing construction of the approved works program.
	Obtain approval for a Construction Environmental Management Plan (CEMP) in accordance with State Referral Agency Condition 9 of MCU-2004-1420, which requires that *"Prior to an application being lodged for a development permit for operational works within the project site, submit to DEHP for review a Construction Environment Management Plan. The plan must be based on the preliminary Construction Environment Management Plan (provided as Appendix X2 of the EIS. Specific requirements must include:* *a) Bulk earthworks and associated sediment control measures designed and staged to minimise the area of soil disturbance and minimise the release of sediment to surface waters generally in accordance with DEHP's guideline for 'Best practice urban stormwater management: erosion and sediment control';* *b) ….(etc)"*	Prior to a commencing construction of the approved works program.
	Implement and maintain approved SQMP Master Plan, SBSMP, WQMP and CEMP in accordance with relevant development approval conditions.	Prior to and ongoing during the construction phase.
Record Keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • all records required under the approved SQMP Master Plan, SBSMP, WQMP and CEMP.	Ongoing
Corrective Actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP	Ongoing

Management Measures		
Tasks	**Actions**	**Timing**
	Sub-Plan 03. Appropriate corrective actions in relation to this environmental management element may include, but may not be limited to: • removal of sediment, reinstatement of sediment fences or other maintenance of erosion and sediment control measures; and • revaluation of the size, location and type of erosion and sediment control measures to improve effectiveness in response to monitoring results.	

4.6 Element 6: Acid Sulphate Soils

Rationale
The approved works program involves filling and excavation of material below 5m AHD in areas likely to contain actual and potential acid sulphate soils (ASS). Disturbance of ASS has the potential to result in release acidic discharge and other contaminants to soil and waters impacting on potential habitat for MNES flora and fauna. Appropriate soil management practices must be employed in order to avoid detrimental impacts to land and water within and adjacent to the works site associated with disturbance to ASS. A geotechnical investigation may be required to confirm the extent and level of acid sulphate soils present within the approved works site and to inform development of a detailed ASS management plan.
Objective / Target
• To minimise and where possible, avoid the exposure of ASS, and prevent acid leachate from leaving the site and potentially impacting on adjacent waters.
Performance Indicators
• Compliance with the requirements of relevant local and state government approvals that deal with the management of Acid Sulphate Soils including, but not necessarily limited to, the following: - Residential West Area (refer MCU-2004-1420).

Management Measures		
Tasks	**Actions**	**Timing**
Appropriately manage development activities involving	An Acid Sulphate Soils Management Plan (ASSMP) has been prepared which covers all upfront works in the Phase 2 area (Phase 2a). This ASSMP has been approved by the relevant state agency (DEHP) and is attached as **APPENDIX F.**	Complete.

Management Measures		
Tasks	**Actions**	**Timing**
disturbance to acid sulphate soils.	Develop an ASSMP for Phase 2b in accordance with: • Moreton Bay Regional Council Condition 12 of MCU-2004-1420, which has the effect of requiring that all potential acid sulphate soil disturbance is carried out in a manner that complies with the Acid Sulphate Soils Code of the Moreton Bay Regional (Caboolture Shire) Plan; and • State Referral Agency Condition 8 of MCU-2004-1420, which requires that: - Prior to an application being lodged for a development permit for operational works involving disturbance of potential and actual acid sulphate soils, submit to the Coordinator General for approval subject to technical advice from DEHP, a site-specific Acid Sulphate Soil Management Plan. - Additional ASS investigations and management plan preparation must be conducted in accordance with: ▪ the former *State Planning Policy (SPP) 2/02 Guideline: Acid Sulphate Soils* (Queensland Government, 2002); ▪ *Sampling and Analysis of Lowland Acid Sulphate Soils in Queensland* (Ahern CR et al., 1998); ▪ *Queensland Acid Sulphate Soil Technical Manual: Soil Management Guidelines* (Dear et al., 2002).	Prior to commencement of any activities involving disturbance to ASS within Phase 2b.
	Implement the approved Acid Sulphate Soils Management Plans to ensure that no environmental harm as defined under the *Environment Protection Act 1994* is caused.	Ongoing during the construction phase.
Record Keeping	The following records and reports are to be retained in relation to this environmental management element and shall be made available to relevant administering authorities upon request: • all records required under the approved Acid Sulphate Soils Management Plans.	Ongoing
Corrective Actions	In the event of a non-compliance with the stated performance indicators, corrective action procedures should be implemented in accordance with **SECTION 5** of this LBEMP Sub-Plan 03.	Ongoing

5 NON-CONFORMANCE AND CORRECTIVE ACTION PROCEDURES

In the event of a non-compliance with the stated performance indicators of this LBEMP Sub-Plan 03 or any other incidents that cause actual or potential harm to any MNES, an investigation should be undertaken to identify the cause of the non-compliance; and a corrective action report (CAR) should be prepared including the following details:

- description of the non-compliance;
- date of non-compliance;
- identified cause of non-compliance;
- description of proposed corrective actions;
- persons / entities consulted in developing corrective actions;
- timeframe for implementation of corrective actions;
- nominated person responsible for implementation; and
- validation monitoring requirements.

An example CAR form is provided in **APPENDIX G.**

Appropriate corrective actions should be developed by the Developer in consultation with relevant experts and the administering authority (where required) and shall be implemented by the Developer within the agreed timeframe noted on the CAR.

Validation monitoring should be undertaken to confirm that the nominated corrective actions have been effective.

The Developer shall maintain a register of CARs, which shall be made available to any relevant local, state or commonwealth government department, any statutory authority or any other person, consensually or as lawfully required.

The Developer shall notify the Commonwealth Department of the Environment of any non-conformances with this LBEMP Sub-Plan 03 or any environmental incidents involving MNES as soon as practicably possible.

6 RECORD KEEPING

The Developer is to maintain appropriate records concerning all tasks and actions undertaken in accordance with this LBEMP Sub-Plan 03 including:

- copies of all relevant permits or approvals relevant to the works the subject of this LBEMP Sub-Plan 03;
- the name, qualifications and contact details of the suitably qualified ecologist engaged to the assist in the preparation of this LBEMP Sub-Plan 03;
- the dates and findings of the pre-clearance flora and fauna surveys and the name, qualifications and contact details of the suitably qualified ecologist who completed the surveys;
- the name, qualifications and contact details of the licensed Fauna Spotter / Catcher engaged to supervise vegetation clearance works;
- the dates and locations of all vegetation clearance works;
- the post-clearance Fauna Management Report as required by **SECTION 4.2** of this LBEMP Sub-Plan 03;
- any records required to be kept in for specific environmental management elements as identified in **SECTION 4** of this LBEMP Sub-Plan 03; and
- all incident reports and corrective action requests generated during the works program.

All records shall be kept for a minimum of 5 years following completion of the works program and shall be made available to any relevant local, state or commonwealth government department, statutory authority or any other person, consensually or as lawfully required.

APPENDIX A – ECOLOGICAL ASSESSMENT REPORT FOR RWA PHASE 2

JWA PTY LTD
Ecological Consultants
ABN 18 862 767 739

Ecological Assessment
North East Business Park – RWA Phase 2
Lot 2 on SP266287
Buckley Road, Burpengary East

A Report Prepared for
North East Business Park Pty Ltd

MAY 2015

QUEENSLAND
Office 28, 115 Wickham Street
Fortitude Valley QLD 4006
p 07 3257 2703 **f** 07 3257 2708
e brisbane@jwaec.com.au

NEW SOUTH WALES
105 Tamar Street
PO Box 1465, Ballina NSW 2478
p 02 6686 3858 **f** 02 6681 1659
e ballina@jwaec.com.au

www.jwaec.com.au

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Client Issue

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		Name	Initials	Name	Initials
RW3	23/04/15	Oliver Robertson Kirsty Macpherson	OR KM	Adam McArthur	AM
RW5	04/06/15	Oliver Robertson Kirsty Macpherson	OR KM	Adam McArthur	AM

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by North East Business Park Pty Ltd to complete an Ecological Assessment for Phase 2 of the North East Business Park (NEBP) Residential West Area (RWA). This Ecological Assessment is intended to support a Reconfiguring a Lot (RoL) application for Phase 2 of the RWA.

The assessment has involved the following:

- determining the suite of Commonwealth and State listed threatened and regionally or locally significant flora and fauna species that occur in the locality from literature and database records;
- ground truthing vegetation communities and determining their conservation status in accordance with the Queensland Department of Natural Resources and Mines (DNRM) Regional Ecosystem Framework (*Vegetation Management Act* [*VMA*, *1999]*);
- assessing the likelihood of occurrence of threatened flora and fauna species on the subject site;
- searching for and recording threatened and regionally or locally significant flora and fauna species;
- assessing habitat provided by the site in the context of the surrounding area;
- assessing the corridor values of the site at a local and regional scale;
- assessing the potential impacts of the proposed development and determining appropriate mitigation measures;
- addressing statutory requirements regarding impacts to flora and fauna; and
- addressing relevant development assessment codes and policies.

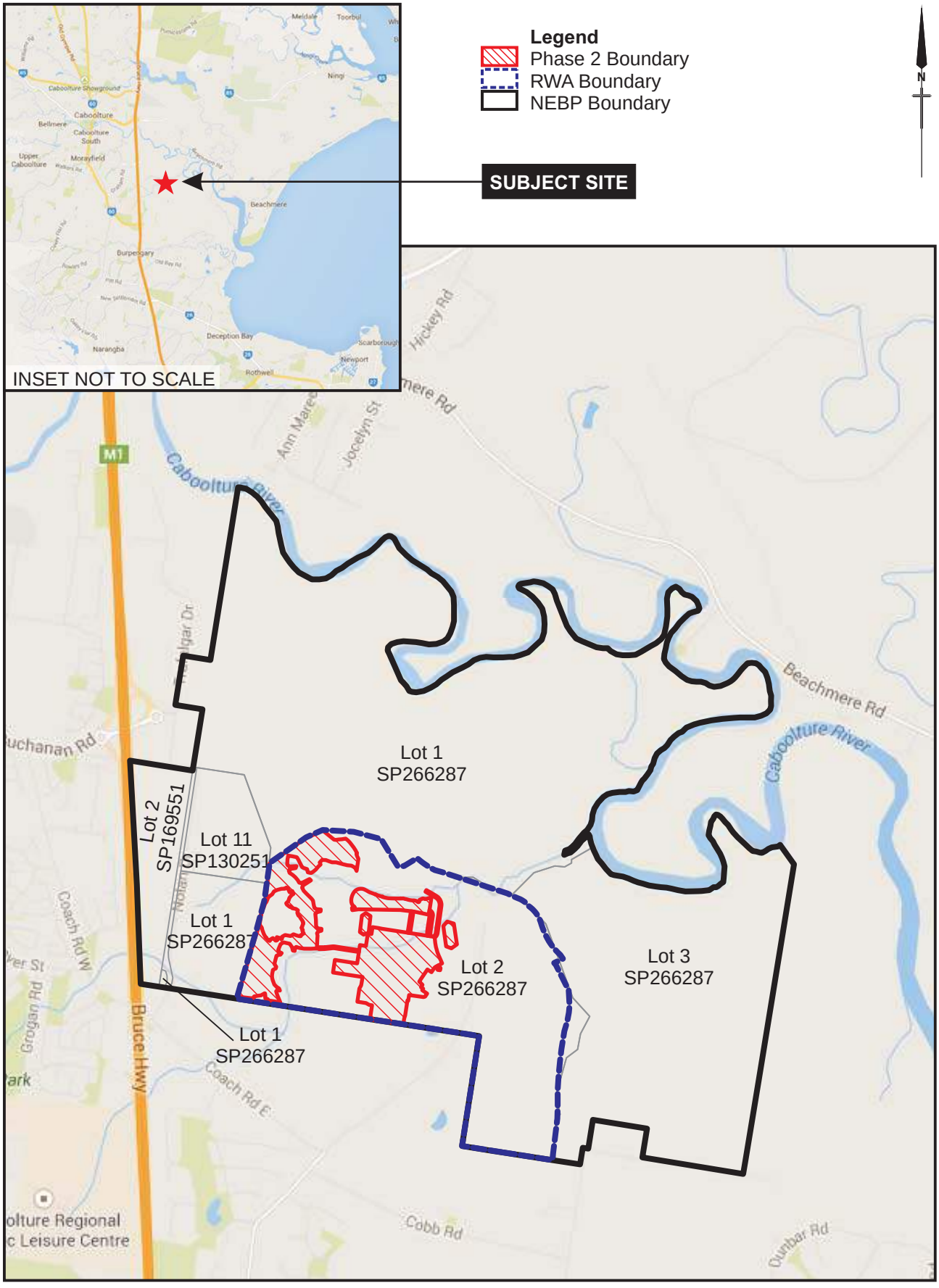
1.2 The Subject Site

The site is located at Buckley Road, Burpengary East and is formally described as part of Lot 2 on SP266287 (**FIGURE 1**). The site is approximately 40.2 ha. An aerial photograph of the site is shown in **FIGURE 2**.

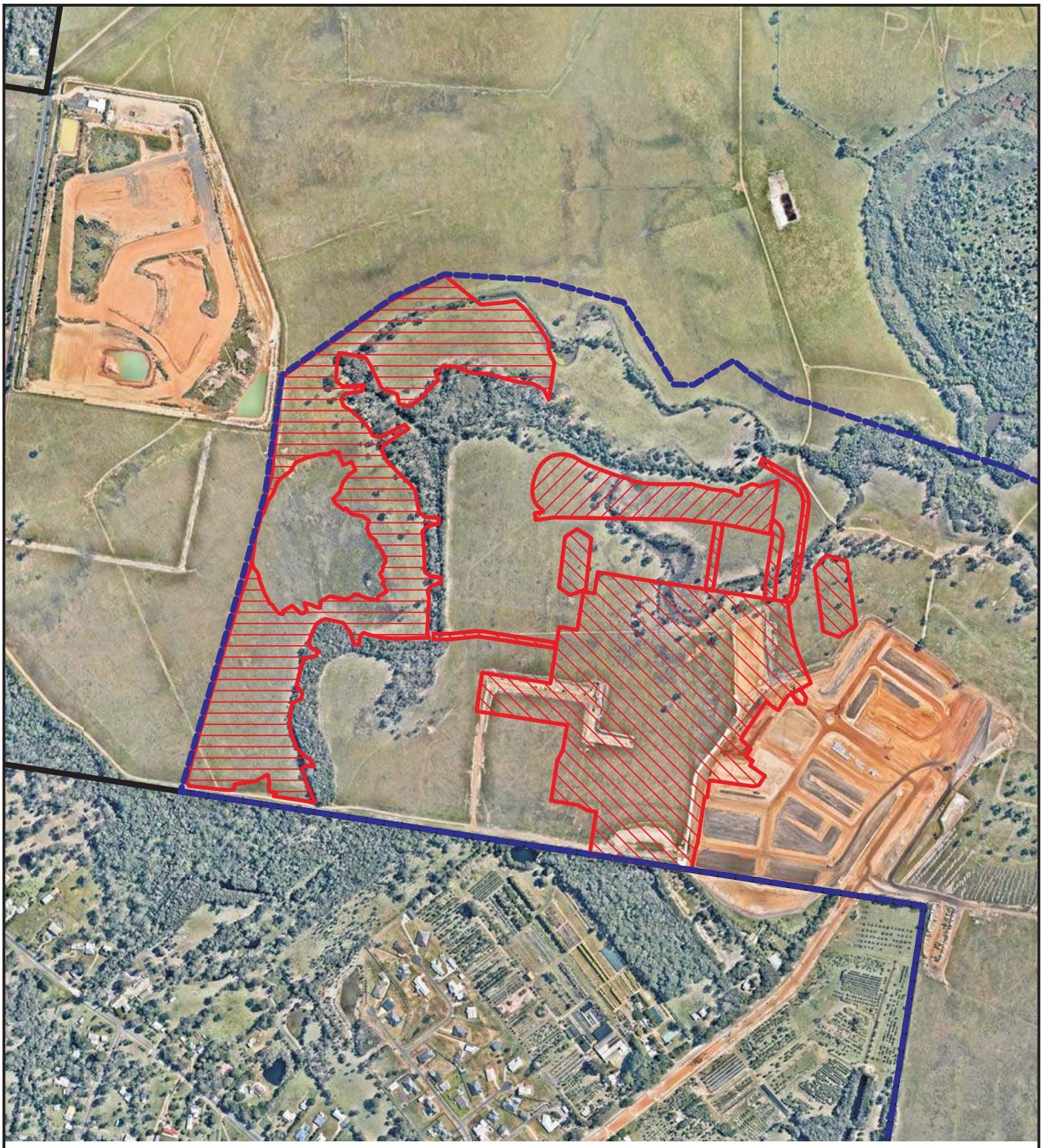
The property is currently used for cattle grazing, with vegetation dominated by a range of native and introduced pasture grasses. Prior to being used for grazing, the site was used for plantation forestry of *Pinus elliottii* (Slash Pine). The site is gently undulating with the lower points containing Raff Creek or small melon hole wetland areas. The site ranges in altitude from 10m to 4m ASL. An anabranch of Raff Creek runs through portions of the Phase 2 site. This waterway is shallow and slow moving, and may be subject to tidal influence during extreme spring tides. The channel is broad and less defined with little or no defined banks.

1.3 Planning Context

The subject site is located within the Morton Bay Regional Council LGA. The subject site is subject to the Caboolture Shire Plan 2005. Under the Caboolture Shire Plan the site is mapped as Distinct Industry (**FIGURE 3**).



SOURCE: Google Maps SCALE: 1 : 30 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT North East Business Park Pty Ltd PROJECT Ecological Assessment - RWA Phase 2 North East Business Park Nolan Drive, Morayfield, QLD Moreton Bay Regional Council LGA	**FIGURE 1** PREPARED: BW DATE: 27 May 2015 FILE: Q15003_Locality (2).cdr	TITLE **LOCALITY PLAN**



Legend

- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: Near Map March 2015 Aerial Photo

SCALE: 1 : 10 000 @ A4

JWA PTY LTD
Ecological Consultants

CLIENT
North East Business Park Pty Ltd

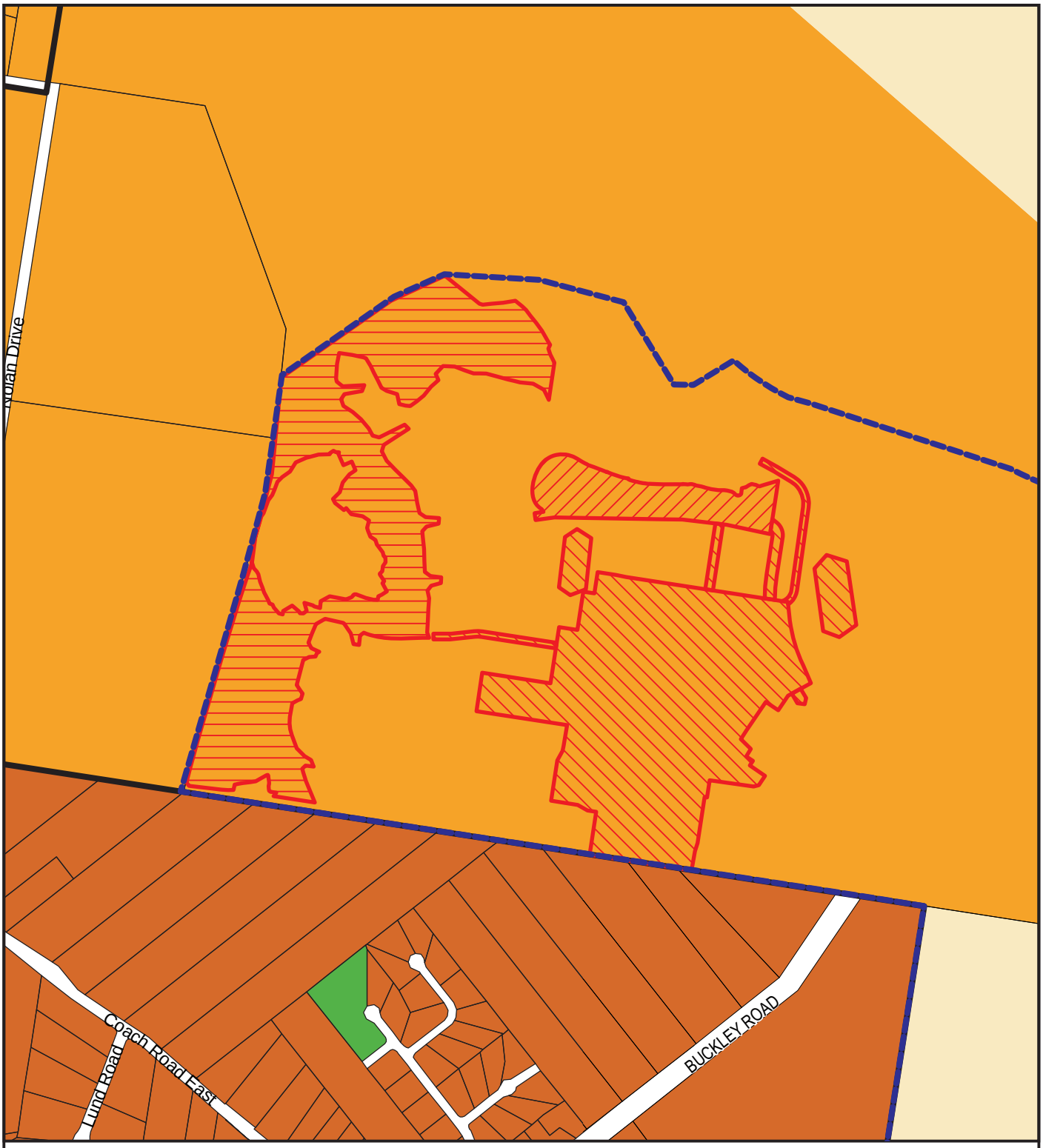
PROJECT
Ecological Assessment - RWA Phase 2
North East Business Park
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

FIGURE 2

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Aerial (2).cdr

TITLE

AERIAL PHOTOGRAPH



Legend

- District Industry
- Open Space
- Rural
- Rural Residential
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: Caboolture Shire Plan - Central Planning Area Zoning Map CZ-13 & CZ-14

SCALE: 1 : 10 000 @ A4

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Nolan Drive, Morayfield, QLD
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FIGURE 3

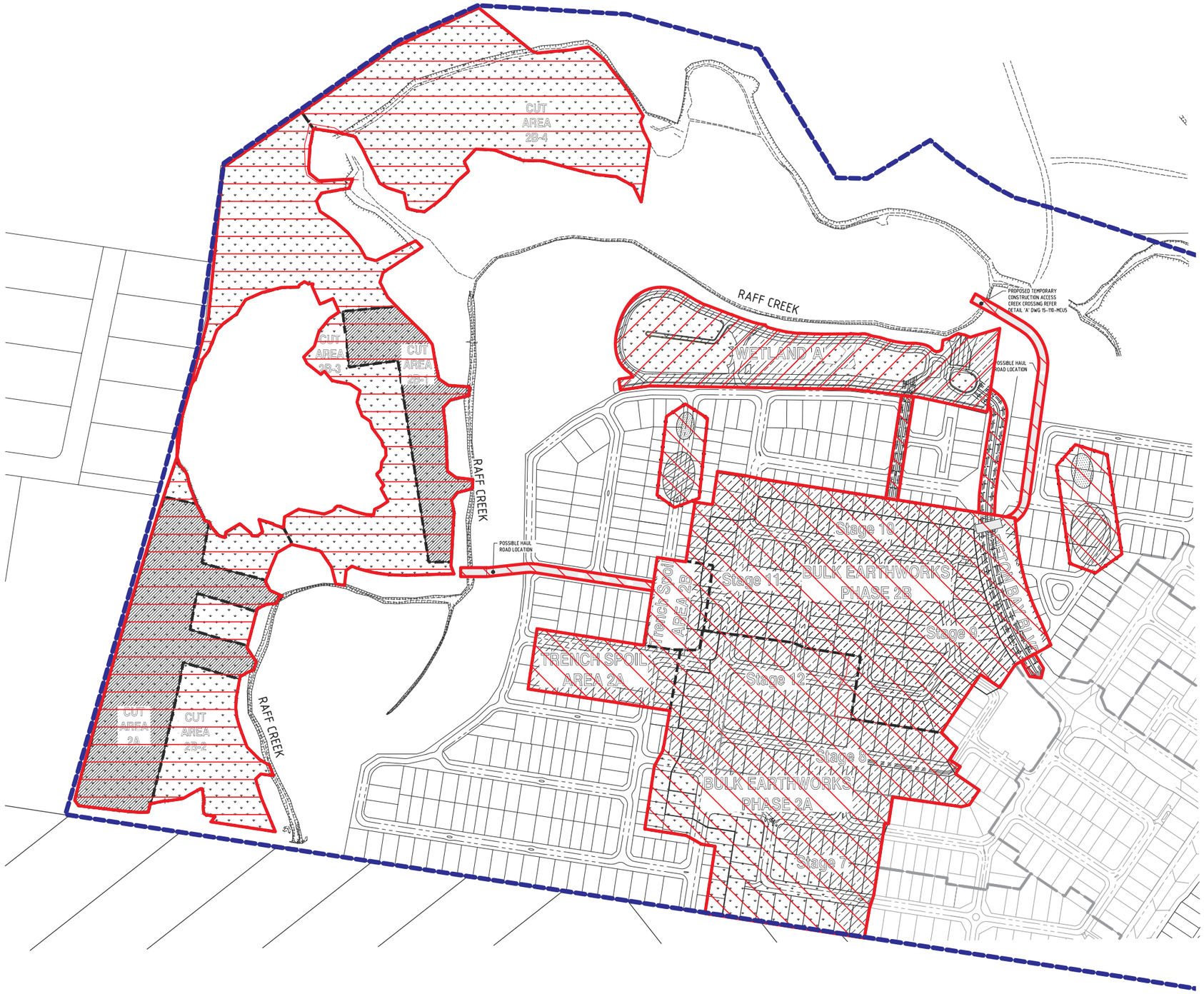
PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Zoning (2).cdr

TITLE

ZONING PLAN

1.4 The Proposed Development

North East Business Park (NEBP) is a multi-use business park that will integrate industry, commercial, marine development, residential, heritage and recreational greenspace precincts. Residential West Area (RWA) is located in the central southern portion of the NEBP and will contain the residential precinct of the NEBP and an open space precinct. Phase 2 of the RWA includes a six (6) stage residential subdivision (19.7 ha) consisting of 199 lots ranging in size from 312.5m^2 to 576m^2 (**FIGURE 4**). Phase 2 also includes a constructed wetland (3.3 ha) to treat stormwater from Phase 1 and subsequent phases including Phase 2, and a compensatory cut area (17.2 ha) that will provide fill for the earthworks in the residential subdivision. This cut area will be rehabilitated to open space in future phases.



N

LEGEND

- Extent of Cut to be Rehabilitated
- Extent of Fill
- Topsoil Stockpile Location
- Mulch Stockpile Location
- Sediment & Diversion Fence (Temporary)
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary

STAGE No.	COMPENSATORY FLOOD VOLUME OFFSET REQUIRED	OFFSET VOLUME AVAILABLE	
PHASE 2A			
STAGE 7	700m³	CUT AREA 2A	31,000m³
STAGE 8	14,800m³ (1,300m³ TEMP. BATTERS)		
STAGE 12	13,700m³ (4,000m³ TEMP. BATTERS)		
TRENCH SPOIL AREA 2A	2,000m³		
SUBTOTAL	31,200m³		31,000m³
PHASE 2B			
STAGE 9	22,500m³	CUTAREA 2B-1	14,000m³
STAGE 10	26,000m³ (INCLUDING BATTERS)	CUT AREA 2B-2	13,500m³
STAGE 11	28,600m³ (INCLUDING BATTERS)	CUT AREA 2B-3	31,000m³
MORETON BAY BLVD	700m³	CUT AREA 2B-4	41,500m³
TRENCH SPOIL AREA 2B	13,000m³		
WETLAND 'A'	500m³		
SUBTOTAL	91,300m³		100,000m³
TOTAL	122,500m³		131,000m³
		FUTURE CUT AREA	21,000m³

0 150m

1 : 5000

SOURCE: KN Group (Ref: 15-110-MCU.PDF)

SCALE: 1 : 5000 @ A3

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Ecological Assessment - RWA Phase 2
North East Business Park
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

FIGURE 4

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Layout.cdr

TITLE

PROPOSED DEVELOPMENT LAYOUT

2 DESKTOP ASSESSMENT

2.1 Introduction

A desktop assessment was completed to highlight any potential conservation significant vegetation communities, any potential habitat for threatened flora and fauna, and any ecologically sensitive areas within the Phase 2 site. The desktop assessment included a review of:

- previous reports prepared for the NEBP site;
- State and Commonwealth databases;
- State environmental mapping; and
- literature review of scientific journal articles and botanical literature to assist with habitat suitability assessments.

2.2 Methods

2.2.1 Literature Review

The Ecological Assessment Report for NEBP – Residential West RoL prepared by Cardno (QLD) Pty Ltd (12th June 2014) was reviewed prior to undertaking field work.

2.2.2 Database Searches

2.2.2.1 Background

The following databases were reviewed as part of the desktop assessment:

- the Commonwealth *Environment Protection Biodiversity and Conservation (EPBC) Act* (*1999*) Protected Matters Search Tool (PMST) (Dept. Environment 2013);
- the Queensland Department of Environment and Heritage Protection (DEHP) Wildlife Online database (DEHP 2014); and
- the Atlas of Living Australia interactive mapping (Australian Government 2014) which includes:
    - Queensland Museum Database of threatened fauna records; and
    - Queensland Herbarium threatened flora records.

2.2.2.2 EPBC Act PMST

The Commonwealth PMST generates a list of protected matters under the Commonwealth *EPBC Act* that may occur in or near the subject area including:

- world heritage and national heritage areas;
- wetlands of international significance (Ramsar Wetlands);
- Commonwealth marine areas;
- threatened ecological communities;
- threatened species; and
- migratory species.

The database incorporates information from a range of sources including government, research and community organisations. It should be noted that there are limitations on the accuracy of some matters reported by the PMST. In particular, database records of

threatened and migratory species are based on their current known distribution and do not necessarily correlate to an actual observation. Database records are an indicator of potential presence only and do not take into account if suitable vegetation, geology, soil, climate or habitat types are actually present to support the occurrence of a significant species or community.

The Commonwealth PMST was used to determine the suite of threatened flora and fauna, migratory species and threatened ecological communities that were likely to be present within a 5km radius of the subject site.

2.2.2.3 DEHP Wildlife Online

The DEHP Wildlife Online database contains recorded wildlife sightings and listings of plants, fungi, protists, mammals, birds, reptiles, amphibians, freshwater fish, marine cartilaginous fish and butterflies in Queensland. The database is based on collated species lists and wildlife records acquired by the Queensland government through a range of sources including specimen collections, research and monitoring programs and community wildlife recording programs.

The DEHP Wildlife Online database was consulted to determine the variety of threatened flora and fauna species known to occur within a 5km radius of the subject site.

2.2.2.4 Atlas of Living Australia

The Atlas of Living Australia includes records that come from either:

- a specimen — an organism, photograph, sound or other multimedia file of a species that has been scientifically collected by, and managed in, a natural history collection such as the Queensland Museum and Queensland Herbarium; or
- an observation — a record of the sighting of an organism by an individual or member of an organisation such as a community environment group. Observations may be supported by a photograph, sound or other multimedia file.

2.2.3 Environmental Mapping

2.2.3.1 Background

The following DEHP environmental mapping was reviewed as part of the desktop assessment:

- Regulated Vegetation Management Mapping (DNRM 2014);
- Regional Ecosystem (RE) and Remnant Mapping (version 8) (DNRM 2014);
- Property Map of Assessable Vegetation (PMAVs) (DNRM 2014);
- Essential Habitat Mapping (version 4) (DNRM 2014);
- Matters of State Environmental Significance (MSES) Mapping (DSDIP 2014);
- Map of Referable Wetlands and Wetland Protection Areas (DEHP 2013);
- State Planning Regulatory Provisions (SPRP) and State Planning Provisions (SPP) Koala Habitat Mapping (DEHP 2012); and
- Coastal Hazard Mapping (DEHP 2014).

DEHP environmental mapping was obtained from the DEHP website using the Lot and Plan numbers of the subject site.

2.2.3.2 Regulated Vegetation Management Mapping

Regulated vegetation management maps are used to determine the requirements that apply under the State Development Assessment Provisions (*VMA 1999*). The vegetation categories on the map are:

- category A (red) - areas subject to compliance notices, offsets and voluntary declarations;
- category B (dark blue) - remnant vegetation;
- category C (light blue) - high-value regrowth vegetation;
- category R (yellow) - regrowth vegetation within 50m of watercourses in priority reef catchment areas; and
- category X (white) - areas not regulated under the *Vegetation Management Act 1999*.

2.2.3.3 Regional Ecosystems

Regional ecosystems (REs) are vegetation communities that are consistently associated with a particular combination of geology, land form and soil in a bioregion. Each RE has been assigned a conservation status which is based on its current extent in a bioregion as a proportion of its pre-clearing extent. Regional ecosystem maps show the extent and conservation status of regional ecosystems at a property level. On a regional ecosystem map, remnant vegetation is shown as either a remnant endangered regional ecosystem, a remnant of concern regional ecosystem, or a remnant least concern regional ecosystem.

The Queensland Herbarium has mapped the extent of RE's and Essential Habitat across Queensland, however it should be noted that mapping was completed at a scale of 1:100,000 and as such there are inaccuracies at a property scale. As a result, RE maps should be considered to indicative only and should not be relied upon as an inherently correct source of vegetation mapping. Site ground truthing is required to confirm the presence of RE types and their extent, verify floristics and structure and confirm conservation status.

2.2.3.4 Essential Habitat Mapping

Essential Habitat are areas identified by DEHP as essential habitat for a species of wildlife listed as endangered, vulnerable, near threatened or rare under the *Nature Conservation Act 1992*. These areas are shown on RE maps and Essential Habitat maps.

2.2.3.5 MSES Mapping

Matters of State Environmental Significance (MSES) are a component of the biodiversity state interest that is defined under the State Planning Policy (SPP) (DSDIP 2014). MSES include certain environmental values that are protected under Queensland legislation including the:

- *Nature Conservation Act 1992*;
- *Marine Parks Act 2004*;
- *Fisheries Act 1994*;
- *Environmental Protection Act 1994*;
- *Wild Rivers Act 2005*;
- *Vegetation Management Act 1999*; and
- legally secured offset areas protected by a registered covenant or similar statutory mechanism.

This includes areas such as wildlife habitats, regulated vegetation, Wild Rivers preservation areas, riverine wetlands, high ecological value waters (watercourses and wetlands) and legally secured offset areas.

2.2.3.6 Referable Wetlands Mapping

Referable wetlands maps show the location of wetlands as defined under the *Environmental Protection Regulation 2008* and wetland protection areas (WPAs) in the Great Barrier Reef catchment.

Wetlands on the referrable wetlands maps have been mapped using the Aquatic Biodiversity Assessment and Mapping Methodology and have been assessed for ecological significance using the environmental values for wetland in section 81A of the *Environmental Protection Regulation 2008*. Wetlands are considered either High Ecological Significance (HES) or of General Ecological Significance (GES) for the purposes of the environmental values.

2.2.3.7 SPRP and SPP Koala Habitat Mapping

SPRP and SPP Koala habitat mapping shows areas within South East Queensland that must incorporate Koala conservation and habitat protection outcomes into planning decisions. The Koala habitat values mapping identifies areas of bushland habitat, areas suitable for rehabilitation and other areas of value.

2.2.3.8 Coastal Hazard Mapping

Queensland coastal hazard areas maps show areas within the Coastal Management District that are vulnerable to coastal erosion or storm tide inundation.

2.3 Results

2.3.1 Literature Review

Cardno (QLD) Pty Ltd completed an Ecological Assessment for the entire RWA site in June 2014 (Cardno 2014). The Ecological Assessment described the site as containing four (4) vegetation communities (Cardno's RWA Wetland Mapping figure 5):

- The more elevated areas (south of the site) were found to contain "Disturbed Terrestrial Grassland / Woodland" (Cardno 2014).
- Low-lying areas within the site were found to contain:
  - "Disturbed Wet Terrestrial Grassland Mosaic"; and
  - "Floodplain, grass, sedge, herb swamp".
- The creek in the northern portion of Phase 2 was found to contain "Floodplain Tree Swamps".

The Ecological Assessment described the presence of three (3) threatened fauna species within the RWA:

- Koala (*Phascolarctos cinereus*);
- Black-necked stork (*Ephippiorhynchus asiaticus*); and
- Wallum froglet (*Crinia tinnula*).

Koalas were sighted within the wider NEBP area, and evidence of habitat use (scats) was observed along the waterway in the northern portion of the Phase 2 site (the focus of this report).

Five (5) threatened fauna species were considered possible occurrences within the RWA or were observed within the wider NEBP:

- Tusked frog (*Adelotus brevis*);
- Cotton pygmy goose (*Nettapus coromandelianus*);
- Wallum rocketfrog (*Litoria freycineti*);
- Lewin's rail (*Lewinia pectoralis*); and
- Australian painted snipe (*Rostratula australis*).

No threatened flora were observed within the RWA.

Four (4) threatened flora species were considered possible occurrences within the RWA or were observed within the wider NEBP:

- *Acacia attenuata*
- Hairy Joint Grass (*Arthraxon hispidus*)
- Leafless Tongue Orchid (*Cryptostylis hunteriana*)
- Lesser Swamp Orchid (*Phaius australis*)

2.3.2 Database Searches

2.3.2.1 Threatened Flora Species and Ecological Communities

Database searches using the Commonwealth PMST identified eleven (11) threatened flora species that may occur within 5 km of the subject site based on the availability of suitable habitat in the locality. The DEHP Wildlife Online database indicated that two (2) threatened flora species have been recorded from within 5km of the subject site.

Threatened flora species detected in the database searches are listed in **TABLE 1**. The conservation status of each species listed in **TABLE 1** is shown in accordance with the Commonwealth *EPBC Act* (*1999*) and Queensland *Nature Conservation (Wildlife) Regulation* (*NCWR, 2006*).

TABLE 1
DATABASE RECORDS OF LISTED THREATENED FLORA SPECIES
WITHIN 5KM OF THE SITE

Scientific Name	Common Name	EPBC#	NCWR*
Acacia attenuata	-	CV	(QV)
Bosistoa selwynii	Heart-leaved bosistoa	CV	-
Bosistoa transversa	Three-leaved bosistoa	CV	-
Cryptocarya foetida	Stinking cryptocarya	CV	(QV)
Cryptostylis hunteriana	Leafless tongue-orchid	CV	-
Lilaeopsis brisbanica	-	-	QE
Macadamia ternifolia	Bopple nut	CV	QV
Phaius australis	Lesser swamp-orchid	CE	(QE)
Phaius bernaysii	-	CE	(QE)
Phebalium distans	My Berryman phebalium	CCE	(QE)
Streblus pendulinus	Siah's backbone	CE	-
Thesium australe	Austral toadflax	CV	(QV)

CCE - Critically Endangered, CE – Endangered and CV - Vulnerable as listed within schedules of the Commonwealth *EPBC Act (1999)*;
* QE - Endangered, QV - Vulnerable and QNT – Near Threatened as listed within schedules of the Queensland *NCWR (2006)*;
() listed but not found in site database search.

Database searches using the Commonwealth PMST also revealed that two (2) threatened Ecological Communities are known to occur within 5km of the subject site:

- Lowland Rainforest of Subtropical Australia – Critically Endangered; and
- Subtropical and Temperate Coastal Saltmarsh - Vulnerable.

2.3.2.2 Threatened Fauna Species and Migratory Species

Database searches using the Commonwealth PMST identified thirty-nine (39) threatened fauna species that may occur within 5km of the subject site based on the availability of suitable habitats. The DEHP Wildlife Online database indicated that eight (8) threatened fauna species have been recorded from within 5km of the subject site.

Threatened fauna species detected in the database searches are listed in **TABLE 2**. The conservation status of each species listed in **TABLE 2** is shown in accordance with the Commonwealth *EPBC Act (1999)* and the Queensland *NCWR (2006)*.

Database searches using the Commonwealth PMST also revealed that thirty-six (36) migratory wetlands and migratory terrestrial species may occur within 5km of the site based on the availability of suitable habitat. Migratory species identified in database searches are listed in **TABLE 3**.

TABLE 2
DATABASE RECORDS OF LISTED THREATENED FAUNA SPECIES WITHIN 5KM OF THE SITE

Scientific Name	Common Name	EPBC#	NCWR*
Adelotus brevis	Tusked frog	-	QV
Anthochaera phrygia	Regent honeyeater	CE	QE
Botaurus poiciloptilus	Australian bittern	CE	-
Caretta caretta	Loggerhead turtle	CE	(QE)
Chalinolobus dwyeri	Large-eared pied bat	CV	(QV)
Chelonia mydas	Green turtle	CV	(QV)
Coeranoscincus reticulatus	Three-toed snake-tooth skink	CV	-
Crinia tinnula	Wallum froglet	-	QV
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	CE	(QE)
Dasyornis brachypterus	Eastern bristlebird	CE	(QE)
Dasyurus hallucatus	Northern quoll	CE	-
Delma torquata	Collared delma	CV	(CV)
Dermochelys coriacea	Leatherback turtle	CE	(QE)
Diomedea exulans (sensu lato)	Wandering albatross	CV	(QV)
Diomedea exulans antipodensis	Antipodean albatross	CV	(QV)
Diomedea exulans exulans	Tristan albatross	CE	-
Diomedea exulans gibsonii	Gibson's albatross	CV	(QV)
Epinephelus daemelii	Black rockcod	CV	-
Eretmochelys imbricata	Hawksbill turtle	CV	(QV)
Erythrotriorchis radiatus	Red goshawk	CV	(QE)
Furina dunmalli	Dunmall's snake	CV	(QV)

Scientific Name	Common Name	EPBC#	NCWR*
Lathamus discolor	Swift parrot	CE	(QE)
Lepidochelys olivacea	Olive ridley turtle	CE	(QE)
Litoria olongburensis	Wallum sedge frog	CV	(QV)
Macronectes giganteus	Southern giant-petrel	CE	(QE)
Macronectes halli	Northern giant-petrel	CV	(QV)
Mixophyes iteratus	Giant barred frog	CE	QE
Natator depressus	Flatback turtle	CV	QV
Numenius madagascariensis	Eastern curlew	-	QNT
Phascolarctos cinereus	Koala	CV	QV
Phyllodes imperialis smithersi	Pink underwing moth	CE	-
Poephila cincta cincta	Black-throated finch (southern)	CE	(QE)
Pteropus poliocephalus	Grey-headed flying-fox	CV	-
Rostratula australis	Australian painted snipe	CE	QV
Thalassarche cauta	Shy albatross	CV	QV
Thalassarche cauta salvini	Salvin's albatross	CV	-
Thalassarche cauta steadi	White-capped albatross	CV	(QV)
Thalassarche eremita	Chatham albatross	CE	(QV)
Thalassarche melanophris	Black-browed albatross	CV	-
Thalassarche melanophris impavida	Campbell albatross	CV	-
Turnix melanogaster	Black-breasted button-quail	CV	(QV)
Xeromys myoides	Water mouse	CV	(QV)

CCE - Critically Endangered, CE – Endangered and CV - Vulnerable as listed within schedules of the Commonwealth *EPBC Act (1999)*;
* QE - Endangered, QV - Vulnerable and QNT – Near Threatened as listed within schedules of the Queensland *NCWR (2006)*;
() listed but not found in site database search.

TABLE 3
DATABASE RECORDS OF COMMONWEALTH LISTED MIGRATORY SPECIES WITHIN 5KM OF THE SITE

Scientific Name	Common Name	Status#
Actitis hypoleucos	Common sandpiper	M
Ardea alba	Great egret	M
Ardea ibis	Cattle egret	M
Arenaria interpres	Ruddy turnstone	M
Calidris acuminata	Sharp-tailed sandpiper	M
Calidris alba	Sanderling	M
Calidris canutus	Red knot	M
Calidris ferruginea	Curlew sandpiper	M
Calidris ruficollis	Red-necked stint	M
Calidris tenuirostris	Great knot	M
Charadrius bicinctus	Double-banded plover	M
Charadrius leschenaultii	Great sand plover	M
Charadrius mongolus	Lesser sand plover	M
Charadrius veredus	Oriental plover	M
Gallinago hardwickii	Latham's snipe	M
Haliaeetus leucogaster	White-bellied sea-eagle	M
Heteroscelus brevipes	grey-tailed tattler	M
Hirundapus caudacutus	White-throated needletail	M

Scientific Name	Common Name	Status#
Limicola falcinellus	Broad-billed sandpiper	M
Limosa lapponica	Bar-tailed godwit	M
Limosa limosa	Black-tailed godwit	M
Merops ornatus	Rainbow bee-eater	M
Monarcha melanopsis	Black-faced monarch	M
Monarcha trivirgatus	Spectacled monarch	M
Myiagra cyanoleuca	Satin flycatcher	M
Numenius madagascariensis	Eastern curlew	M
Numenius minutus	Little curlew	M
Numenius phaeopus	Whimbrel	M
Pluvialis fulva	Pacific golden plover	M
Pluvialis squatarola	Grey plover	M
Rhipidura rufifrons	Rufous fantail	M
Rostratula benghalensis (sensu lato)	Painted snipe	M
Tringa glareola	Wood sandpiper	M
Tringa stagnatilis	Marsh sandpiper	M
Xenus cinereus	Terek sandpiper	M

CCE - Critically Endangered, CE - Endangered, CV - Vulnerable and M – Migratory as listed within schedules of the Commonwealth *EPBCA (1999).*

2.3.3 DEHP Environmental Mapping

2.3.3.1 Regulated Vegetation Management and RE Mapping

The current regulated vegetation management map of the subject site includes Category X (vegetation not regulated under the VMA) areas on the site (**FIGURE 5**). No Regional Ecosystems are mapped on the site. A watercourse is mapped through the Phase 2 site (**FIGURE 6**).

2.3.3.2 Essential Habitat Mapping

Regional Ecosystem (RE) mapping (Version 8) shows no Essential Habitat on the subject site (**FIGURE 6**). Neighbouring properties to the south-west and west of the site contain Essential Habitat for Wallum Froglet (*Crinia tinnula*) and Koala (*Phascolarctos cinereus*).

2.3.3.3 MSES Mapping

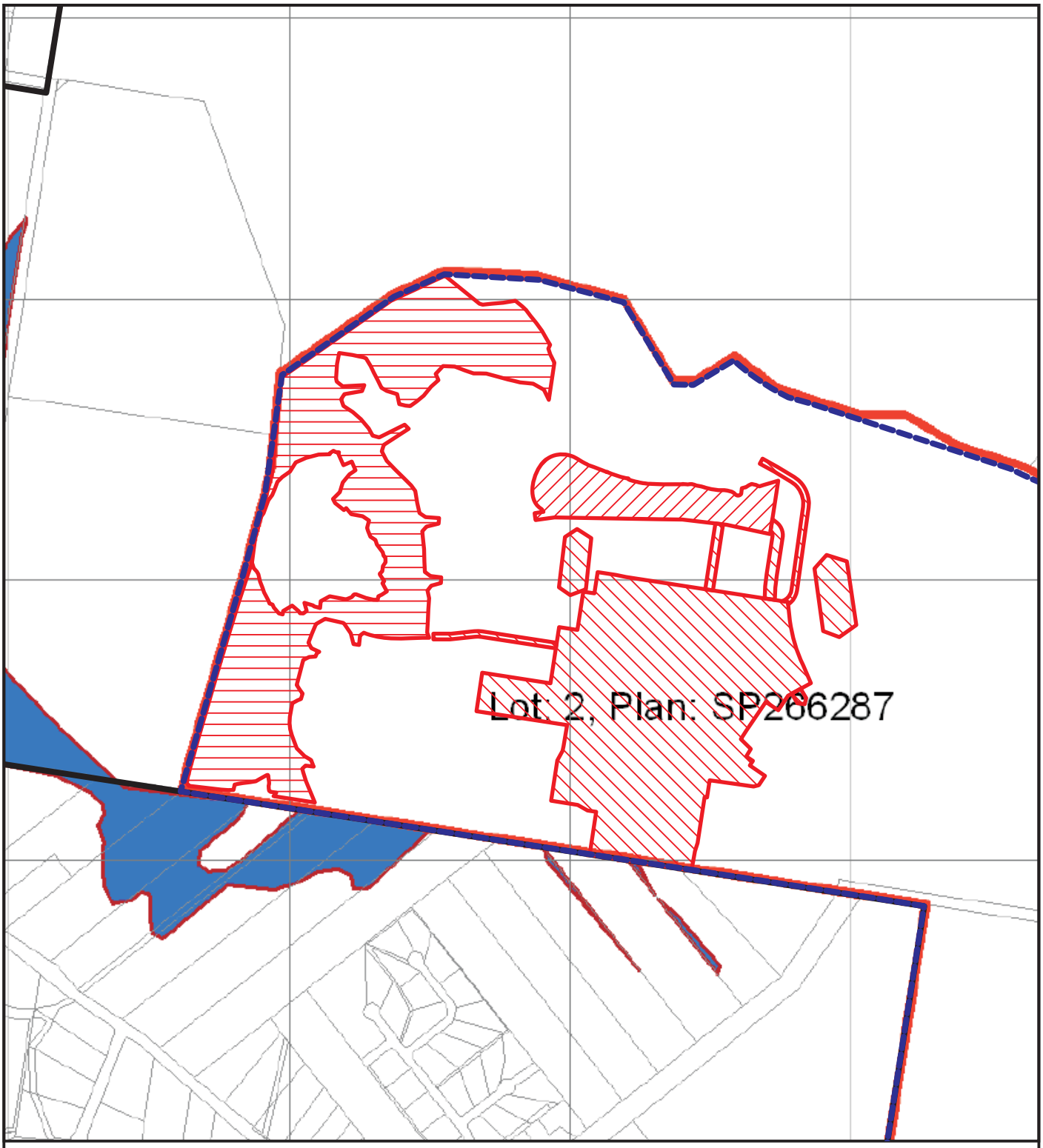
MSES mapping includes regulated vegetation intersecting a watercourse mapped over the vegetated area associated with Raff Creek (**FIGURE 7**).

2.3.3.4 Referable Wetlands Mapping

Referable Wetlands mapping shows no Referable Wetlands or Wetland Protection Areas on the subject site (**FIGURE 8**). Neighbouring properties to the north-east and south-west are mapped as containing High Ecological Significance (HES) and General Ecological Significance (GES) wetlands.

2.3.3.5 SPRP and SPP Koala Habitat Mapping

The site is outside SPRP Koala Assessable Development Area. The SPP mapping shows the site to be generally unsuitable for Koalas (**FIGURE 9**).



Legend

- Category V Area (Remnant Vegetation)
- Category X Area (Vegetation not regulated under the VMA)
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: QLD DNRM Regulated Vegetation Management Map (dated 16.03.15)

SCALE: 1 : 10 000 @ A4

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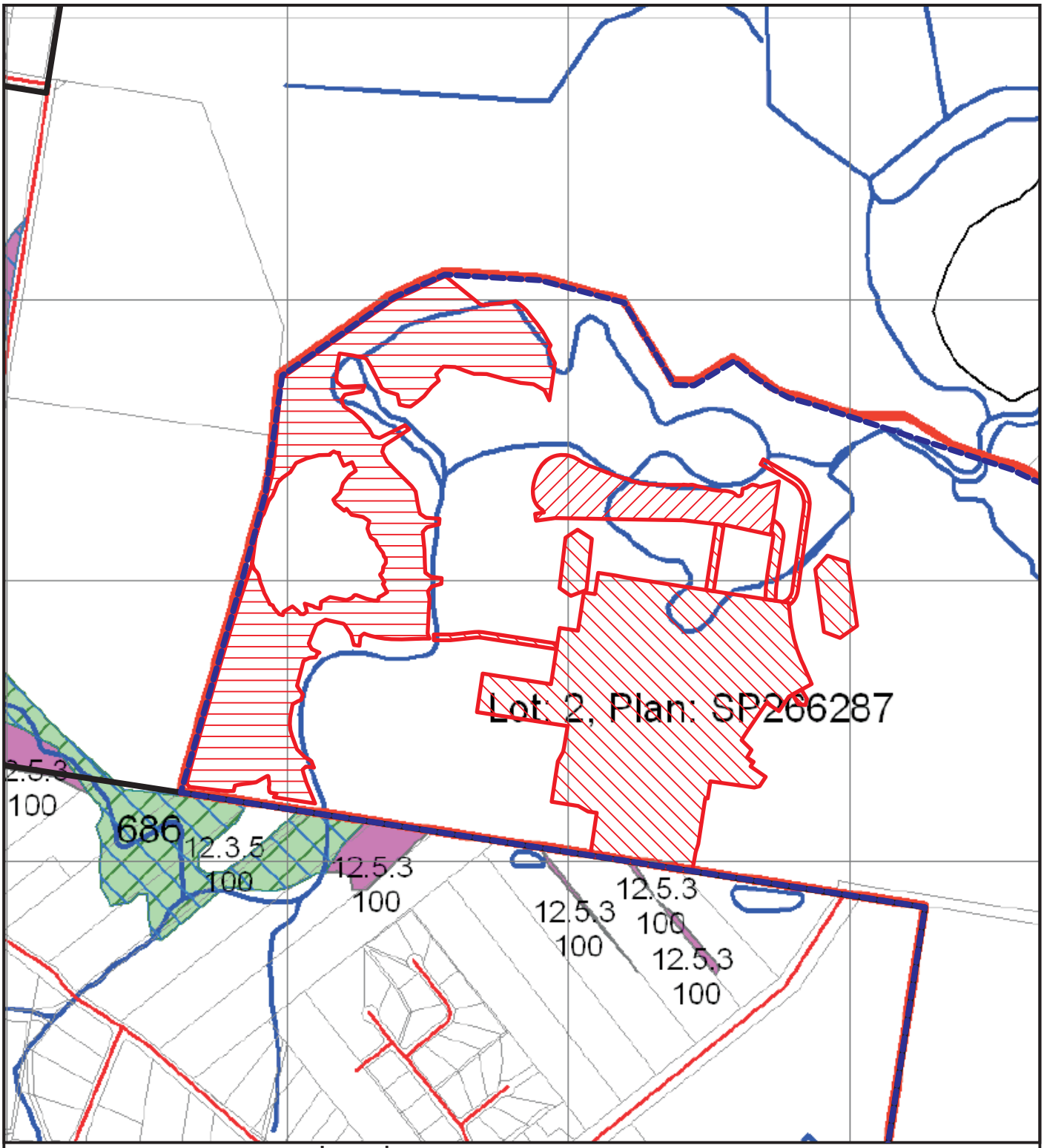
FIGURE 5

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_RVM Map (2).cdr

TITLE
REGULTED VEGETATION MANAGEMENT MAP



SOURCE: QLD DNRM Vegetation Management Supporting Map (dated 16.03.15)

SCALE: 1 : 10 000 @ A4

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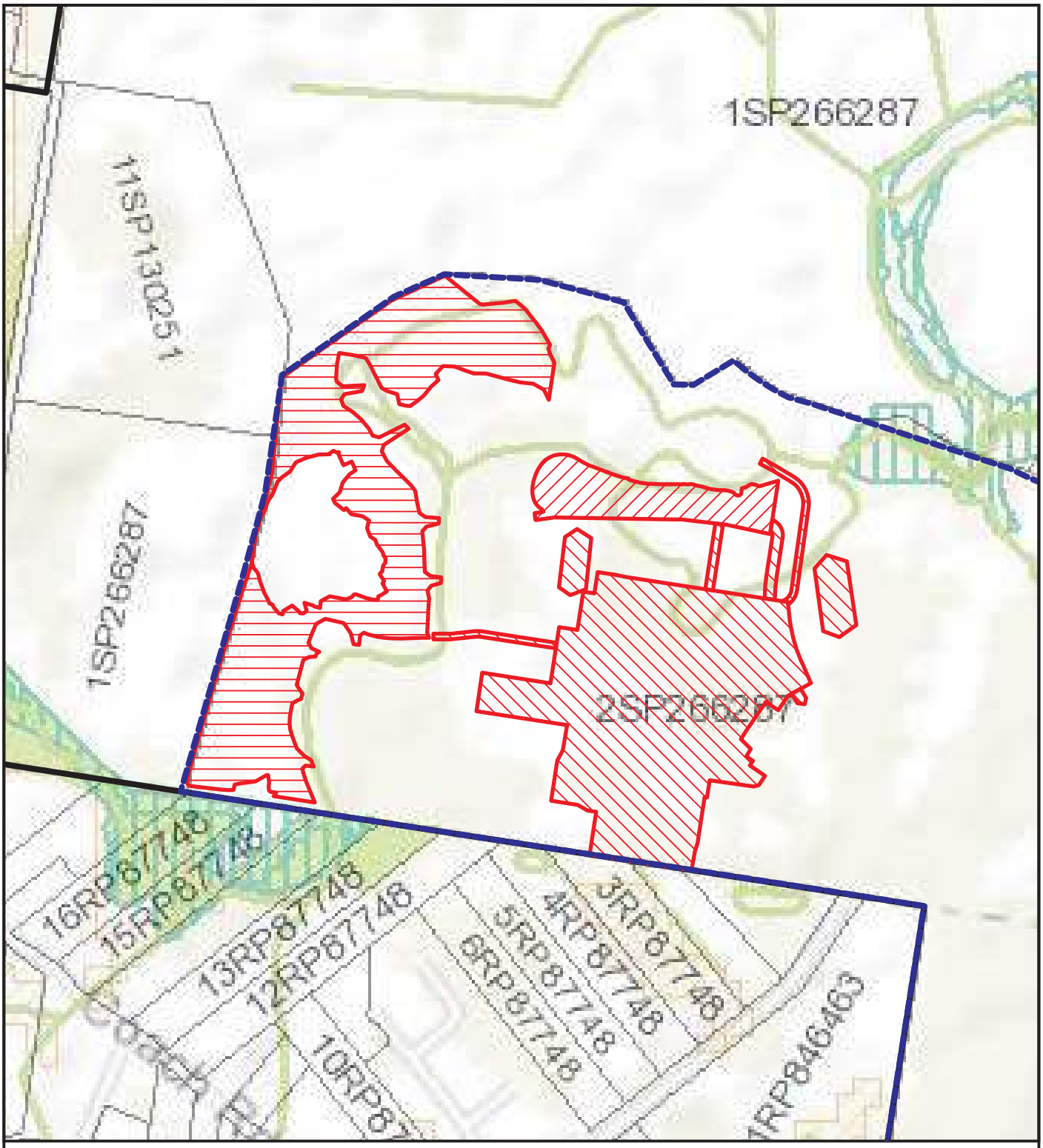
FIGURE 6

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_RE Map (2).cdr

TITLE

REGIONAL ECOSYSTEMS



Legend

- Regulated Vegetation
- Regulated Vegetation (intersecting a watercourse)
- Wildlife Habitat
- High Ecological Significance Weltands
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: QLD DSD State Planning Policy Matters of State Environmental Significance (dated 15.04.15)
SCALE: 1 : 10 000 @ A4

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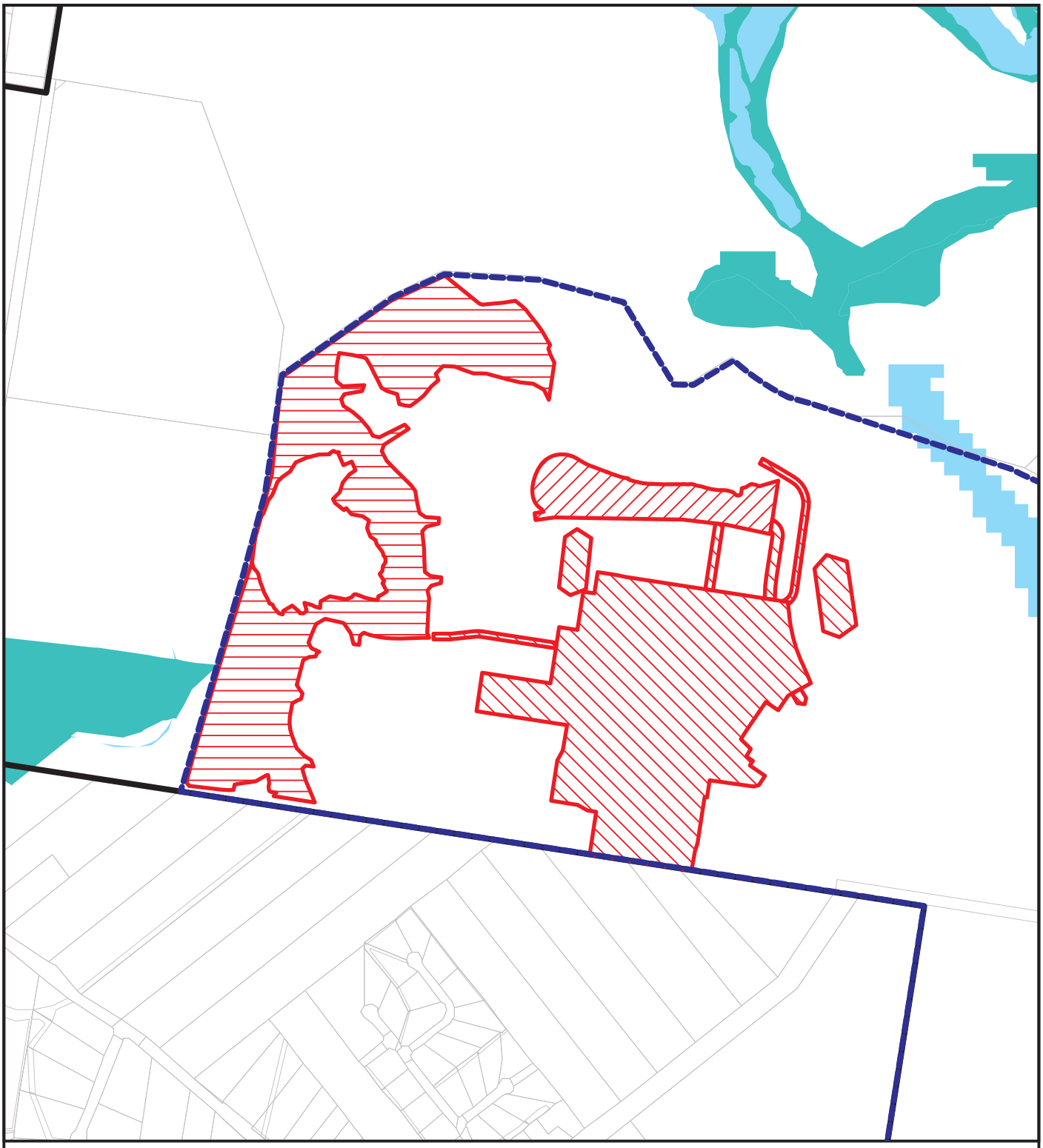
FIGURE 7

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_MSES Map (2).cdr

TITLE
MATTERS OF STATE ENVIRONMENTAL SIGNIFICANCE



Legend

- HES Wetland
- GES Wetland
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: QLD DEHP Map of Referable Wetlands for the EPA 1994 (dated 16.03.15)

SCALE: 1 : 10 000 @ A4

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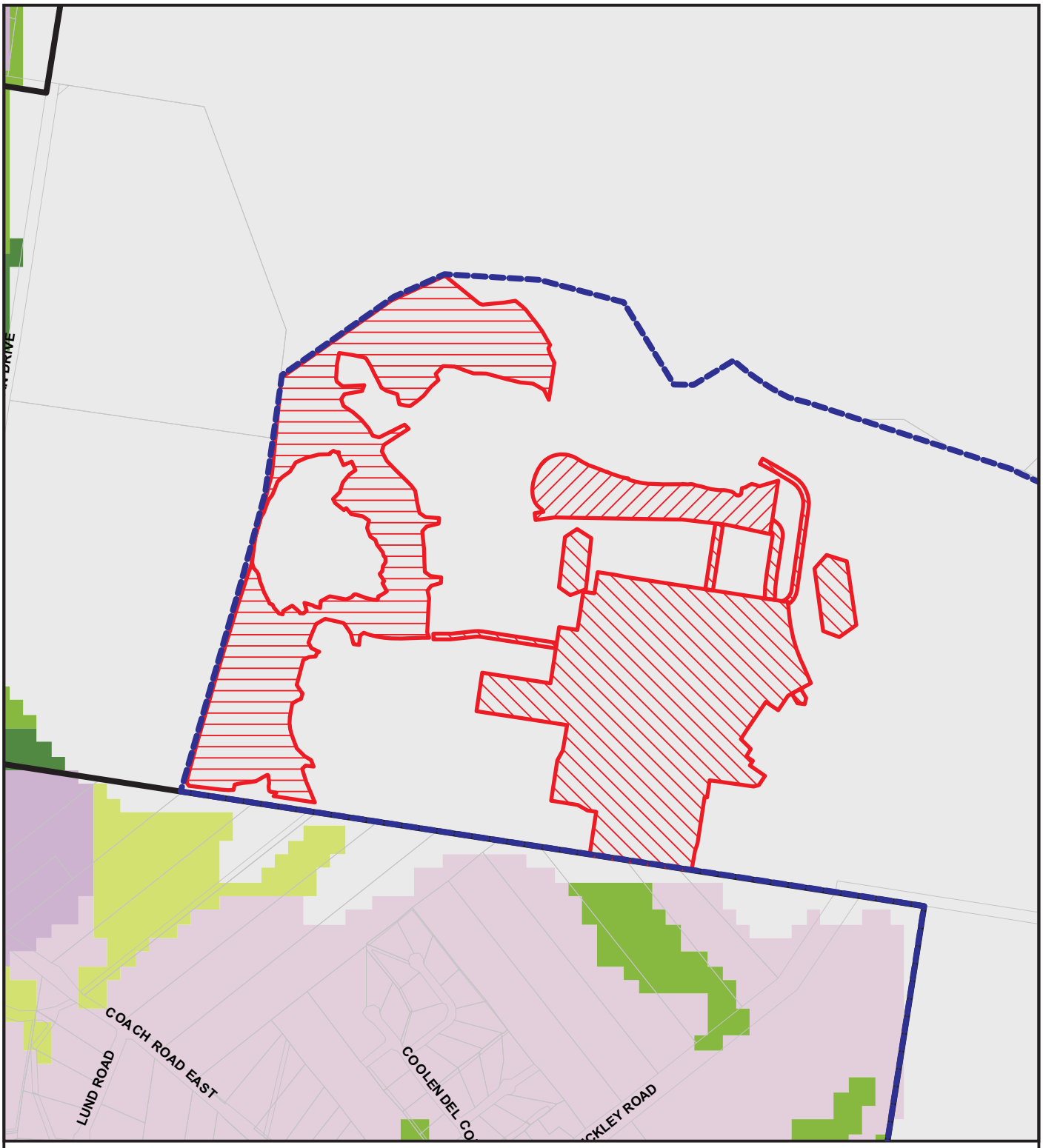
FIGURE 8

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Ref Wetlands (2).cdr

TITLE

REFERABLE WETLANDS



Legend

- Medium Value Bushland Habitat
- Low Value Bushland Habitat
- Low Value Rehabilitation
- Low Value Other
- Generally Not Suitable
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: QLD DEHP Koala Habitat in South East Queensland (dated 16.03.15)

SCALE: 1 : 10 000 @ A4

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FIGURE 9

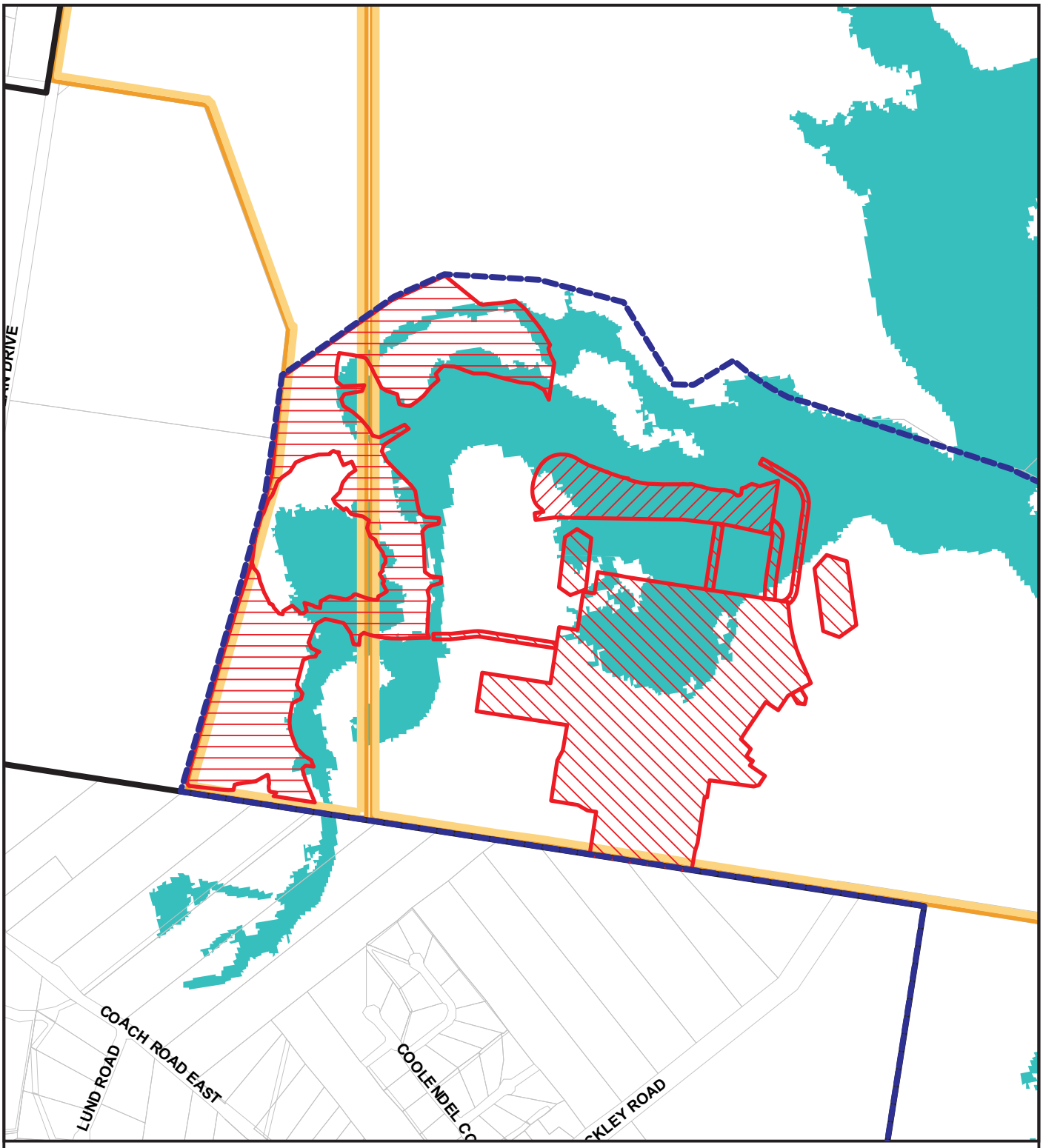
PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Koala SPP (2).cdr

TITLE

KOALA HABITAT

2.3.3.6 Coastal Hazard Mapping

The site is just within the coastal management district. A large proportion of the site is mapped as "Storm Tide Inundation Area - Medium hazard area (less than 1.0m water depth)" (**FIGURE 10**). The eastern portion of Raff Creek located outside of Phase 2 is mapped as "Indicative Erosion Prone Area – Erosion due to storm impact and long term trends of sediment loss and channel migration" (**FIGURE 11**).



Legend

- Storm Tide Inundation Area
  - Medium hazard area (less than 1.0m water depth)
- Coastal Management District
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: QLD DEHP Coastal Hazard Areas Map - Storm Tide Inundation Area (dated 16.03.15)
SCALE: 1 : 10 000 @ A4

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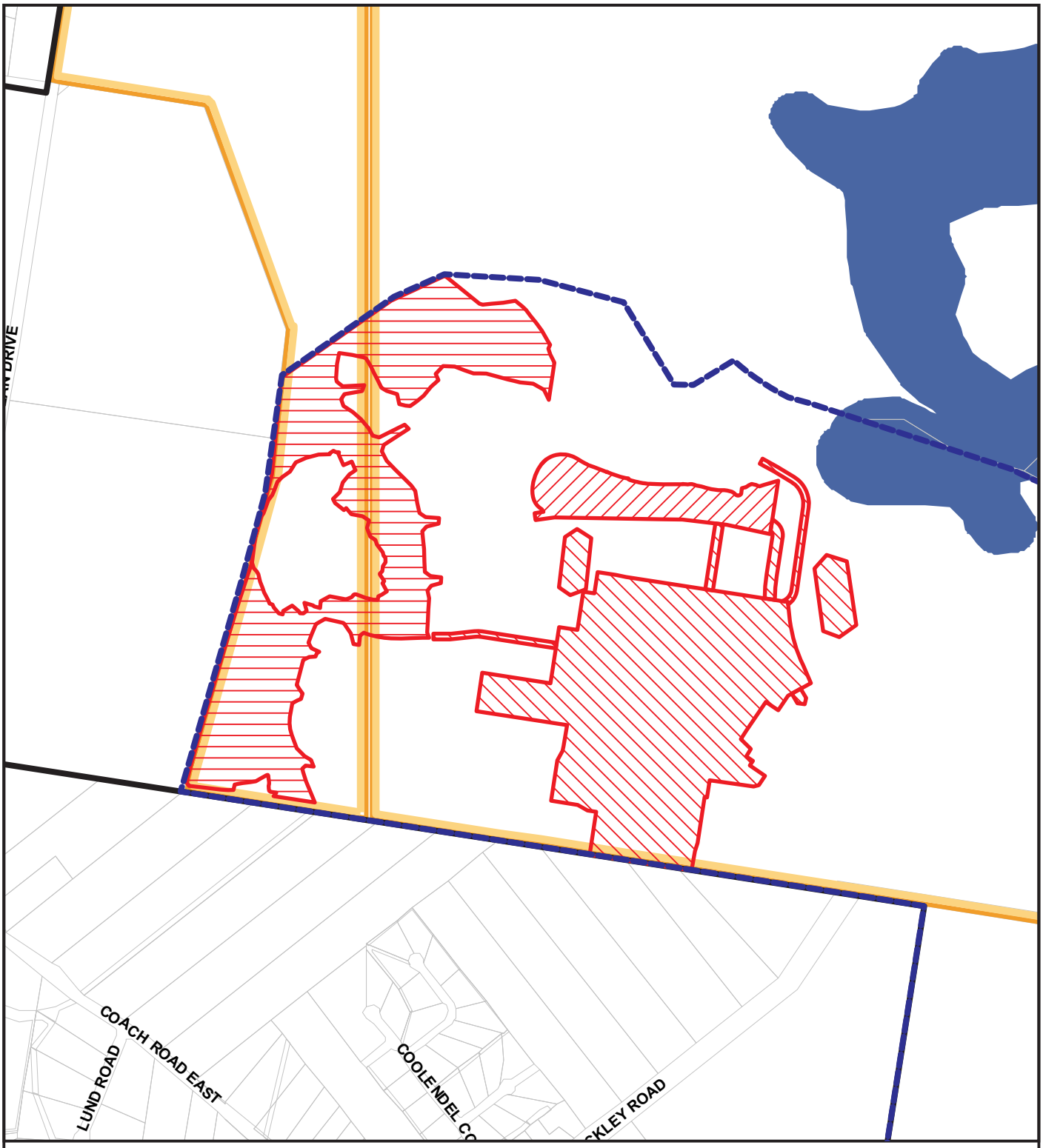
FIGURE 10

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Coastal Storm(2).cdr

TITLE

STORM TIDE INUNDATION AREA



Legend

- Indicative Erosion Prone Area - Erosion due to storm impact and long term trends of sediment loss and channel migration
- Coastal Management District
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: QLD DEHP Coastal Hazard Areas Map - Erosion Prone Area (dated 16.03.15)

SCALE: 1 : 10 000 @ A4

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FIGURE 11

PREPARED: BW
DATE: 27 May 2015
FILE:Q15003_Coastal Erosion(2).cdr

TITLE

EROSION PRONE AREAS

3 SITE ASSESSMENT

3.1 Introduction

This section discusses the methods used in the site assessment and presents the results of the assessment.

3.2 Methods

3.2.1 Site Vegetation Surveys

3.2.1.1 Background

A site inspection of the RWA Phase 2 site was undertaken by two (2) JWA scientists on the 11th March and the 15th and 16th April 2015. A total of approximately four (24) person hours were spent on this component of the survey.

The flora surveys employed an assessment of floral taxa and vegetation communities in keeping with the methodology employed by the Queensland Herbarium for the survey of Regional Ecosystems and vegetation communities (Neldner et al. 2005). Preliminary identification of the vegetation communities was conducted prior to the commencement of fieldwork via interpretation of current RE mapping (Version 8) and aerial photographs.

Field surveys involved a botanical assessment at a number of representative sites within the RWA Phase 2 site. The surveys utilised a number of standard methods including quaternary survey sites and random meander search areas.

3.2.1.2 Tertiary Survey Sites

The field survey utilised two (2) tertiary transects within the site, each of which comprised of 10 x 50m (500m^2) transects. Locations of transects were recorded using a handheld GPS unit. The location of each tertiary survey site is shown in **FIGURE 12**.

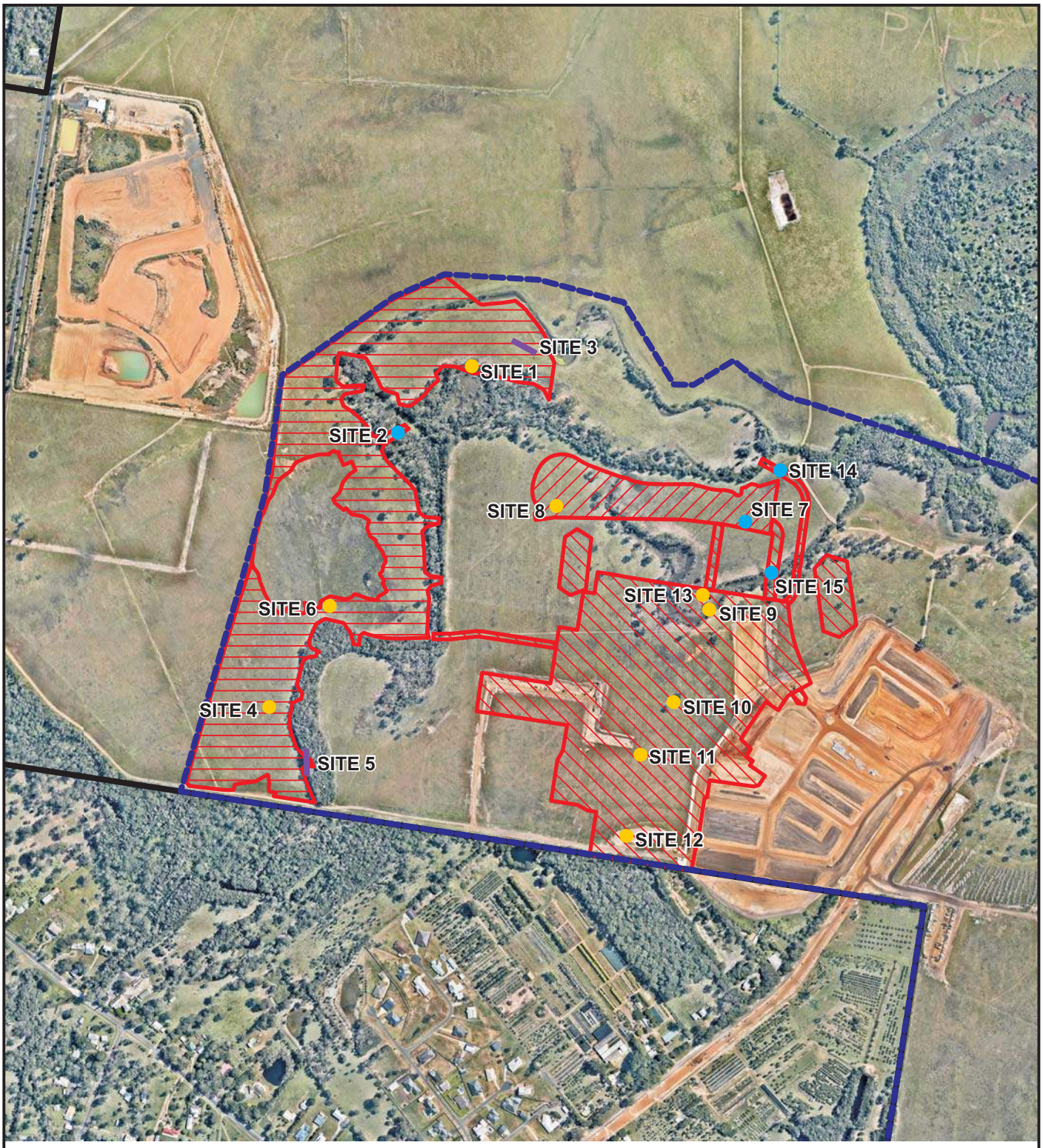
Descriptive site information recorded at tertiary transects included location, orientation, aspect, slope, soil type, landform, disturbance, fire history, hydrology and general notes on ecological integrity. Several digital photographs were taken at each plot as a visual reference.

Floristic analysis included plant identification and species diversity characterisation of all flora present. Relative abundance was assigned for all species recorded.

The structural analysis included recording the height class and life form of the dominant species within each strata present. The height of each stratum was recorded using ocular estimation. Foliage projective cover (FPC) of the mid and upper strata (if present) was calculated along each transect where foliage projection intersected the 50m centre tape. The FPC of the ground layer was determined using visual estimation of cover within five (5) 1m subplots spaced at 12.5 m equal intervals along the primary 50m transect.

3.2.1.3 Quaternary Survey Sites

The field surveys employed nine (9) quaternary survey sites. Quaternary survey sites were used to ground truth vegetation communities and confirm dominant characteristic species. Locations of transects were recorded using a handheld GPS unit. The location of each quaternary survey site is shown in **FIGURE 12**.



Legend

- Quaternery Survey Site
- Tertiary Survey Site
- Vegetation Confirmation Survey Site
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: JWA Site Investigations; Near Map March 2015 Aerial Photo

SCALE: 1 : 10 000 @ A4

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FIGURE 12

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Survey Sites (2).cdr

TITLE

SURVEY SITES

Descriptive site information recorded at quaternary sites included location, orientation, aspect, slope, soil type, landform, disturbance, fire history and general notes on ecological integrity. Several digital photographs were taken at each plot as a visual reference.

Floristic analysis included determination of the dominant species within the mid and canopy strata. Structural analysis included recording the height class and life form of the dominant species within the mid and canopy strata. The height of each stratum was recorded using ocular estimation.

3.2.1.4 Vegetation Confirmation Sites

The field surveys employed four (4) survey sites to confirm vegetation type. These sites were used to ground truth vegetation communities, confirm dominant characteristic species and collect hydrology information. Locations of transects were recorded using a handheld GPS unit. The location of each vegetation confirmation site is shown in **FIGURE 12**.

3.2.1.5 Random Meander Searches

The random meander technique (Cropper 1993) was used to identify changes in landform, identify vegetation community boundaries and to complete targeted searches for threatened flora species. The floral characteristics of each vegetation community that was evident from detailed aerial photographs were examined by 'on foot' inspections. Vegetation communities were mapped and described using the technique contained in Walker and Hopkins (1998). Vegetation structural formation classes were assessed according to Neldner et al. (2005). RE classification of vegetation communities were determined as per Sattler and Williams (1999) and in accordance with the Regional Ecosystems Description Database (REDD) (Queensland Herbarium 2014).

3.2.1.6 Weeds

Weeds were assessed for significance under the Queensland *Land Protection (Pest and Stock Route Management) Act 2002* (LP Act) and the Commonwealth Weed of National Significance (WoNS).

The Queensland *LP Act* lists exotic flora and fauna that are considered Class 1, 2 or 3 pests under the Act. The different classes require different pest management strategies and landholder requirements to control pests on their land. Landowners are required to manage Class 1 and 2 Declared weed on their land (DAFF 2011).

Thirty-two (32) Weeds of National Significance (WoNS) have been identified by Australian governments based on their invasiveness, potential for spread and environmental, social and economic impacts. A list of twenty (20) WoNS endorsed in 1999 and a further twelve (12) were added in 2012. Individual landowners and managers are responsible for managing WoNS on their land.

3.2.1.7 Koala Tree Survey

The site was assessed for the presence of Koala habitat and food trees. Koala habitat trees are defined as a tree of the species *Eucalyptus, Corymbia, Angophora, Lophostemon* or *Melaleuca* that has: a) a height of more than four (4) metres; or b) a trunk with a circumference of more than 31.5 centimetres at 1.3 metres above the ground (> 10cm diameter at breast height [DBH]) (DERM 2010). Koala food trees are

those species of habitat trees that Koalas feed on. Areas supporting koala habitat were identified and mapped.

3.2.1.8 Nomenclature

Taxonomic nomenclature used for the description of floral species is according to Henderson (2002). Introduced species are signified in all text by an asterix (*). Any additional changes in taxonomic nomenclature have been incorporated as described in Jessup (2002, 2003 and 2005). Field references utilised for the identification and description of floral species include: Stanley and Ross (1989); Harden et al. (2006); Brooker and Kleinig (1994a and 1994b); Leiper et al. (2008); Haslam (2004) and Queensland Museum (2003)].

3.2.2 Site Fauna Survey

3.2.2.1 Introduction

A brief fauna survey was carried out in conjunction with the flora survey by one (1) JWA scientists on the 11th March 2015. Techniques utilised during the fauna survey are described below.

3.2.2.2 Opportunistic Sightings

The random meander technique (Cropper 1993) was used to traverse the site. All incidental records of fauna utilising the study area were recorded. Discoveries of scratch marks on trees, scats, footprints, diggings, bones and other animal traces were noted.

3.2.2.3 Active Searching

Any logs, sheets of tin, cardboard, bark and leaves were overturned in search of reptiles and amphibians while traversing the site. Searches were undertaken for diggings, scats, and bones. Eucalypt trees were inspected for signs of Koala activity such as scratch marks and scats. Active observation of bird and amphibian activity, both aurally and visually, was undertaken during the site visit.

3.2.2.4 Spotlighting and Call Playback

Spotlighting and call playback targeting Koala (*Phascolarctos cinereus*) and Wallum froglet (*Crinia tinnula*) along the Raff Creek corridor was completed on evening of the 11th March 2015. Pre-recorded territorial and mating calls of these species were broadcast intermittently throughout potential habitat for one (1) minute each, followed by a five (5) minute listening period.

3.2.3 Habitat Suitability Assessment

The suitability of the habitats on the site for listed threatened flora and fauna species and migratory species identified in database searches was assessed to determine which of those species could potentially occur on the site. Assessments were based on the following:

- desktop research of scientific journal articles and botanical literature;
- consultations with specialist academic staff; and
- targeted field surveys within the subject site and surrounds.

The impacts associated with current landuses, vegetation clearing, land and waterway erosion/degradation, weed and feral invasion and previous fire regimes were all considered when completing habitat suitability assessments. Furthermore, the assessment determined whether it was likely for habitat features that typically support threatened species to be present on the subject site. Particular attention was paid to habitat features such as:

- the presence of mature trees with hollows, fissures and/or other suitable roosting/nesting places;
- the presence of Koala food trees;
- the presence of preferred glossy black cockatoo feed trees (forest oak and/or black she-oak);
- the presence of characteristic signs of foraging (e.g. chewed cones or glider feeding scars);
- condition, flow and water quality of drainage lines and bodies of water;
- areas of dense vegetation;
- presence of hollow logs/debris and areas of dense leaf litter;
- presence of fruiting flora species;
- presence of blossoming flora species, particularly winter-flowering species;
- vegetation connectivity and proximity to neighbouring areas of intact vegetation; and
- presence of caves and man-made structures suitable as microchiropteran bat roost sites.

Potential occurrences of threatened flora and fauna species and migratory species are discussed as *unlikely*, *possible* or *likely* to occur in habitats on the site. Possible occurrences are species which may occur sporadically or are provided with small areas of potentially suitable habitat. Likely occurrences are provided with habitat of high quality on the subject site.

3.3 Results

3.3.1 Site Vegetation Survey

3.3.1.1 Background

Six (6) broad vegetation communities were identified on the subject site. This section provides a description of each of the vegetation communities and a discussion of the condition and conservation status of each. The conservation status of vegetation communities is discussed with reference to the Regional Ecosystem Description Database (Queensland Herbarium 2014) and the Queensland *VMA (1999*) where appropriate.

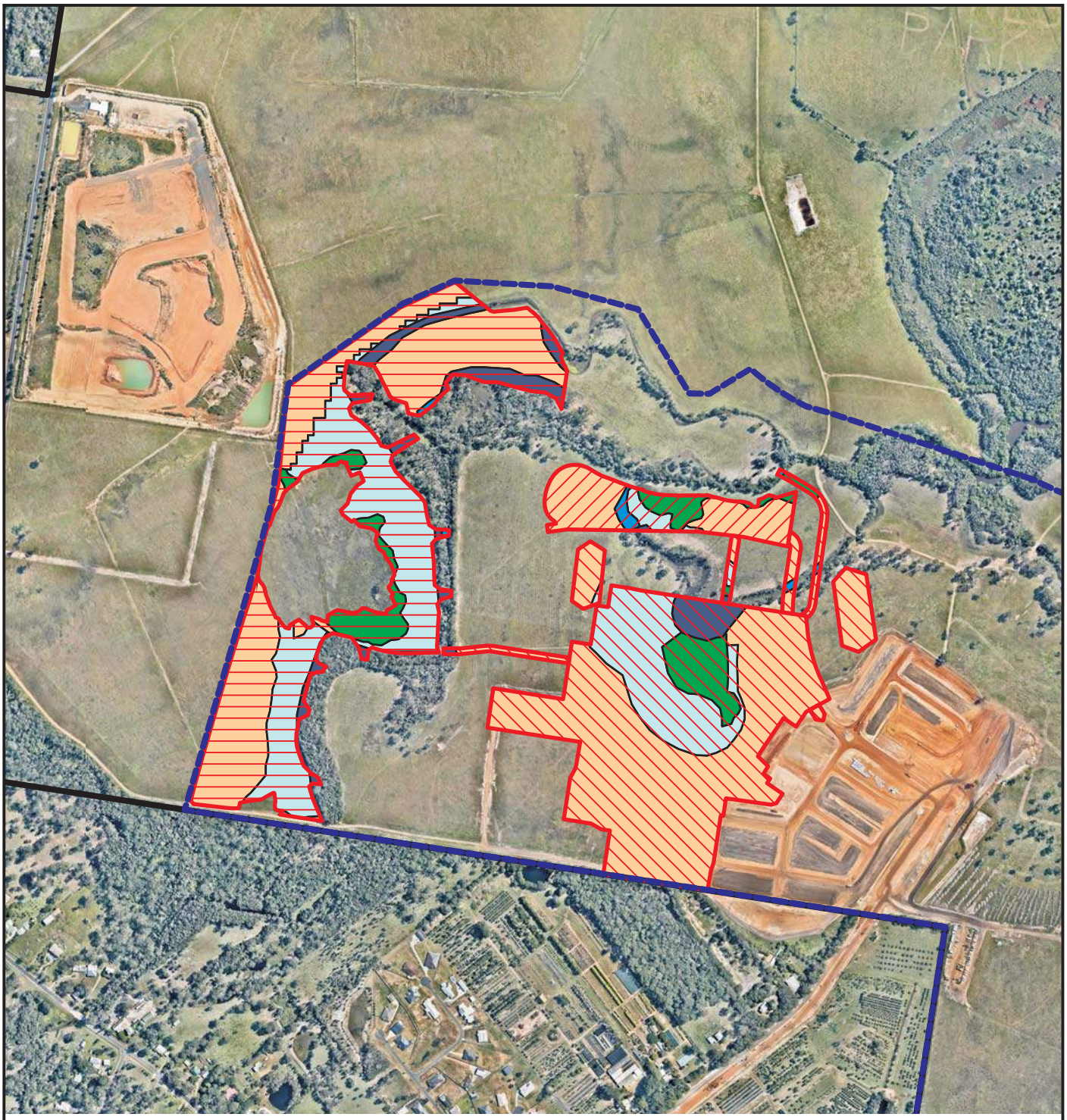
No threatened plant species were recorded on the subject site during the site inspection. **APPENDIX 1** provides a complete description of the survey sites including a species list.

3.3.1.2 Vegetation Community Descriptions

3.3.1.2.1 Community 1: Coastal and Subcoastal Floodplain, Grass, Sedge, Herb Swamps

Location and area

This wetland community is located adjacent to Raff Creek and its tributaries beyond the tidal influence (**FIGURE 13**). Survey sites 6 and 14 were used to assess the boundaries of this community (**FIGURE 12**).



Legend

- Community 1: Coastal and subcoastal floodplain, grass, sedge herb swamps
- Community 2: Coastal and subcoastal floodplain tree swamps – melaleuca and eucalypt
- Community 3: Mangrove and casuarina estuarine wetlands
- Community 4: Disturbed wet-terrestrial grassland/sedgeland mosaic
- Community 5: Disturbed terrestrial grassland/woodland
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

0 300m

N

SOURCE: JWA Site Investigations; Near Map March 2015 Aerial Photo

SCALE: 1 : 10 000 @ A4

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FIGURE 13

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Vegetation (2).cdr

TITLE

VEGETATION COMMUNITIES

Description
This is a native regrowth community. The vegetation is dominated by sedges with varying densities of regrowth *Melaleuca quinquenervia* shrubs. There was also the occasional *Melaleuca nodosa* and *Melaleuca thymifolia* shrubs. Groundcover include some exotic pasture herbs and grasses but mostly native sedge species. Native species include *Cyperus polystachyos, Cyperus haspan, Fimbristylis ferruginea, Fimbristylis autumnalis, Fimbristylis miliacea, Fuirena sp., Juncus spp., Centella asiatica, Goodenia paniculata, Philydrum lanuginosum*, *Persicaria decipiens*, *Calochlaena dubia*, *Lomandra longifolia, Ludwigia octovalis,* and *Blechnum indicum*. Introduced species include fleabane (*Conyza sp.*), green couch (*Cynodon dactylon*) and *Paspalum sp*. pasture grasses.

Condition
This community is in very poor condition with grazing impacts highly evident. This community would originally have supported *Melaleuca quinquenervia* forests. These areas are actively managed to suppress regrowth of an overstorey of paperbarks and allied species. Removal of disturbance pressures (i.e. grazing) would likely see most of these areas transition over time to the community described as Coastal and sub-coastal floodplain tree swamps - Melaleuca and Eucalypt.

Conservation Status
This area is not mapped as remnant vegetation (DNRM 2014) and has no conservation status under the *VMA (1999)*.

3.3.1.2.2 Community 2: Coastal and Subcoastal Floodplain Tree Swamps – Melaleuca and Eucalypt

Location and area
This wetland community is located along Raff Creek and its tributaries beyond the tidal influence (**FIGURE 13**). Survey sites 1, 2, 5, 9 and 13 were used to assess the boundaries of this community (**FIGURE 12**).

Description
This community contains mature remnant vegetation. The vegetation is dominated by broad-leaved paperbark (*Melaleuca quinquenervia*). Canopy species include *Melaleuca quinquenervia,* Queensland blue gum (*Eucalyptus tereticornis*), grey ironbark (*Eucalyptus siderophloia*) and swamp box (*Lophostemon suaveolons*), swamp mahogany (*Eucalyptus robusta*) to 16-20m. Sometimes the Eucalypts are emergent. The understorey is dominated by a combination of native species and introduced plants. Native species include *Trema tomentosa*, *Parsonsia straminea, Melaleuca linariifolia, Melicope elleryana, Glochidion sumatranum, Stephania japonica, Pittosporum revolutum,* and *Alphitonia excelsa*. Introduced species include Camphor laurel (*Cinnamomum camphora*), Groundsel bush (*Baccharis halimifolia*), and Wild tobacco (*Solanum mauritianum*).

Groundcover include some exotic pasture herbs and grasses but mostly native species. Native species include Dusky Coral Pea (*Kennedia rubicunda*), Frogsmouth (*Philydrum lanuginosum*), Saw sedge (*Gahnia sieberiana)*, Smartweed (*Persicaria sp.*), Soft bracken (*Calochlaena dubia*), *Lomandra longifolia, Ludwigia octovalis, Blechnum indicum*, and *Phragmites australis* (can have a weedy habit). Introduced species include Water hyacinth (*Eichhornia crassipes*), Fleabane (*Conyza sp.*), and white passion flower (*Passiflora subpeltata*).

Phragmites australis, *Gahnia sieberiana* and *Blechnum indicum* become locally dominant in some areas of the community when associated with the drainage lines.

Condition
The majority of this community on the RWA is in good condition with the exception of the Raff Creek anabranch. The vegetation along the anabranch is in very poor condition with grazing impacts highly evident. The creek banks have been trampled and water plants grazed. There are also salt scalds on the inside of the anabranch loop suggesting that extreme high tides may possibly make it into this area.

Conservation Status
This area is not mapped as remnant vegetation (DNRM 2014) and therefore has no conservation status under the *VMA (1999).*

3.3.1.2.3 Community 3: Mangrove and Casuarina Estuarine Wetlands

Location and area
This wetland community is located along Raff Creek below HAT and in most frequently tidally inundated areas. The water is saline (**FIGURE 13**). Survey site 15 was used to assess the boundaries of this community (**FIGURE 12**).

Description
This community contains regrowth vegetation. The community occurs on soils that are classically estuarine, fine dark silty clay which is highly saline and anaerobic. It is dominated by Grey mangrove (*Avicennia marina*) and River mangrove (*Aegiceras corniculatum*) with a fringing band of Saltwater couch (*Sporobolus virginicus*), Swamp oak (*Casuarina glauca*) and other species such as Suaeda sp., mangrove fern (*Acrostichum aureum*) and Ruby saltbush (*Enchylaena tomentosa*). In some areas the dominant species is *Casuarina glauca* with only the occasional mangrove along the creek edge. The ground cover is dominated by salt couch (*Sporobolus virginicus*). Introduced species include broad-leaf pepper tree (*Schinus terebinthifolius*) and lantana (*Lantana camara*).

Condition
The portion of this community within Phase 2 is in poor due to grazing impacts. The creek banks have been trampled and the salt couch grazed. This community on the site consist of a thin line of single trees along the watercourse.

Conservation Status
This area is not mapped as remnant vegetation (DNRM 2014) and has no conservation status under the *VMA (1999).*

3.3.1.2.4 Community 4: Disturbed Wet-terrestrial Grassland/Sedgeland Mosaic

Location and area
This community is located in areas below the Q100 flood contour (excluding areas mapped as other wetlands) surrounding Raff Creek and its tributaries beyond the tidal influence (**FIGURE 13**). Survey sites 4 and 10 were used to assess the boundaries of this wetland community (**FIGURE 12**).

Description
This community contains regrowth vegetation. This community is primarily grazing pasture with greater than 50% cover of wetland indicator species. Groundcovers include both exotic pasture herbs and grasses and native species. Native species include *Cyperus polystachyos*, *Kennedia rubicunda*, *Persicaria sp.*, *Lomandra longifolia,* Pink Swamp Lily *(Murdannia graminea), Tricoryne elatior, Triglochin procera,* feathered yellow-eye *(Xyris complanata)*, *Blechnum indicum,* blady grass (*Imperata cylindrica*), Bracken (*Pteridium esculentum*) and *Paspalum sp*. pasture grasses. Introduced species include rat's tail grass

(*Sporobolus sp.**), *Cynodon dactylon*, convolvulus sp.**, *Lepidium sp.*, Conyza sp.**, and *Passiflora subpeltata*.

Condition
This vegetation community it is in poor condition given the lack of a shrub or tree layer. Grazing impacts are evident.

Conservation Status
This area is not mapped as remnant vegetation (DNRM 2014) and has no conservation status under the *VMA (1999)*.

3.3.1.2.5 Community 5: Disturbed Terrestrial Grassland

Location and area
This community is located on the remainder of the site (**FIGURE 13**). Survey sites 3, 7, 8, 11 and 12 were used to assess the boundaries of this wetland community (**FIGURE 12**).

Description
The remainder of the site is open pasture with the occasional *E. tereticornis* paddock shade tree. There are also the occasional melon hole populated with sedges such as *Cyperus polystachyos, Fimbristylis spp., Juncus spp.,* and Frogsmouth (*Philydrum lanuginosum*). Pasture grasses include *Paspalum sp* and Cynodon dactylon**. Introduced species include rat's tail grass (*Sporobolus sp.**), *convolvulus sp.**, *Lepidium sp.*, Conyza sp.**, and *Passiflora subpeltata*.

Condition
As grazing pasture this community is in good condition with only light grazing impacts. As a vegetation community it is in poor condition given the lack of a shrub or tree layer. The eucalypt paddock trees appear healthy but isolated in the landscape.

Conservation Status
This area is not mapped as remnant vegetation (DNRM 2014) and has no conservation status under the *VMA (1999)*.

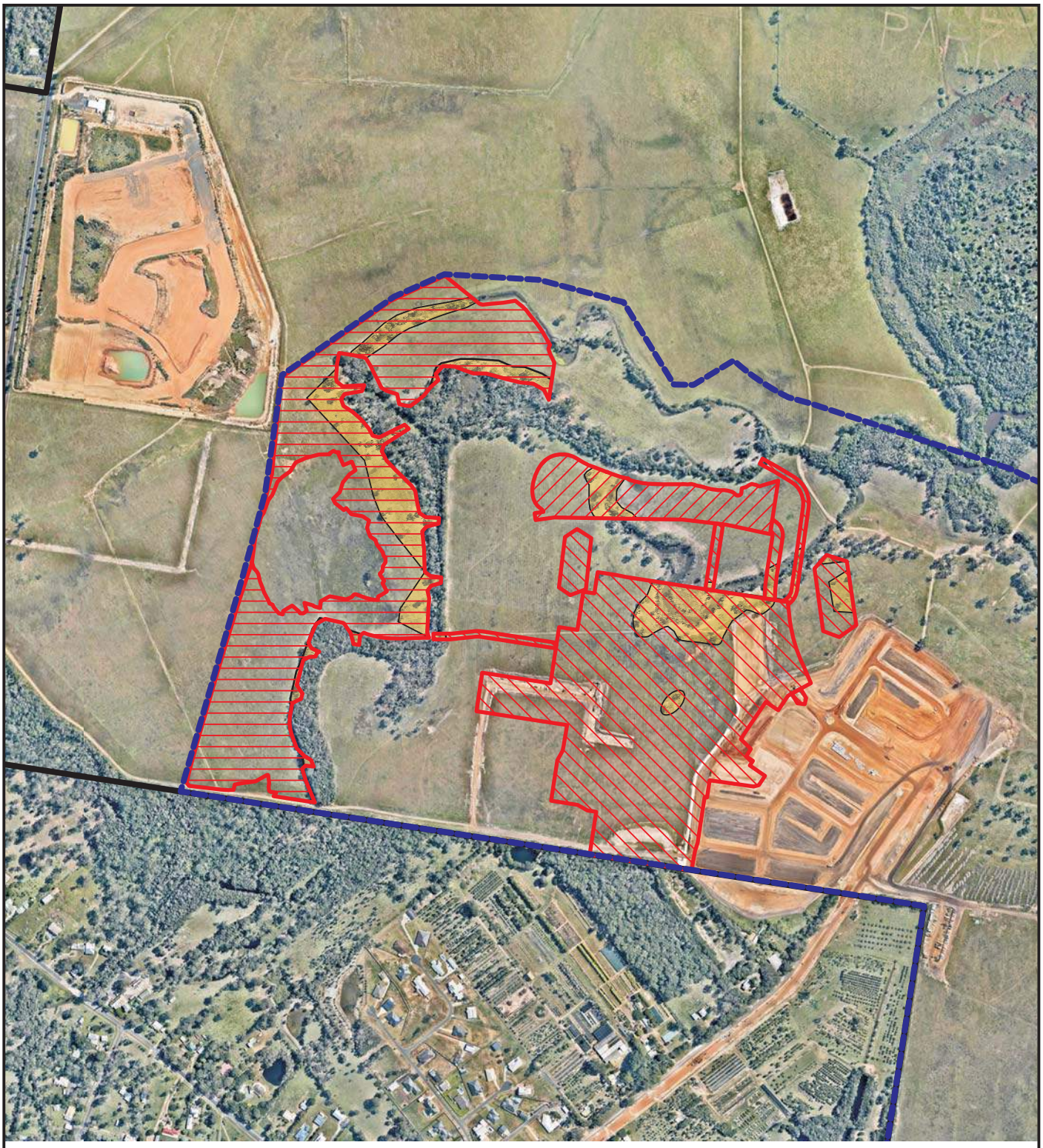
3.3.1.3 Koala Tree Survey

A Koala tree survey revealed that all trees with a DBH greater than 10cm and of species *Eucalyptus, Corymbia, Angophora, Lophostemon* or *Melaleuca*, were suitable to be classed as koala habitat trees. As such the majority of maturing trees above 5 m in height within the Phase 2 boundary are considered Koala habitat trees. Koala food trees were identified on the site including species *Eucalyptus tereticornis* and *E. robusta*. The areas containing koala food trees were mapped and are shown in **FIGURE 14**.

3.3.2 Habitat Suitability Assessment for Threatened Flora Species

Habitat suitability assessments of the twelve (12) threatened flora species that are known to occur or considered possible occurrences in the locality (**TABLE 1**) determined that three (3) of these species had the potential to be present within the subject site. These species are:

- *Phaius australis* (Lesser swamp-orchid);
- *Lilaeopsis brisbanica*; and
- *Acacia attenuata*.



Legend

- Areas Containing Koala Food Trees
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: JWA Site Investigations; Near Map March 2015 Aerial Photo

SCALE: 1 : 10 000 @ A4

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FIGURE 14

PREPARED: BW
DATE: 04 June 2015
FILE: Q15003_Koala Trees (3).cdr

TITLE

KOALA FOOD TREES AREAS

APPENDIX 2 lists the threatened flora species that are known or considered to possibly occur in the locality and notes the likelihood of occurrence of each species within the subject area.

3.3.3 Site Fauna Survey

3.3.3.1 Introduction

This section provides details of the fauna species and associated habitats recorded on the site during the fauna survey. Conditions during the fauna survey were warm and dry. No rain was recorded during the survey.

3.3.3.2 Amphibians

The site contains a range of suitable habitat for frogs, including paperbark swamp, sedges and flood prone pasture with melon holes. The majority of suitable frog habitats on site have been degraded due to damage by cattle and feral pigs, invasive weeds, and the presence of introduced fauna species including Cane toads (*Rhinella marinus*) and Mosquitofish (*Gambusia holbrookii*). The lower reaches of Raff Creek, its tributaries, and drainage lines are subject to varying degrees of tidal influence. The anabranch of Raff Creek within Phase 2 is not likely to be subject to tidal influences except in extreme tide events.

No threatened or native amphibian species were observed on site during a diurnal survey or during nocturnal spotlighting and call playback. A large number of Cane toads were observed.

3.3.3.3 Reptiles

The best habitat for reptiles on site occurs along Raff Creek and its associated vegetation. The *Melaleuca quinquenervia* regrowth wetlands are likely to act as refuges for aquatic and semi-aquatic reptiles during dry periods. The absence of rocky habitats on site diminished the number of reptile species likely to occur on site. No threatened or non-threatened reptiles were observed within Phase 2 of the RWA. Conditions during the assessment were generally suitable for detecting reptiles, with warm and humid conditions.

3.3.3.4 Birds

The subject site provides suitable habitat for a range of disturbance adapted open country birds such as the magpie (*Gymnorhina tibicen*), Lewin's honeyeater (*Meliphaga lewinii*), Torresian crow (*Corvus orru*), magpie-lark (*Grallina cyanoleuca*) and noisy miner (*Manorina melanocephala*). The wetland regrowth vegetation along Raff Creek anabranch may provide habitat for semi-aquatic bird species such as ducks, rails and crakes.

No threatened bird species were observed during the site survey. Three (3) native bird species were observed on site:

- Laughing kookaburra (*Dacelo novaeguineae*);
- Noisy miner (*Manorina melanocephala*); and
- Magpie-lark (*Grallina cyanoleuca*).

3.3.3.5 Mammals

The cleared grazing lands in the southern portion of the subject site may provide suitable habitat for the larger macropod species such as Eastern grey kangaroos (*Macropus giganteus*).

The presence of *Eucalyptus tereticornis*, a Koala food tree, may provide suitable habitat for the Koala. No evidence of Koala activity (i.e. scratched or scats) was observed during the site assessment. No Koalas were observed during the diurnal site assessment or nocturnal spotlighting survey. However, previous surveys (Cardno 2014) have recorded Koala scats within the Phase 2 site close to the waterway and observed Koalas within the wider NEBP area (Section 2.3.1).

No native and/or threatened mammal species were observed during the site assessment.

3.3.4 Habitat Suitability Assessment for Threatened Fauna Species

Habitat suitability assessments of the forty-two (42) threatened fauna species and thirty-five (35) migratory fauna species that are known to occur or considered possible occurrences in the locality (**TABLE 2** and **TABLE 3**) determined that twenty-three (23) of these species had potential to be present within the subject site. These species are:

- Australian bittern (*Botaurus poiciloptilus*);
- Australian painted snipe (*Rostratula australis*);
- Cattle egret (*Ardea ibis*);
- Common sandpiper (*Actitis hypoleucos*);
- Great egret (*Ardea alba*);
- Grey plover (*Pluvialis squatarola*);
- Grey-headed flying-fox (*Pteropus poliocephalus*);
- Koala (*Phascolarctos cinereus*);
- Latham's snipe (*Gallinago hardwickii*);
- Marsh sandpiper (*Tringa stagnatilis*);
- Pacific golden plover (*Pluvialis fulva*);
- Rainbow bee-eater (*Merops ornatus*);
- Red goshawk (*Erythrotriorchis radiatus*);
- Rufous fantail (Rhipidura rufifrons);
- Satin flycatcher (Myiagra cyanoleuca);
- Sharp-tailed sandpiper (*Calidris acuminata*);
- Spectacled monarch (*Monarcha trivirgatus*);
- Swift parrot (*Lathamus discolor*);
- Tusked frog (*Adelotus brevis*);
- Wallum froglet (*Crinia tinnula*);
- White-bellied sea-eagle (*Haliaeetus leucogaster*);
- White-throated needletail (*Hirundapus caudacutus*); and
- Wood sandpiper (*Tringa glareola*).

APPENDIX 2 lists the threatened and migratory fauna species that are known or considered to possibly occur in the locality and discusses the likelihood of occurrence of each species within the subject area.

4 CORRIDORS AND CONNECTIVITY

4.1 Background

The term 'connectivity' is used to describe the degree to which the landscape facilitates or impedes the movement of species among habitat areas (Bélisle 2005). The level of connectivity between habitat areas in the landscape can be described along a continuum from high, to medium, to low and isolated.

Landscapes with high levels of connectivity form an unbroken expanse of habitat through which a wide range of the inhabitant species are able to easily move and select high quality habitats. Landscapes with low levels of connectivity are characterised by habitat areas that are separated by wide gaps and where the quality and quantity of remaining habitat is reduced (habitat fragmentation). Habitat fragmentation impedes the movement of species among remaining suitable habitat areas (Andrén 1994; Fahrig 2003) and generally restricts movement to all but the most mobile of species.

At a broad landscape scale, maintaining habitat connectivity is necessary to maintain the viability of species populations in the long term (Beier and Noss 1998). In fragmented landscapes, corridors of native vegetation (ecological corridors) connect larger habitat areas and can enhance landscape connectivity by:

- providing habitat for fauna and flora species; and
- facilitating the movement and dispersal of fauna and flora species between larger and/or more suitable habitat areas in the landscape.

The following sections provide an assessment of the corridor and connectivity values of native vegetation on the site and surrounding areas.

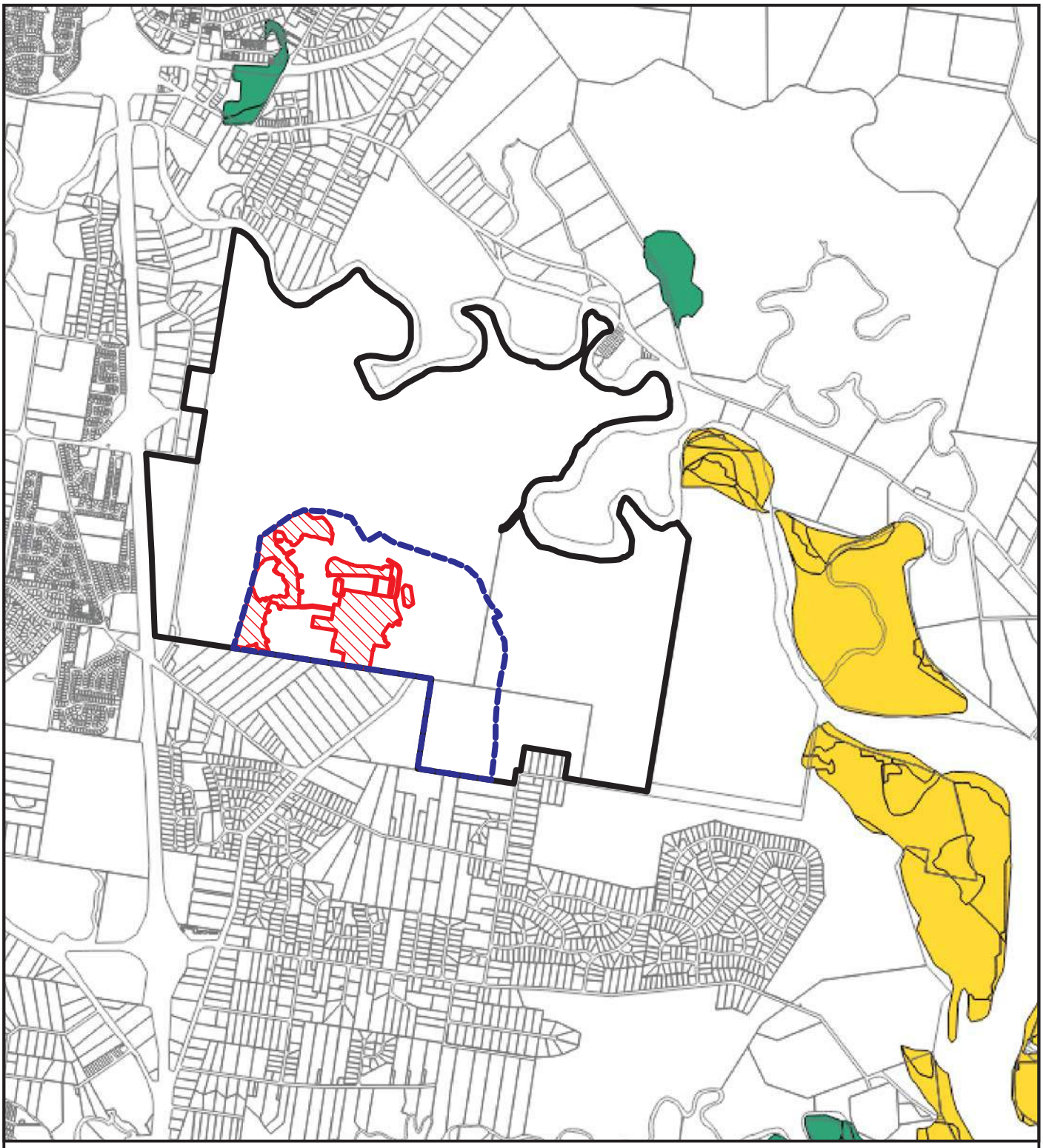
4.2 Recognition of Corridor Values On or Near the Subject Site

State and regional corridors in South-east Queensland have been identified in the Biodiversity Planning Assessment (BPA): South East Queensland South Landscape Expert Panel Report (EPA 2006). No state or regional corridors mapped on the site. A state corridor is mapped to the east of the site along the Caboolture River. Small areas of regional corridors are mapped to the north and east of the site. BPA corridors are shown in **FIGURE 15**.

The Caboolture Shire Plan identifies an Ecological Corridor to the east of the site along the Caboolture River however this corridor does not extend into the Phase 2 site. Refer to Section 6.8 for council mapping.

4.3 Site Assessment

The waterway corridor along Raff Creek is vegetated with remnant woodland that provides good habitat corridors for wildlife. The anabranch that transects the constructed wetland and residential development areas forms a degraded corridor connection to the major arm of Raff Creek. There is no remnant vegetation on the anabranch of Raff Creek and the quality of the corridor at this point is considered to be low.



Legend
- State Corridors
- Regional Corridors
- Phase 2 Boundary
- RWA Boundary
- NEBP Boundary

N

0 1km

SOURCE: Biodiversity Planning Assessment v3.5 Criteria J Corridors

SCALE: 1 : 40 000 @ A4

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FIGURE 15

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_BPA Corridors (2).cdr

TITLE

BPA CORRIDORS

5 IMPACTS AND AMELIORATION

5.1 Introduction

The following sections examine the likely direct and indirect impacts of the proposed development and recommends amelioration measures to minimise and mitigate impacts on the biodiversity and habitat values of the site.

5.2 Potential Impacts of the Proposed Development

5.2.1 Habitat Loss/Vegetation Clearing

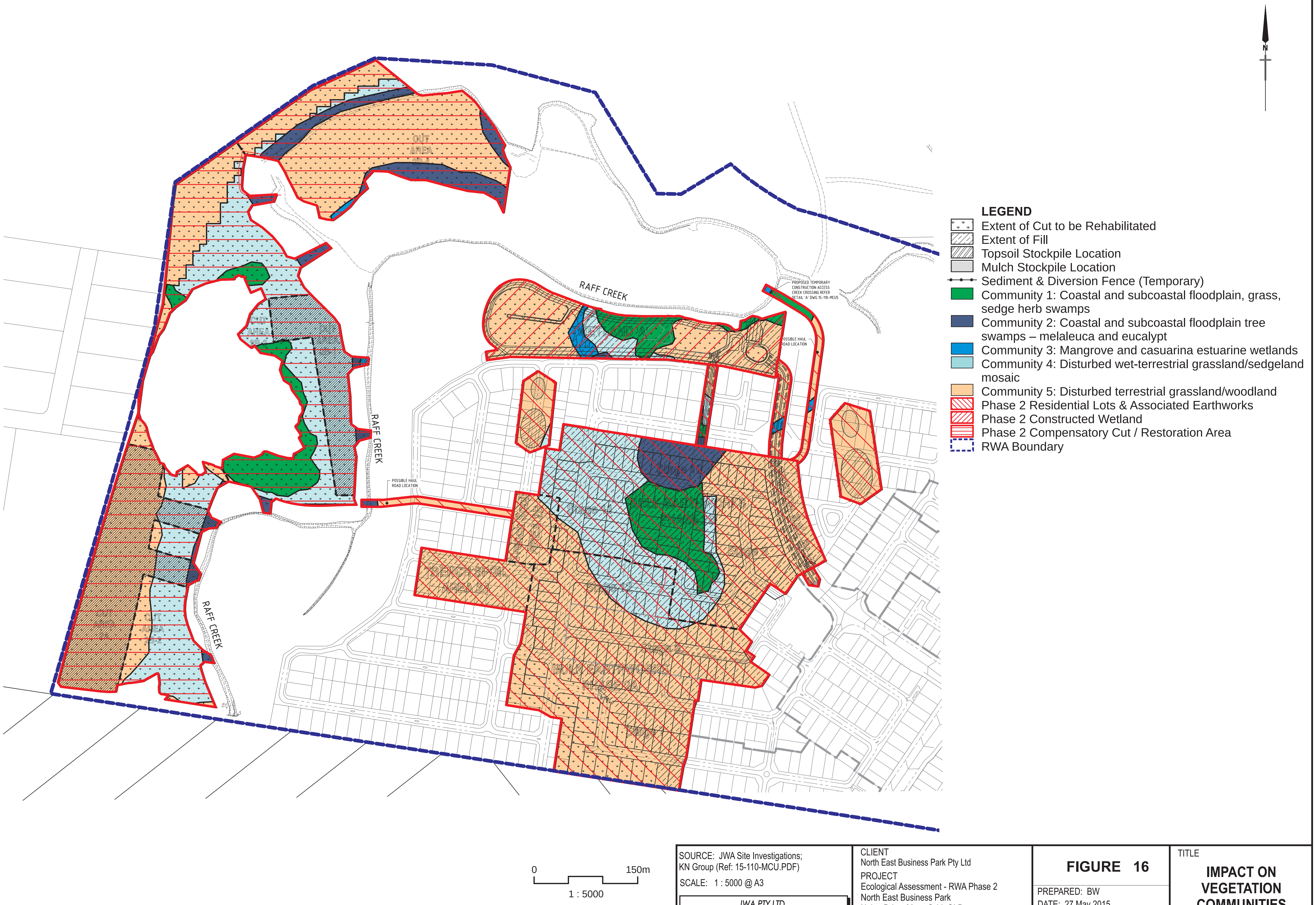
The proposed development will result in vegetation and habitat loss associated with the construction of the residential subdivision, the constructed wetland, the compensatory cut areas and other associated infrastructure. The impact of the proposed development on vegetation communities on the site is shown in **FIGURE 16**. The proposed development will result in the removal of approximately 15.6ha of native regrowth and remnant vegetation. The impacts of clearing on vegetation communities are provided in **TABLE 4**.

TABLE 4
IMPACTS OF CLEARING ON VEGETATION COMMUNITIES

Vegetation Community	Area to be Removed in Phase 2 (ha)
Community 1: Floodplain, grass, sedge herb swamps	3.0
Community 2: Floodplain tree swamps	2.0
Community 3: Mangrove and casuarina estuarine wetlands	0.3
Community 4: Disturbed wet-terrestrial grassland/sedgeland mosaic	10.3
Community 5: Disturbed terrestrial grassland	24.6

Additional impacts that may occur as a result of the removal of vegetation communities on the subject site are summarised as follows:

- Clearance of vegetation on the subject site will reduce the size and area of habitats available for the dispersal and recruitment of native flora species and may reduce dispersal and visits by pollinators which may negatively impact on the reproductive success of remaining flora in the area.
- Disturbance to the subject site will create opportunities for weeds to colonise both the site and adjacent vegetation. Weeds are likely to be introduced to the subject site and adjacent vegetation in construction materials or by vehicles. Weed numbers on site are also likely to increase due to dumping of garden waste, changes in the nutrient status of the soil and increased light penetration.
- Occupation of the subject site by future residents may create opportunities for ornamental and landscape garden plant species to disperse into adjacent areas of retained vegetation.
- The removal of vegetation from the subject site will result in a decrease in organic material and biomass on the site.



SOURCE: JWA Site Investigations; KN Group (Ref: 15-110-MCU.PDF) SCALE: 1 : 5000 @ A3 JWA PTY LTD Ecological Consultants	CLIENT North East Business Park Pty Ltd PROJECT Ecological Assessment - RWA Phase 2 North East Business Park Nolan Drive, Morayfield, QLD Moreton Bay Regional Council LGA	**FIGURE 16** PREPARED: BW DATE: 27 May 2015 FILE: Q15003_Impact Veg.cdr	TITLE **IMPACT ON VEGETATION COMMUNITIES**

- The removal of vegetation will disturb the soil structure and integrity which can reduce the health and longevity of adjacent areas of remaining vegetation and result in increased soil erosion which may cause sedimentation of watercourses.
- Clearing may result in injury, displacement and death to fauna.
- Clearing physically removes food sources, shelter and other habitat attributes that fauna use.
- Domestic dogs and cats prey on native fauna and may have significant impacts on the populations of native species. The proposed development may increase the rate by which non-native predators such as dogs and cats are introduced into habitats retained on the site or adjoining the site.
- Vegetation clearing may result in fragmentation of remaining habitat areas leads to reduced habitat connectivity and reduces dispersal opportunities for fauna and flora species.
- The proposed development will result in an increase in traffic on and to the subject site. This increases the likelihood of animals being killed or injured by vehicles. The establishment of infrastructure with people, noise and lighting can have important implications for the behaviour of fauna within retained vegetation (particularly nocturnal fauna) and may cause reclusive species to move away from habitat edges and will act as a deterrent on the movement of animals through the site.

5.2.2 Waterways and Wetlands

The Raff Creek anabranch watercourse is in a severely degraded condition with significant grazing impacts. Cattle have unrestricted access to this area and had trampled the creek banks and bank vegetation. Parts of this watercourse are to be filled in as part of the residential development and the constructed wetland. There will be significant impacts to the anabranch of Raff Creek with its complete removal and change of land levels resulting in a change of hydrology. A short section of the anabranch located between the development and the constructed wetland will become isolated (**FIGURE 13**). This may result in the drying out of this section of the creek as both ends of the anabranch will be cut and may in turn result in the change from wetland grasses and sedges to species that prefer drier areas.

Areas of Community 2 will be impacted by the construction of swale drains in the compensatory cut areas as part of stormwater management. These areas will be revegetated in future phases (JWA 2015).

The melon hole wetlands found in Communities 1 and 4 will be completely cleared and re-levelled within the residential development area and constructed wetland. Melon hole wetlands within the compensatory cut areas will be removed as fill is extracted from the area.

5.2.3 Koala Food and Habitat Trees

Koala food tree areas recorded within the residential development area and constructed wetland will be removed as a result of the proposed development. All koala habitat trees will also be removed.

Koala food and habitat trees located within the compensatory cut areas will be removed for the extraction of fill.

5.2.4 Threatened Flora

Three (3) threatened flora species were considered as possible occurrences given the habitat available on site. However, given the poor condition of the habitat due to previous the land use of pine plantations and grazing, it is unlikely that there will be any significant impacts to the habitat available for threatened flora due to the site development.

5.2.5 Threatened Fauna

The Koala has previously been identified on site (Section 2.3.1). However, no signs of Koalas were recorded during this site survey. The proposed development may have a minor impact on this species' potential habitat with the loss of 2 ha of regrowth riparian woodland along the Raff Creek.

The following threatened fauna are considered a possible or likely occurrence on site:

- Tusked frog (*Adelotus brevis*);
- Australian bittern (*Botaurus poiciloptilus*);
- Wallum froglet (*Crinia tinnula*);
- Red goshawk (*Erythrotriorchis radiatus*);
- Swift parrot (*Lathamus discolor*);
- Grey-headed flying-fox (*Pteropus poliocephalus*); and
- Australian painted snipe (*Rostratula australis*).

The Tusked frog, Australian bittern, Wallum froglet, and Australian painted snipe are wetland species and may be impacted by the loss of 2ha of riparian habitat. Occasional mature trees within the regrowth vegetation fringing the anabranch Raff Creek provide potential habitat for the Red goshawk, Swift parrot, and Grey-headed flying-fox. The proposed development will result in the loss of 2ha of suitable habitat for these species.

5.2.6 Remnant Vegetation

There is no remnant RE's or Essential Habitat mapped by DNRM on the site. Remnant vegetation was recorded during the site survey along Raff Creek. Community 1 is mostly remnant vegetation with the exception of the regrowth vegetation along the anabranches of Raff Creek. The first anabranch is in the residential development and constructed wetland areas, the second is the thin branch to the north of the main creek line within the compensatory cut area (north west corner of Phase 2).

Remnant vegetation will be cleared for swale drains along the edge of the compensatory cut areas for storm water management. Remnant vegetation will be avoided where practicable when collecting fill material. Any remnant vegetation cleared in the compensatory cut areas will be revegetated and rehabilitated in future phases (JWA 2015).

5.2.7 Corridors Values

There are no state or regional corridors mapped on the site. The waterway corridor along the Raff Creek anabranch that transects the northern portion of the residential development area and constructed wetland forms a degraded corridor connection to the major arm of Raff Creek. There is no remnant vegetation on this anabranch creek line

and the quality of the corridor is low. This waterway will be filled as part of the development removing this portion of the corridor.

Corridor habitat along Raff Creek will be cleared for swale drains along the edge of the compensatory cut areas for storm water management. This will have minimal impacts to the corridor habitat as the areas are small and do not dissect the corridor. These areas will be rehabilitated in future phases of the development.

5.3 Amelioration Strategies

5.3.1 Habitat Loss/Vegetation Clearing

The proposed development will result in the loss of 15.6ha of native vegetation. The rehabilitation of the RWA open space areas is discussed in the Raff Creek Restoration Concept Plan (JWA 2015). Individual restoration plans will be completed for each phase of the development. The following amelioration measures are recommended to be included:

- Any landscape plantings should utilise locally endemic native plant species.
- Weeds should be controlled during construction through vehicle, tool and plant hygiene measures.
- Weeds should be controlled in landscaped areas and known environmental weeds (e.g. Umbrella tree) should be avoided in landscape plantings.
- The use of appropriate fencing to allow fauna movement between vegetated areas and exclude fauna from hazardous areas should be incorporated into the detailed design.
- Landowners should control dogs and cats. All dogs should reside within fenced enclosures and be on a leash when outside of the enclosure.
- Appropriate disposal of rubbish and food scraps reduces opportunities for non-native predators and disturbance adapted competitors.
- The effects of light on adjoining vegetation could be managed by the capping of night lights to reduce glare into the sky and the careful positioning of lighting and use of screening vegetation.
- Appropriate flora and fauna management strategies including the use of a spotter-catcher and tree protection fencing should be implemented during site clearing operations to minimise potential adverse impacts on flora and fauna.
- Vegetation removed during construction should be mulched for use on the site. This will prevent the introduction of weeds from seeds in mulch brought in from elsewhere and will retain biomass that would otherwise be removed from the system.

5.3.2 Koala Food and Habitat Trees

Appropriate flora and fauna management strategies including the use of a spotter-catcher and tree protection fencing should be implemented during site clearing operations to minimise potential adverse impacts on flora and fauna. Where possible, large mature trees removed during construction should be kept whole or in large but manageable sections. These trees should be relocated to the open space precinct within the RWA to preserve their value as fauna habitat.

5.3.3 Waterways and Wetlands

The removal of the anabranch of Raff Creek will be compensated for by the preservation and rehabilitation of other areas of Raff Creek in future phases (see Raff Creek Restoration Concept Plan [JWA 2015]). Sediment and erosion control will be implemented to ensure ground works in Phase 2 do not impacts on the creek further downstream.

5.3.4 Corridors Values

The majority of Raff Creek corridor will be preserved and rehabilitated within the open space precinct during future phases of the NEBP development (JWA 2015). These areas support mature vegetation and Koala habitat. Rehabilitation efforts will include revegetation and weed control.

6 CONSIDERATION OF STATUTORY REQUIREMENTS

6.1 Introduction

This section includes assessments of the impacts of the proposed development with regard to the following Commonwealth, State and Local legislation:

- the Commonwealth *Environment Protection and Biodiversity Conservation Act (1999)*;
- the Queensland *Nature Conservation Act (1992)* and subordinate legislation;
- the Queensland *Vegetation Management Act (1999)*;
- the South-East Queensland Koala State Planning Regulatory Provisions (2010);
- the Queensland State Planning Policy 2/10: Koala Conservation in South East Queensland (2010);
- the Queensland Coastal Plan (2012); and
- the Caboolture Shire Plan 2005.

6.2 Commonwealth EPBC Act (1999)

6.2.1 Background

The *Environment Protection Biodiversity and Conservation (EPBC) Act (1999)* was passed by Commonwealth Parliament in June 1999 and came into force on 16 July 2000. A person must not, without an approval under the Act, take an action that has or will have, or is likely to have, a significant impact on a Matter of National Environmental Significance (MNES). These MNES are listed as follows:

- the world heritage values of a declared World Heritage property;
- the ecological character of a declared Ramsar wetland;
- a threatened species or endangered community listed under the Act;
- a migratory species listed under the Act; or
- the environment in a Commonwealth marine area or on Commonwealth land.

The Act also prohibits the taking, without an approval under the Act, of:

- a nuclear action; or
- an action in a Commonwealth marine area or on Commonwealth land that has or will have, or is likely to have, a significant impact on the environment.

MNES in Queensland are:

- declared World Heritage areas;
- declared Ramsar wetlands;
- listed threatened species (Schedule 1 and 2 of the Commonwealth Endangered Species Protection Act 1992);
- listed ecological communities; and
- listed migratory species (JAMBA and CAMBA).

An action includes a project, development, undertaking or an activity or series of activities. An action does not require approval if it is a lawful continuation of a use of

land, sea or seabed that was occurring before the commencement of the Act. An enlargement, expansion or intensification of a use is not a continuation of a use.

The *EPBC Act (1999)* does not require Commonwealth approval for the rezoning of land. It does, however, suggest that when rezoning land, planning authorities should consider whether to allow actions that could significantly affect NES matters or the environment of Commonwealth land.

A Commonwealth Assessment will be required for proposed activities on the subject site if they affect a MNES. The Commonwealth Department of the Environment has prepared *EPBC Act* Policy Statements, including the *EPBC Act* – Principal Significant Impact Guidelines 1.1 (2009) which provides a self-assessment process to assist in determining whether an action should be referred to the Commonwealth for a decision on whether assessment and approval is required under the Act. The proposed development has been considered against the Principal Significant Impact Guidelines for each of the MNES identified on the subject site. This assessment is provided in the following sections.

6.2.2 Declared World Heritage Areas On or Near the Site

There are no declared World Heritage areas on, or within 5km, of the subject site.

6.2.3 Declared Ramsar Wetlands On or Near the Site

6.2.3.1 Significant Impact Criteria

An action is likely to have a significant impact on the ecological character of a declared Ramsar wetland if there is a real chance or possibility that it will result in:

- areas of the wetland being destroyed or substantially modified;
- a substantial and measurable change in the hydrological regime of the wetland, for example, a substantial change to the volume, timing, duration and frequency of ground and surface water flows to and within the wetland;
- the habitat or lifecycle of native species, including invertebrate fauna and fish species, dependent upon the wetland being seriously affected;
- a substantial and measurable change in the water quality of the wetland, for example, a substantial change in the level of salinity, pollutants, or nutrients in the wetland, or water temperature which may adversely impact on biodiversity, ecological integrity, social amenity or human health; or
- an invasive species that is harmful to the ecological character of the wetland being established (or an existing invasive species being spread) in the wetland.

6.2.3.2 Site Assessment

Morton Bay Ramsar site (which includes the Caboolture River) is located within 1km of the site. Sediment and erosion control will be implemented to avoid any impacts to the Moreton Bay Ramsar site.

6.2.4 Commonwealth Listed Threatened Flora and Fauna Species

6.2.4.1 Significant Impact Criteria

An action is likely to have a significant impact on a Critically Endangered, Endangered or Vulnerable species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population;
- reduce the area of occupancy of the species;
- fragment an existing population into two or more populations;
- adversely affect habitat critical to the survival of a species;
- disrupt the breeding cycle of a population;
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;
- introduce disease that may cause the species to decline; or
- interfere with the recovery of the species.

A 'population of a species' is defined under the *EPBC Act* as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to a geographically distinct regional population, or collection of local populations, or a population, or collection of local populations that occur within a particular bioregion.

An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.

6.2.4.2 Site Assessment

No threatened flora or fauna species were located on subject site. Although a small area of wetland habitat will be disturbed during development, no significant impacts to threatened flora or fauna or their habitat is expected.

Habitat assessment determined that eight (8) EPBC listed threatened species are considered a possible or likely occurrence on site:

Flora

- *Phaius australis* (Lesser swamp-orchid); and
- *Acacia attenuata*.

Fauna

- Australian bittern (*Botaurus poiciloptilus*);
- Australian painted snipe (*Rostratula australis*);
- Grey-headed flying-fox (*Pteropus poliocephalus*);
- Koala (*Phascolarctos cinereus*);
- Red goshawk (*Erythrotriorchis radiatus*); and
- Swift parrot (*Lathamus discolor*).

6.2.5 Listed Ecological Communities

6.2.5.1 Significant Impact Criteria

An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:

- reduce the extent of an ecological community;
- fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines;
- adversely affect habitat critical to the survival of an ecological community;
- modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns;
- cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting; or
- cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:
  - assisting invasive species, that are harmful to the listed ecological community, to become established; or
  - causing regular mobilization of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community; or
  - interfere with the recovery of an ecological community.

6.2.5.2 Site Assessment

Database searches revealed that two (2) threatened Ecological Communities are known to occur within 5km of the subject site:

- lowland rainforest of subtropical Australia – critically endangered; and
- subtropical and temperate coastal saltmarsh – vulnerable.

Neither of these communities was recorded during the site assessment.

6.2.6 Listed Migratory Species On or Near the Site

6.2.6.1 Significant Impact Criteria

An action will require approval if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species. The significant impact criteria below are relevant to migratory species that are not threatened.

An action is likely to have a significant impact on a migratory species if there is a real chance or possibility that it will:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles; or
- altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species; or
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species; or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.

An area of 'important habitat' for a migratory species is:

- habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species; and/or
- habitat that is of critical importance to the species at particular life-cycle stages; and/or
- habitat utilized by a migratory species which is at the limit of the species range; and/or
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, the definition of what an 'ecologically significant proportion' of the population is varies with the species (each circumstance needs to be evaluated). Some factors that should be considered include the species' population status, genetic distinctiveness and species specific behavioural patterns (for example, site fidelity and dispersal rates).

The term 'population' in relation to migratory species, means the entire population or any geographically separate part of the population of any species or lower taxon of wild animals, a significant proportion of whose members cyclically and predictably cross one (1) or more national jurisdictional boundaries including Australia.

6.2.6.2 Site Assessment

Habitat assessment determined that fifteen (15) migratory species are considered a possible or likely occurrence on site:

- Common sandpiper (*Actitis hypoleucos*);
- Great egret (*Ardea alba*);
- Cattle egret (Ardea ibis);
- Sharp-tailed sandpiper (*Calidris acuminata*);
- Latham's snipe (*Gallinago hardwickii*);
- White-bellied sea-eagle (*Haliaeetus leucogaster*);
- White-throated needletail (*Hirundapus caudacutus*);
- Rainbow bee-eater (Merops ornatus);
- Spectacled monarch (*Monarcha trivirgatus*);
- Satin flycatcher (*Myiagra cyanoleuca*);
- Pacific golden plover (*Pluvialis fulva*);
- Grey plover (*Pluvialis squatarola*);
- Rufous fantail (*Rhipidura rufifrons*);
- Wood sandpiper (*Tringa glareola*); and
- Marsh sandpiper (*Tringa stagnatilis*).

The White-bellied sea-eagle and Latham's snipe were observed in the wider NEBP area during the site survey.

The proposed development will not have a significant impact on these migratory species due to the extensive availability of suitable habitat in the wider landscape, particularly along the Caboolture River. The removal of habitat will be ameliorated with the retention and rehabilitation of the remainder of Raff Creek.

6.2.7 Requirement for Commonwealth Referral

There is no requirement for Commonwealth referral. No offsets will be required under the Commonwealth *EPBC Act* Environmental Offsets Policy (2012).

6.3 Queensland Nature Conservation Act (1992) and Nature Conservation (Wildlife) Regulation (2006)

6.3.1 Background

The Queensland *Nature Conservation Act* (*NCA*, *1992*) details the management intent for listed flora and fauna species considered presumed Extinct, Endangered, Vulnerable, Near Threatened, Least Concern, International and Prohibited in Queensland. It discusses their significance and states the declared management intent and the principles to be observed in any taking and use for each group.

The proposed management intent for Endangered wildlife includes the following:

- to take action to ensure viable populations of the wildlife in the wild are preserved or re-established;
- to regularly monitor and review the status of Endangered wildlife and its habitat;
- to encourage scientific research and inventory programs likely to contribute to an understanding of Endangered wildlife and its habitat and management requirements;
- to recognize that the habitat of Endangered wildlife is likely to be a critical habitat or area of major interest; and
- to monitor and review the adequacy of environmental impact assessment procedures to ensure that they take into account the need to accurately assess the extent of the impact on Endangered wildlife and develop effective mitigation measures.

The proposed management intent for Vulnerable wildlife includes the following:

- to take action to ensure viable populations of the wildlife in the wild are reserved or established;
- to recognize that the conservation of the habitat of Vulnerable wildlife is critical to ensuring survival of that wildlife; and
- to monitor and review the adequacy of environmental impact assessment procedures to ensure that they take into account the need to accurately assess the extent of the impact on Vulnerable wildlife and develop effective mitigation measures.

The proposed management intent for Near Threatened wildlife includes the following:

- to regularly monitor and review the wildlife's conservation status and its habitat;
- to recognize the habitat of the wildlife as a potentially critical habitat or area of major interest; and
- to monitor and review the adequacy of environmental impact assessment procedures to ensure that they take into account the need to accurately assess the extent of the impact on Near Threatened wildlife and develop effective mitigation measures.

6.3.2 Site Assessment

6.3.2.1 Flora

No threatened flora species were located on site during the survey.

Twelve (12) threatened flora species listed under the *Nature Conservation (Wildlife) Regulation* (2006) are considered possible occurrences in the locality (as listed in **TABLE 1**). Three (3) of these were considered as *possible* occurrences in habitat within the subject site including:

- *Phaius australis (*Lesser swamp-orchid*)* – Endangered;
- *Lilaeopsis brisbanica* – Endangered; and
- *Acacia attenuata* – Vulnerable.

Suitable habitat for these three (3) species is provided by the vegetated watercourse associated with Raff Creek and its anabranches. However, as the impacts are mostly to the southern anabranch, and given the poor condition of vegetation on the anabranch it is unlikely that removing this anabranch of Raff Creek will have significant impacts on the habitat suitable for these threatened species. The future rehabilitation of the Raff Creek system will provide suitable habitat for these species.

6.3.2.2 Fauna

Six (6) fauna species listed under the *Nature Conservation (Wildlife) Regulation* (2006) are considered possible, likely, or known occurrences in habitat within the subject site including:

- Australian painted snipe (*Rostratula australis*) – Vulnerable;
- Swift parrot (*Lathamus discolor*) – Endangered;
- Wallum froglet (*Crinia tinnula*) – Vulnerable;
- Tusked frog (*Adelotus brevis*) - Vulnerable;
- Red goshawk (*Erythrotriorchis radiatus*) – Endangered; and
- Koala (*Phascolarctos cinereus*) - Vulnerable.

For the Tusked frog and Wallum froglet potential habitat is provided by the swamp regrowth vegetation associated with the anabranch of Raff Creek and adjacent grassland melon holes. Flood prone grassland with melon holes is located in the central portion of the site to the south of the Raff Creek anabranch. For the Red goshawk, suitable habitat is provided by the mature trees fringing Raff Creek anabranch. For the Koala, habitat is provided by mature *Eucalyptus, Lophostemon,* and *Melaleuca* tree species on site. Food trees are the *Eucalyptus tereticornis* and *E. robusta* trees on site.

These habitats have been degraded by historical agricultural land-use and it is considered that their removal will not have any significant impacts on threatened species. Habitat loss will be ameliorated with the retention and rehabilitation of the remainder of Raff Creek in future phases.

6.4 Queensland Vegetation Management Act (1999)

6.4.1 Background

The purpose of the *Vegetation Management Act (VMA, 1999)* is to regulate the broad scale clearing of vegetation on freehold land to preserve remnant Regional Ecosystems

(RE), vegetation in areas of high nature conservation value areas and areas vulnerable to land degradation. The *VMA (1999)* also ensures that clearing does not cause land degradation, maintains or increases biodiversity, maintains ecological processes and allows for ecologically sustainable land use. The *VMA (1999)* is currently supported by the State Policy for Vegetation Management (2013), which includes codes for the clearing of vegetation.

Approval is required under the *VMA (1999)* when clearing is to be undertaken within a declared area or within a remnant Regional Ecosystem, unless listed under Exemptions relating to the Act. A declared area is an area declared by the Minister to be of high conservation value or vulnerable to land degradation. Approvals to clear remnant vegetation on properties greater than 5 ha are managed by the State Assessment and Referral Agency (SARA). SARA coordinates the assessment of vegetation clearing applications which are considered against the State Development Assessment Provisions (SDAP).

The SDAP includes Module 8: Native Vegetation Clearing (2013) which uses certified mapping (DEHP mapping) to administer the *VMA*. Mapping includes:

- regulated vegetation management mapping for remnant vegetation and remnant vegetation associated with any natural watercourse or wetland;
- regional ecosystem (RE) mapping for Endangered REs and Of Concern REs;
- essential habitat (EH) mapping for habitat essential for threatened species; and
- referable wetlands mapping for waterway contributing to the Great Barrier Reef catchment.

Other categories assessed under module 8 include:

- clearing to maintain connectivity;
- clearing on acid sulphate soils;
- soil erosion; and
- salinity.

Property Maps of Assessable Vegetation (PMAVs) are a part of the framework of the *VMA*. They are property-scale maps that show the location, boundary and conservation status of vegetation. PMAVs are submitted by landholders and used to update DEHP's Regulated Vegetation mapping for determining the location of vegetation assessable under the *VMA*.

6.4.2 Assessable Vegetation on the Subject Site

6.4.2.1 Regulated Vegetation Management Mapping

There is no regulated vegetation mapped on the site.

6.4.2.2 Regional Ecosystems

There are no Regional Ecosystems mapped on the site.

6.4.2.3 Essential Habitat

There is no Essential Habitat mapped on the site.

6.4.2.4 Referable Wetlands

There are no referable wetlands mapped on the site.

6.4.2.5 Vegetation Clearing to Maintain Connectivity

No impacts to connectivity are expected as no areas of vegetation will be left isolated without connections.

6.4.2.6 Vegetation Clearing on Acid Sulphate Soils

A portion of the site is located within Land zone 3. A significant proportion of the site is below the 5m Australian Height Datum (AHD).

Under SDAP module 8 clearing in Land zone 3 in areas below the 5m AHD can only occur where:

- it does not involve mechanical clearing; and
- the acid sulphate soils (ASS) management is consistent with the *State Planning Policy*, and with the *Soil Management Guidelines in the Queensland Acid Sulfate Soil Technical Manual* (DNRM 2002).

While no signs of active acid sulphate soils were noted during the site survey it was not within the scope of this study to assess the possibility of ASS on site. It is recommended that an assessment by a qualified person is made prior to the start of clearing works on site.

6.4.2.7 Soil Erosion

No active erosion was recorded on the site during the survey except that induced by cattle along waterway edges. The land is slightly undulating. There was a spoil dump in the southeast corner of the site that had erosion on its batters. Erosion control was in place. Any on site works will be undertaken in accordance with a sediment and erosion control plan which avoids and minimises land degradation.

6.4.2.8 Salinity

Salt scolds were present along the southern anabranch. However, this is most likely due to an extreme high tide event and not due to land based salinity.

6.5 South East Queensland Koala Conservation State Planning Regulatory Provisions (2010)

6.5.1 Background

The South East Queensland Koala Conservation State Planning Regulatory Provisions (2010) (Koala SPRP) came into effect in May 2010. The regulatory provisions apply to assessable development within the South East Queensland Koala Protection Area (SEQKPA) where Koalas are identified as most at risk – i.e. the Koala Coast and Pine Rivers areas. The Koala SPRP outlines requirements for development within the SEQKPA in order to minimize the impacts of development on Koala populations.

6.5.2 Applicability to the Subject Site

The site is located outside SPRP Koala Assessable Development Area. The *South East Queensland Koala Conservation State Planning Regulatory Provisions* does not apply to this site.

6.6 State Planning Policy 2/10: Koala Conservation in South East Queensland

6.6.1 Background

The State Planning Policy 2/10: Koala Conservation in South East Queensland (Koala SPP) came into effect on 31 May 2010. The Koala SPP complements the South East Queensland Koala Conservation State Planning Regulatory Provisions (2010) and provides direction to local governments when making or amending their planning schemes, as well as for other land allocation processes such as master planning/structure planning processes, and community infrastructure designations. The Koala SPP significantly expands the area within South East Queensland that must incorporate Koala conservation and habitat protection outcomes into planning decisions. The Koala SPP applies to the seven eastern local government areas of South East Queensland: Sunshine Coast Regional Council, Moreton Bay Regional Council, Brisbane City Council, Redland City Council, Ipswich City Council, Logan City Council and Gold Coast City Council.

The Koala SPP contains Koala Habitat Values maps that apply to the seven eastern local government areas. The Koala Habitat Values mapping identifies areas of bushland habitat, areas suitable for rehabilitation and other areas of value.

6.6.2 Applicability to the Subject Site

The SPP Koala habitat mapping shows the site to be generally unsuitable for Koalas (**FIGURE 9**).

6.7 The Queensland Coastal Plan (2012)

6.7.1 Background

The Coastal Management Plan is prepared under the *Coastal Protection and Management Act 1995* (*Coastal Act*) to describe how the coastal zone of Queensland is to be managed. The objects of the *Coastal Act* related to coastal management are to:

- provide for the protection, conservation, rehabilitation and management of the coastal zone, including its resources and biological diversity; and
- encourage the enhancement of knowledge of coastal resources and the effect of human activities on the coastal zone.

This plan provides direction and guidance for use of Queensland's coastal resources to achieve coastal management outcomes. Queensland Coastal Hazard Areas maps show areas vulnerable to coastal erosion or storm tide inundation.

Coastal development is assessed by SARA under the State Development Assessment Provisions module 10: Coastal Protection.

6.7.2 Site Assessment

The site is located just within the coastal management district. It is mapped as "Storm Tide Inundation Area - Medium hazard area (less than 1.0m water depth)" (**FIGURE 11**). The presence of salt scalds along the southern Raff Creek anabranch supports this assessment. This development will be assessed under module 10: Coastal Protection. A small area (0.3ha) of estuarine vegetation (e.g. mangroves) is located along the southern anabranch within the constructed wetland and associated infrastructure footprint.

6.8 Caboolture Shire Plan 2005

6.8.1 Background

The Caboolture Shire Plan (2005) was prepared in accordance with the requirements of the *Integrated Planning Act 1997* which requires Councils to have a planning scheme that is prepared in accordance with the provisions of the Act. The 2005 Planning Scheme was applicable from the 12th December 2005 to May 2015.

The Caboolture Shire Plan 2005:

- identifies land in zones and precincts;
- maps land use constraints such as landslide hazard in the form of overlays;
- states what can and cannot be undertaken within each zone, precinct and overlay; and
- sets outcomes that development must meet within each zone, precinct and overlay.

6.8.2 Zoning

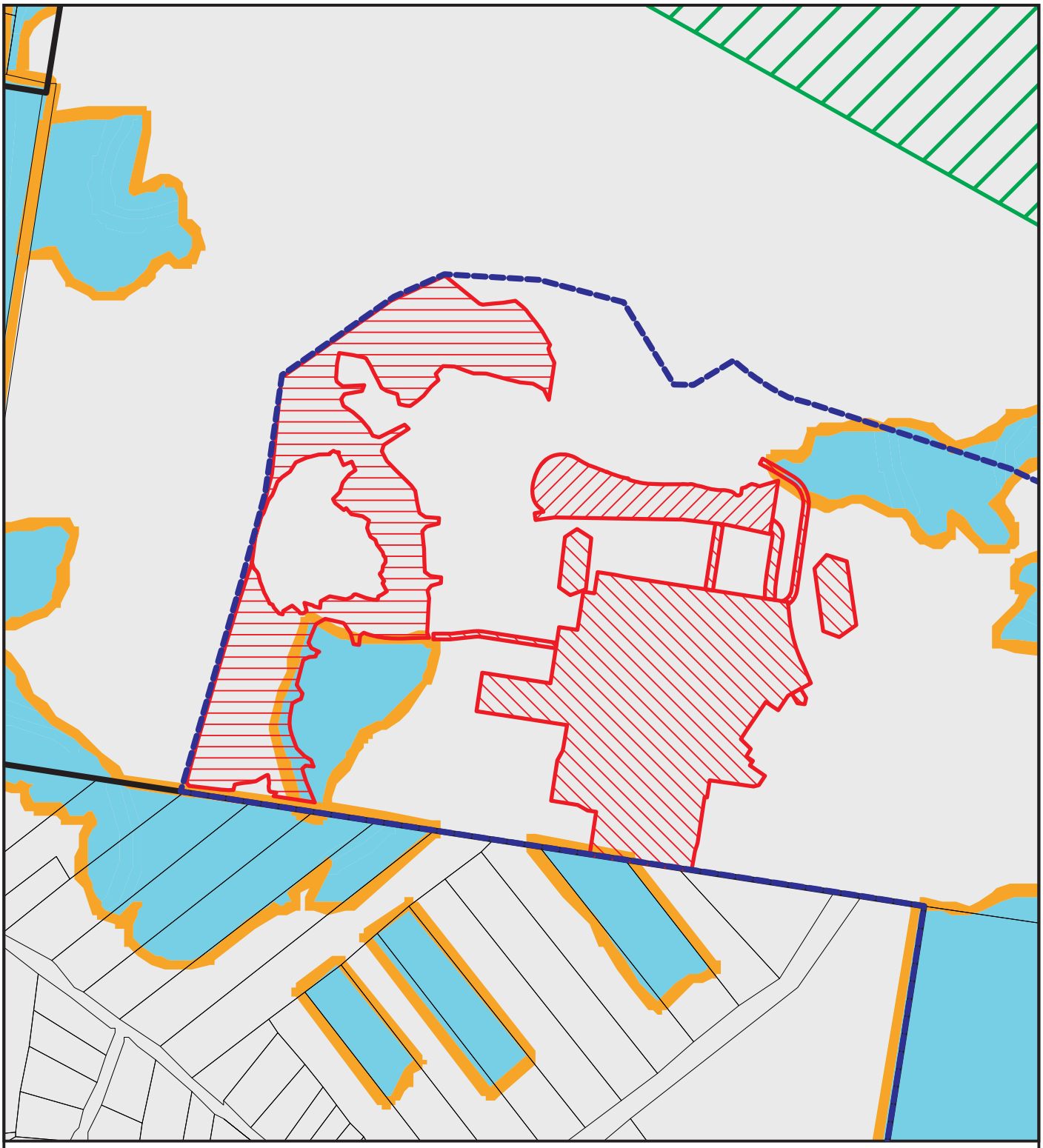
Under the Caboolture Shire Plan 2005, the site is located within the Central planning area and is zoned as Distinct Industry (**FIGURE 3**).

6.8.3 Nature Conservation Overlay Code

The site is mapped as containing areas of 'Biodiversity Significance' under the nature conservation overlay map (CO10) (**FIGURE 17**). In total 0.6ha of mapped Biodiversity Significance and 1.0ha of 20m buffer will be impacted by the development (**FIGURE 18**). The proposed development is therefore assessable under the nature conservation overlay code. An assessment of the proposed development against the code is provided in **APPENDIX 3**.

Areas of mapped as Biodiversity Significance align roughly with the remnant vegetation on the RWA. However, the mapping is not very accurate and covers areas of cleared wetland and pasture areas as well.

It is considered that the proposed development largely complies with the overall intent of the nature conservation overlay code. Rehabilitation of the compensatory cut areas will provide open space areas able to buffer the remnant vegetation from development areas.



Legend

- Biodiversity Significance
- 20m Buffer
- Ecological Corridors
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: Caboolture Shire Plan - Central Planning Areas Overlay Map CO10 Nature Conservation

SCALE: 1 : 10 000 @ A4

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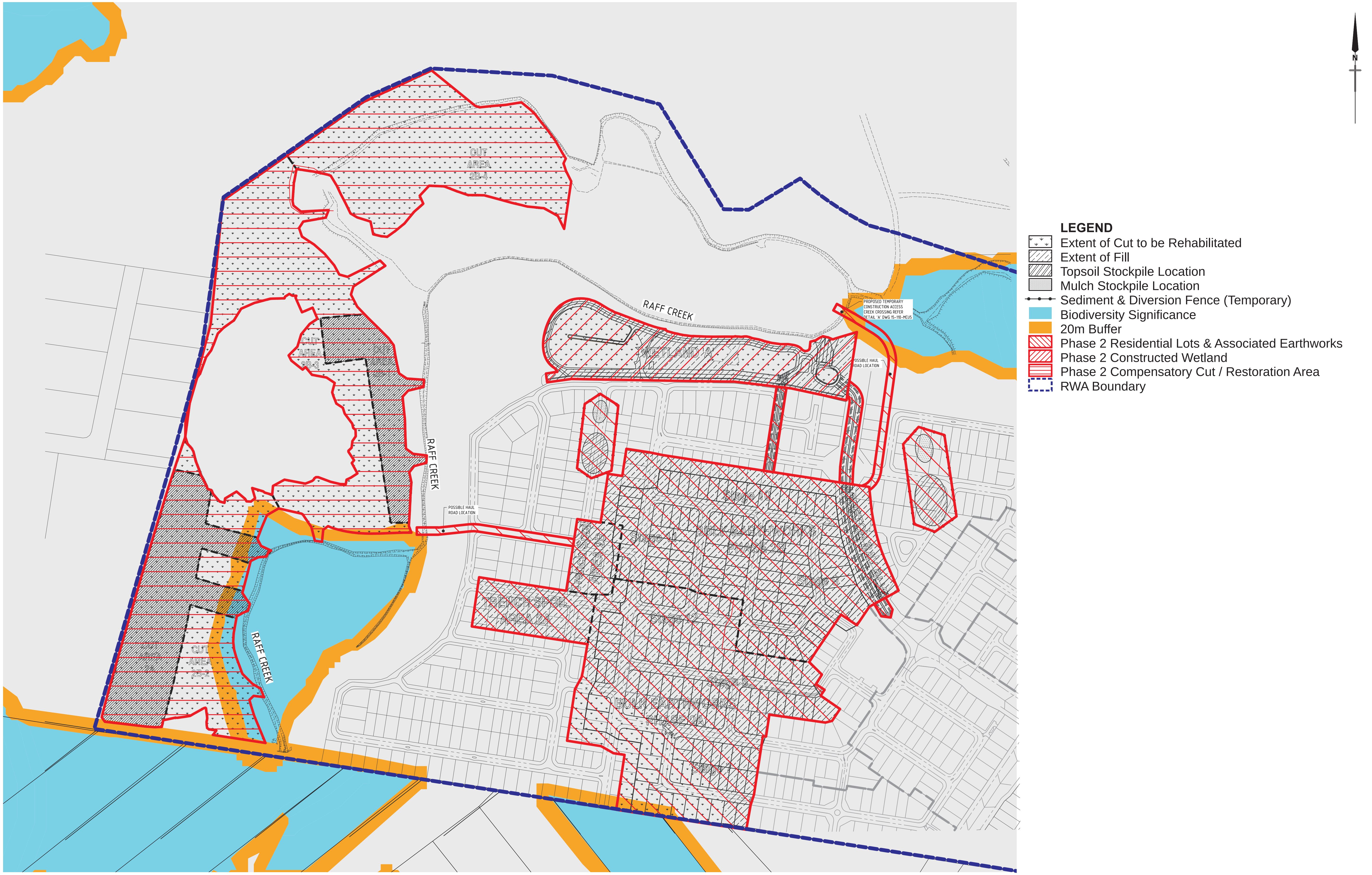
FIGURE 17

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Council Co10 (2).cdr

TITLE

NATURE CONSERVATION OVERLAY MAP



0 150m
1 : 5000

SOURCE: KN Group (Ref: 15-110-MCU.PDF); Caboolture Shire Plan - Central Planning Areas Overlay Map CO10 Nature Conservation
SCALE: 1 : 5000 @ A3

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FIGURE 18

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Impact CO10.cdr

TITLE
IMPACT ON NATURE CONSERVATION OVERLAY MAP

6.8.4 Catchment Protection Overlay Code

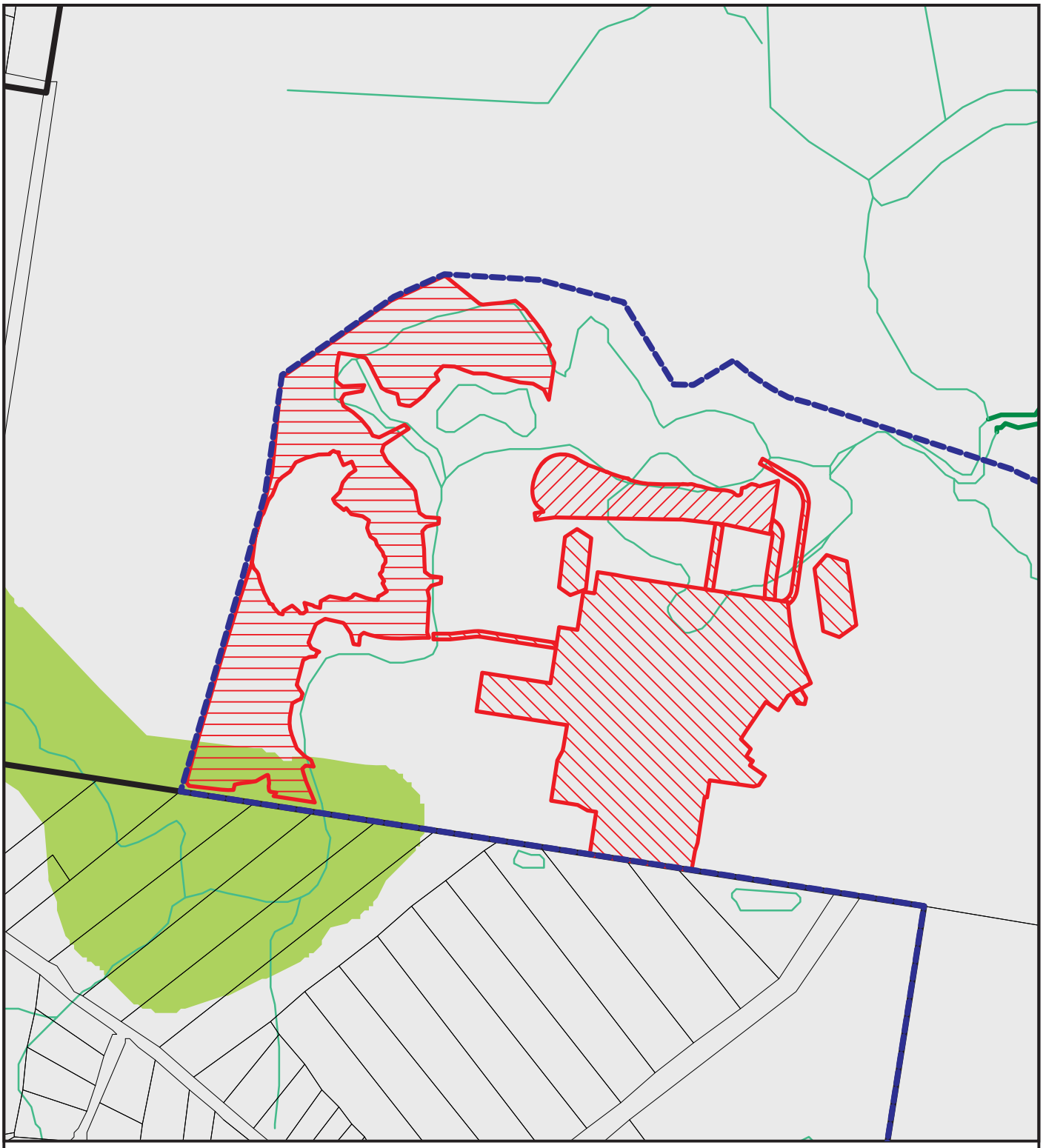
The subject site is mapped under the catchment protection overlay map (CO3) as containing 'Catchment Protection Minor Waterway' and a 'Wetland Protection Area' (**FIGURE 19**).

The development will result in the loss of 1.1km of Catchment Protection Minor Waterway and 1.5ha of Wetland Protection Area (**FIGURE 20**). The proposed development is therefore assessable under the catchment protection overlay code. An assessment of the proposed development against the catchment protection overlay code is provided in **APPENDIX 4**.

It is considered that the proposed development largely complies with the overall intent of the catchment protection overlay code. Although the development will result in significant disturbance of the Raff Creek anabranch the majority of Raff Creek will be rehabilitated to provide koala habitat, improved corridor connections and an environmental gain within the RWA.

6.8.5 Koala Conservation Overlay Code

The subject site is not mapped under the Koala conservation overlay map (CO8). Assessment against this code is therefore not required.



Legend

- Catchment Protection Minor Waterway
- Catchment Protection Major Waterway
- Wetland Protection Area
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary
- NEBP Boundary

N

0 300m

SOURCE: Caboolture Shire Plan - Central Planning Areas Overlay Map CO3 Catchment Protection

SCALE: 1 : 10 000 @ A4

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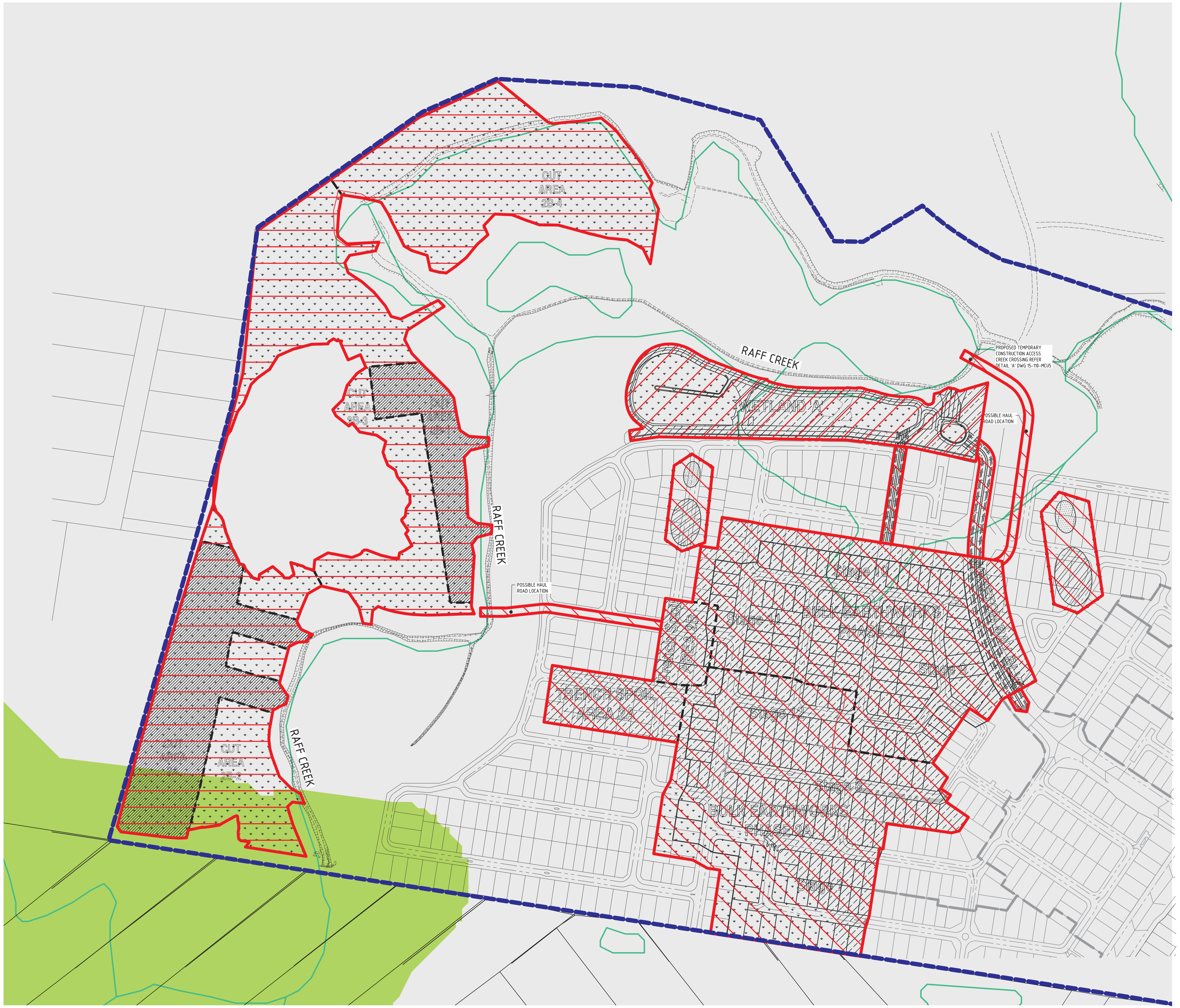
FIGURE 19

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Council Co3 (2).cdr

TITLE

CATCHMENT PROTECTION OVERLAY MAP



LEGEND

- Extent of Cut to be Rehabilitated
- Extent of Fill
- Topsoil Stockpile Location
- Mulch Stockpile Location
- Sediment & Diversion Fence (Temporary)
- Catchment Protection Minor Waterway
- Wetland Protection Area
- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary

0 150m
1 : 5000

SOURCE: KN Group (Ref: 15-110-MCU.PDF); Caboolture Shire Plan - Central Planning Areas Overlay Map CO3 Catchment Protection
SCALE: 1 : 5000 @ A3

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FIGURE 20

PREPARED: BW
DATE: 27 May 2015
FILE: Q15003_Impact C03.cdr

TITLE
IMPACT ON CATCHMENT PROTECTION OVERLAY MAP

7 SUMMARY AND CONCLUSIONS

JWA Pty Ltd has been engaged by North East Business Park to complete an ecological assessment of Phase 2 of the North East Business Park (NEBP) Residential West Area (RWA). The ecological assessment will be used for a Reconfiguring a Lot (RoL) application for Phase 2 of the RWA.

Database searches using the Commonwealth PMST identified eleven (11) threatened flora species and thirty-nine (39) threatened fauna species that may occur within 5km of the subject site based on the availability of suitable habitat in the locality. The DEHP Wildlife Online database indicated that two (2) threatened flora species and eight (8) threatened fauna species have been recorded from within 5km of the subject site. The habitat requirements of these species were assessed against the habitat available on site. Eleven (11) threatened species were determined to have the potential to be present within the subject site given the habitat available, including:

Flora species:

- *Phaius australis* (Lesser swamp-orchid*);*
- *Lilaeopsis brisbanica;* and
- *Acacia attenuata.*

Fauna species:

- Tusked frog (*Adelotus brevis*);
- Australian bittern (*Botaurus poiciloptilus*);
- Wallum froglet (*Crinia tinnula*);
- Red goshawk (*Erythrotriorchis radiatus*);
- Swift parrot (*Lathamus discolor*);
- Koala (*Phascolarctos cinereus*);
- Grey-headed flying-fox (*Pteropus poliocephalus*); and
- Australian painted snipe (*Rostratula australis*).

Environmental mapping showed no areas of state or local environmental significance on the site with the exception of DEHP Coastal Hazard Mapping, DSDIP MSES Mapping and mapping associated with the Caboolture Shire Plan 2005. DEHP Coastal Hazard Mapping showed areas of Storm 'Tide Inundation Area - Medium hazard area (less than 1.0m water depth)'. The MSES mapping showed regulated vegetation intersecting a watercourse. The Caboolture Shire Plan 2005 - catchment protection overlay map showed a 'Catchment Protection Minor Waterway' and a 'Wetland Protection Area', and the Caboolture Shire Plan 2005 – nature conservation overlay map showed areas of 'Biodiversity Significance'.

No threatened species were recorded on the site during the survey. The site survey found remnant vegetation along Raff creek. The survey recorded areas of salt scalds near the anabranch of Raff Creek suggesting that extreme storm tides may reach the site. The quality of the waterway corridor is considered to be good along the main track of Raff creek with low quality corridor habitat along the anabranches.

Impacts to the site from the proposed development of a residential subdivision and a constructed wetland will include filling in the flood prone grasslands with melon hole wetlands and filling in the anabranch of Raff Creek including the removal of its associated regrowth vegetation community. Impacts to the site from the proposed compensatory cut areas will include clearing small amounts of remnant vegetation for swale drains for stormwater management and clearing areas of melon hole wetlands. This development

will result in impacts to 15.6ha of native regrowth and remnant vegetation, 1.1km of 'Catchment Protection Minor Waterway', 1.5ha of Wetland Protection Area, 0.6ha of 'Biodiversity Significance' areas and 11.8ha of 'Tide Inundation Area'. These impacts will be managed and mitigated through the design and management of the development and the rehabilitation of Raff Creek in future phases.

Due to the degraded nature of the majority of the Phase 2 site it is expected that the proposed development will have minimal impacts to the environment within the RWA and that the rehabilitation of Raff Creek in future phases will result in positive environmental gains.

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APPENDIX 1 - SURVEY SITE DATA

ASSESSMENT SITE 1

Assessment site	1
Vegetation Assessment level	Quaternary
Survey point (zone 56)	E499022.842, N7000758.538
Aspect	flat
Slope (%)	0
Geology	flood plain
Soil type	Earth/Organic, clayey earth
Soil colour	dark brown
Declared Weeds	broad leaved pepper tree, lantana,
Erosion	nil
Grazing impacts	Occasional,
Fire history	> 10 year
Hydrology indicators	Flood debris, flood staining,
Fauna habitat	channel appears artificial cut
General notes	Possible salt water influence, channel only

Strata	Dominant Species	Height	FPC%
Canopy T1	Eucalyptus tereticornis	16	15
T2	Casuarina glauca, Melaleuca quinquenervia, Acacia concurrens	10	35

Shrubs	Melaleuca quinquenervia, Lantana camara, Parsonsia straminea, Acrostichum aureum	2	20
Ground cover	Cyperus polystachyos, Imperata cylindrica, Phragmites australis, Fimbristylis ferruginea	0.3	90
Level of disturbance	Not significant		

ASSESSMENT SITE 2

Assessment site	2
Vegetation Assessment level	Veg confirmation
Survey point (zone 56)	E498675.069, N7000821.903
Hydrology indicators	Inundated areas
Fauna habitat	Koala scats
General notes	-
Vegetation	Paperbark forest, Melaleuca quinquenervia, Eucalyptus tereticornis
Level of disturbance	Not significant

ASSESSMENT SITE 3

Assessment site	**3**		
Vegetation Assessment level	Tertiary		
Survey point start (zone 56)	E498897 N7000932		
Survey point finish	E498940 N7000909		
Baring of transect	w-e		
Aspect	flat top small rise		
Slope (%)	0		
Geology	small rise		
Soil type	Clay-red cracking clay		
Soil colour	red		
Declared Weeds	lantana		
Erosion	Tunnel, Minor, holes		
Grazing impacts	Moderate, trampling		
Fire history	> 10 year		
Hydrology indicators	No hydrology indicators		
Fauna habitat	-		
General notes	Not a wetland		
Strata	**Dominant Species**	**Height**	**FPC%**
Canopy T1	0	0	0
T2	0	0	0
Shrubs	Pteridium esculentum, Gomphocarpus physocarpus, Breynia oblongifolia, Lophostemon sauveolens	1	30
Ground cover	Imperata cylindrica, Poaceae sp. , Cynodon dactylon, Paspalum sp., Sporobolus sp.	0.2	Veg 96% Litter 1% Bare 3%
Basal Count Species	**Count**		
0	0		
Level of disturbance	Significant		

ASSESSMENT SITE 4

Assessment site	**4**		
Vegetation Assessment level	Quaternary		
Survey point (zone 56)	E498464.138, N7000277.361		
Aspect	east		
Slope (%)	2		
Geology	marine sediments		
Soil type	Clay, sandy clay		
Soil colour	grey		
Declared Weeds	0		
Erosion	nil		
Grazing impacts	Moderate,		
Fire history	> 10 year		
Hydrology indicators	Melon holes		
Fauna habitat	melon holes		
General notes	-		
Strata	**Dominant Species**	**Height**	**FPC%**
Canopy T1	0	0	0
T2	0	0	0
Shrubs	Melaleuca quinquenervia, Gomphocarpus physocarpus, Leptospermum sp.	1	30
Ground cover	Cyperus polystachyos, Poaceae spp., Imperata cylindrica	0.3	0
Level of disturbance	Significant		

ASSESSMENT SITE 5

Assessment site	**5**
Vegetation Assessment level	Tertiary
Survey point start (zone 56)	E498529 N7000282
Survey point finish	E498533 N7000237
Baring of transect	n-s
Aspect	flat
Slope (%)	0
Geology	wetland/watercourse
Soil type	Earth/Organic-silty earth
Soil colour	brown
Declared Weeds	0
Erosion	Sheet, Minor, flood
Grazing impacts	Occasional,
Fire history	> 10 year
Hydrology indicators	Inundated areas, swamp hummocks, flood carried debris, flood staining
Fauna habitat	watercourse, standing water
General notes	vc2, vc5,

Strata	**Dominant Species**	**Height**	**FPC%**
Canopy T1	Melaleuca quinquenervia, Eucalyptus tereticornis	15	84
T2	Melaleuca quinquenervia, Lophostemon sauveolens, Eucalyptus tereticornis, Melaleuca linariifolia,	8	40
Shrubs	Acacia sp., Melaleuca quinquenervia,	3	5
Ground cover	Centella asiatica, Sida rhombifolia, paspalum sp., Gahnia sieberiana, Tradescantia fluminensis	0.3	Veg 27% Litter 47% Bare 31.4%

Basal Count Species	**Count**
Melaleuca quinquenervia	51
Eucalyptus tereticornis	2
Level of disturbance	Not significant

ASSESSMENT SITE 6

Assessment site	**6**		
Vegetation Assessment level	Quaternary		
Survey point (zone 56)	E498567.827, N7000485.871		
Aspect	flat		
Slope (%)	0		
Geology	wetland, standing water		
Soil type	Earth/Organic, clayey earth		
Soil colour	dark brown		
Declared Weeds	0		
Erosion	nil		
Grazing impacts	Occasional, trampling, grazing		
Fire history	> 10 year		
Hydrology indicators	Inundated areas, melon holes		
Fauna habitat	standing water, melon holes		
General notes	-		
Strata	**Dominant Species**	**Height**	**FPC%**
Canopy T1	0	0	0
T2	0	0	0
Shrubs	Melaleuca quinquenervia, Melaleuca linariifolia, Melaleuca thymifolia	2	20
Ground cover	Cyperus haspan, Fimbristylis ferruginea, Fimbristylis autumnalis, Fimbristylis miliacea, Fuirena sp., Juncus spp., Fimbristylis miliacea	0.5	95
Level of disturbance	Significant		

ASSESSMENT SITE 7

Assessment site	7
Vegetation Assessment level	Veg confirmation
Survey point (zone 56)	E499314.144, N7000608.403
Hydrology indicators	melon holes <50%
Fauna habitat	0
General notes	Not a wetland
Vegetation	Grassland with occasional sedge patches
Level of disturbance	Significant

ASSESSMENT SITE 8

Assessment site	**8**		
Vegetation Assessment level	Quaternary		
Survey point (zone 56)	E498909.92, N7000617.686		
Aspect	flat		
Slope (%)	0		
Geology	flood plain		
Soil type	Clay, med clay		
Soil colour	dark brown		
Declared Weeds	0		
Erosion	nil		
Grazing impacts	Moderate, trampling		
Fire history	> 10 year		
Hydrology indicators	melon holes <50%		
Fauna habitat	swales, no standing water		
General notes	Not a wetland		
Strata	**Dominant Species**	**Height**	**FPC%**
Canopy T1	0	0	0
T2	0	0	0
Shrubs	Melaleuca quinquenervia, Lantana camara, Eucalyptus sp., Acacia sp., Leptospermum sp.	1	2
Ground cover	Cyperus polystachyos, Sporobolus sp., paspalum sp., convolvulus sp., Cynodon dactylon, Imperata cylindrica	0.2	90
Level of disturbance	Significant		

ASSESSMENT SITE 9

Assessment Site	**9**
Assessment Level	Quaternary
Survey Point	56J 499277 7000451
Aspect	flat
Slope (%)	flat
Geology	Creek bank
Soil	Medium brown clay
Declared Weeds	Broad-leaved pepper tree, lantana, groundsel bush
Erosion	Bank erosion, cattle watering point
Grazing Impacts	Heavy grazing
Fire History	>10
Fauna Habitat	Shallow water with emergent vegetation, salt affected, no logs/hollows/rocks
General Notes	Signs of salinity, salt scalds
Ground Truthed Regional Ecosystem	**Regrowth vegetation (not RE)**

Strata	**Dominant Species**	**Height (m)**	**FPC%**
Emergent	*Eucalyptus tereticornis*	20	<1%
Canopy T1	*Melaleuca quinquenervia, , E. robusta*	12	5%
T2	-		
Shrubs	*Melaleuca quinquenervia, Eucalyptus spp. Lantana camara*, Schinus terebinthifolius**	1	5%
Ground Cover	*Cyperus polystachyos, Fimbristylis spp. Sporobolus virginicus, Baccharis halimifolia*, Imperata cylindrica, Blechnum indicum, Paspalum* sp*.	0-0.5	50% Veg 5% litter 45% bare ground

ASSESSMENT SITE 10

Assessment Site	**10**
Assessment Level	Quaternary
Survey Point	56J 499186 7000286
Aspect	flat
Slope (%)	flat
Geology	Flood plain
Soil	light brown clay
Declared Weeds	Possible rats tail grass
Erosion	nil
Grazing Impacts	moderate grazing
Fire History	>10
Fauna Habitat	Large paddock tree (Koala food tree), melon holes
General Notes	-
Ground Truthed Regional Ecosystem	**Pasture (not RE)**

Strata	**Dominant Species**	**Height (m)**	**FPC%**
Emergent	*Eucalyptus tereticornis*	20	<1%
Canopy T1	-		
T2	-		
Shrubs	*Acacia leiocalyx, Eucalyptus spp., Lophostemon sp. Leptospermum sp.*	0.5-1	15%
Ground Cover	*Cyperus polystachyos, Murdannia graminea, Tricoryne elatior, Triglochin procera, Lepidium sp.*, Sporobolus sp.*, Imperata cylindrica, Paspalum* sp*.	0-0.5	90% Veg 0% litter 10% bare ground

ASSESSMENT SITE 11

Assessment Site	**11**
Assessment Level	Quaternary
Survey Point	56J 499127 7000192
Aspect	North
Slope (%)	2%
Geology	Bottom of low hill
Soil	mid brown clay
Declared Weeds	-
Erosion	nil
Grazing Impacts	moderate grazing
Fire History	>10
Fauna Habitat	Melon holes
General Notes	Deep sewer construction underway
Ground Truthed Regional Ecosystem	**Pasture (not RE)**

Strata	**Dominant Species**	**Height (m)**	**FPC%**
Canopy T1	-		
T2	-		
Shrubs	*Acacia leiocalyx, Melaleuca quinquenervia, Lophostemon sp.*	0.5-1	10%
Ground Cover	*Cyperus polystachyos, Xyris complanata, Paspalum* sp*.	0-0.5	95% Veg 0% litter 5% bare ground

ASSESSMENT SITE 12

Assessment Site	**12**
Assessment Level	Quaternary
Survey Point	56J 499102 7000047
Aspect	North
Slope (%)	5%
Geology	Middle of low hill
Soil	mid brown sandy clay
Declared Weeds	nil
Erosion	Batters of soil dump have rill erosion
Grazing Impacts	occasional grazing
Fire History	>10
Fauna Habitat	South of the site is remnant woodland
General Notes	Deep sewer construction underway
Ground Truthed Regional Ecosystem	**Pasture (not RE)**

Strata	**Dominant Species**	**Height (m)**	**FPC%**
Canopy T1	-		
T2	-		
Shrubs	*Acacia leiocalyx, Lophostemon sp.*	0.5-1	10%
Ground Cover	*Cyperus polystachyos, Xyris complanata, Paspalum* sp*. *Senna sp*. Fimbristylis sp.*	0-0.5	95% Veg 0% litter 5% bare ground

ASSESSMENT SITE 13

Assessment Site	**13**
Assessment Level	Quaternary
Survey Point	56J 499238 7000477
Aspect	flat
Slope (%)	flat
Geology	flood plain
Soil	Medium brown clay
Declared Weeds	Broad-leaf pepper tree
Erosion	Bank erosion, cattle watering point
Grazing Impacts	Heavy grazing
Fire History	>10
Fauna Habitat	Shallow water with emergent vegetation and tidal influence, small marine clay pan, 2 Koala food trees, fallen log
General Notes	Signs of salinity, salt scalds
Ground Truthed Regional Ecosystem	**Regrowth vegetation (not RE)**

Strata	**Dominant Species**	**Height (m)**	**FPC%**
Emergent	*Eucalyptus tereticornis*	18	<1%
Canopy T1	-	12	5%
T2	*Melaleuca quinquenervia*		
Shrubs	*Melaleuca quinquenervia, Schinus terebinthifolius**	1	30%
Ground Cover	*Cyperus polystachyos, Fimbristylis spp. Sporobolus virginicus, Imperata cylindrica, Blechnum indicum, Paspalum* sp*.	0-0.5	40% Veg 5% litter 55% bare ground

ASSESSMENT SITE 14

Assessment site	14
Vegetation Assessment level	Veg confirmation
Survey point (zone 56)	E499370, N7000675
Hydrology indicators	Melon holes
Fauna habitat	0
General notes	cattle disturbance
Vegetation	Sedgeland (>50%) with melon holes
Level of disturbance	Significant

ASSESSMENT SITE 15

Assessment site	15
Vegetation Assessment level	Veg confirmation
Survey point (zone 56)	E499485, N7000605
Hydrology indicators	creek line
Fauna habitat	0
General notes	cattle disturbance
Vegetation	Mangroves
Level of disturbance	Significant

APPENDIX 2 - HABITAT SUITABILITY ASSESSMENTS

HABITAT SUITABILITY ASSESSMENT FOR THREATENED FLORA SPECIES

Scientific Name	Common Name	Likelihood of Occurring on the Site
Acacia attenuata	-	**Possible**. Occurs on flat coastal lowland plains, at altitudes of lower than 30m above sea level. Typically found in seasonally waterlogged areas of wet heathland or heathland margins, open forest and woodland communities, and specifically on sandy poorly drained soils or peat swamps which are infertile (Dept. Environment 2012). Site contains poorly drained swampy areas.
Bosistoa selwynii	Heart-leaved bosistoa	**Unlikely.** Occurs in lowland subtropical rainforest up to 300m above sea level. In the gold coast hinterland it grows on reddish loam over basalt rock on a very steep slope in complex notophyll vine forest with emergent Brush Box (*Lophostemon confertus*). Associated canopy species include White Booyong, Soft Corkwood (*Caldcluvia paniculosa*), Rosewood (*Dysoxylum fraserianum*), Yellow Carabeen (*Sloanea woollsii*) and Giant Water Gum (*Syzygium francisii*). At Buderim, Queensland, it has been found in remnant vine forest pockets within highly disturbed and weed infested habitats on a site with varying slope, from relatively flat to a steep scree slope. The species appears to occur only in areas that have experienced minimal disturbance (Dept. Environment 2012). No rainforest areas on site.
Bosistoa transversa	Three-leaved bosistoa	**Unlikely.** Occurs in lowland subtropical rainforest up to 300m above sea level. In the gold coast hinterland it grows on reddish loam over basalt rock on a very steep slope in complex notophyll vine forest with emergent Brush Box (Lophostemon confertus). Associated canopy species include White Booyong, Soft Corkwood (*Caldcluvia paniculosa*), Rosewood (*Dysoxylum fraserianum*), Yellow Carabeen (*Sloanea woollsii*) and Giant Water Gum (*Syzygium francisii*). At Buderim, Queensland, it has been found in remnant vine forest pockets within highly disturbed and weed infested habitats on a site with varying slope, from relatively flat to a steep scree slope. The species appears to occur only in areas that have experienced minimal disturbance (Dept. Environment 2012). No rainforest areas on site.
Cryptocarya foetida	Stinking cryptocarya	**Unlikely.** Occurs in coastal sands, or close to the coast, occurring in littoral

Scientific Name	Common Name	Likelihood of Occurring on the Site
		rainforest on old sand dunes and subtropical rainforests over slate and occasionally on basalt to an altitude of 150 m. Associated species include *Syzygium hemilamprum* (Broad-leaved Lilly Pilly), *Acronychia imperforata* (Beach Acronychia*), Cryptocarya triplinervis* (Three-veined Laurel), *Cupaniopsis anacardioides* (Tuckeroo), *Flindersia bennettiana* (Bennet's Ash*), Lophostemon confertus* (Brush Box) and *Syzygium luehmannii* (Small-leaved Lilly Pilly). Distribution, Iluka on the north coast of New South Wales, to Fraser Island in Queensland (Dept. Environment 2012). No rainforest areas on site.
Cryptostylis hunteriana	Leafless tongue-orchid	**Unlikely.** This species occurs in a wide range of habitats including heathlands, healthy woodlands, sedgelands, *Xanthorrheoa* spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests (grassy sub-formation). Found in soils that are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils (Dept. Environment 2012). Soils on site are clay and not suitable.
Lilaeopsis brisbanica	-	**Possible.** Occurs along tidal riverbanks in grey saline mud, in association with mangrove trees. Although occurring naturally in areas near saline waters, fresh water is satisfactory for the growth of this species (DEHP 2013). The water is fresh but may sometimes be inundated with salt water at extreme tides. There are mangroves within Phase 2.
Macadamia ternifolia	Bopple nut	**Unlikely.** Occurs in lowland warm complex notophyll vine forest and *Araucarian* notophyll vine forest on basic and intermediate volcanic soils and alluvia in higher rainfall areas of south-east Queensland. This species generally occurs in south-facing gullies with fertile, basalt-derived krasnozem soils or the interface between sandstone and basalt krasnozems. Surface soils tend to be dark, of varying textures (sandy loams to light clays), slightly acid (pH 5.5–7.0) and well drained (Dept. Environment 2012). No rainforest areas on site.
Phaius australis	Lesser swamp-orchid	**Possible.** This species is associated with coastal wet heath/sedgeland wetlands, swampy grassland or swampy forest and often where broad-leaved paperbark (*Melaleuca leucadendra*) or Swamp Mahogany (*Eucalyptus robusta*) is found. Less commonly, this species has been found in drier forest near the coast (Dept. Environment 2012). There is swampy forest with broad-leaved paperbark along

Scientific Name	Common Name	Likelihood of Occurring on the Site
		the waterway.
Phaius bernaysii	-	**Unlikely.** Occurs along the margins between open forest/woodland and closed sedgeland, along the perimeter of a swamp, often in a fairly shady environment in *Melaleuca quinquenervia–Eucalyptus robusta* open forest in sandy or peaty soil. This species is currently known to occur only in one area on Stradbroke Island, near Myora in Queensland (Dept. Environment 2012). While the swamp type and species are correct the site is quite far inland and not sufficiently similar in climate to Stradbroke island.
Phebalium distans	My Berryman phebalium	**Unlikely.** Occurs in semi-evergreen vine thicket on red volcanic soils, or in communities adjacent to this vegetation type. Geology of the area in which this species occurs is deeply weathered basalt with undulating to hilly terrain. Soils range from red-brown earths to brown clays (derived from siltstone and mudstones), and lithosols to shallow, gravelly krasnozems (very dark brown loam). Vegetation associations in which Mt Berryman Phebalium occur include microphyll to notophyll vine forest with or without *Araucaria cunninghamii* and low microphyll vine forest and semi-evergreen vine thicket with or without *Araucaria cunninghamii*. Populations are known from near Mt Berryman, Kingaroy (Mt Jones Plateau and surrounds) and Mt Walla (Coalston Lakes) (Dept. Environment 2012). No vine thicket forests on site.
Streblus pendulinus	Siah's backbone	**Unlikely.** Occurs in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800m above sea level. This species grows in well-developed rainforest, gallery forest and drier, more seasonal rainforest (Dept. Environment 2012). No rainforest areas on site.
Thesium australe	Austral toadflax	**Unlikely.** Austral toadflax is semi-parasitic on roots of a range of grass species, notably Kangaroo Grass (*Themeda triandra*). It occurs in shrubland, grassland or woodland, often on damp sites, in subtropical, temperate and subalpine climates over a wide range of altitudes. It occurs on soils derived from sedimentary, igneous and metamorphic geology on a range of soils including black clay loams to yellow podzolics and peaty loams. Vegetation types include open grassy heath dominated by Swamp Myrtle (*Leptospermum myrtifolium*), Small-fruit Hakea (Hakea microcarpa), Alpine Bottlebrush (Callistemon sieberi), Woolly Grevillea (*Grevillea lanigera*), Coral Heath (*Epacris microphylla*) and Poa spp.; Kangaroo Grass grassland surrounded by Eucalyptus woodland; and

Scientific Name	Common Name	Likelihood of Occurring on the Site
		grassland dominated by Barbed-wire Grass (*Cymbopogon refractus*) (Dept. Environment 2012). None of the above species present.

HABITAT SUITABILITY ASSESSMENT FOR THREATENED FAUNA AND MIGRATORY SPECIES

Scientific Name	Common Name	Likelihood of Occurring on the Site
Actitis hypoleucos	Common sandpiper	**Possible**. This species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. This species has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and clay pans, and occasionally piers and jetties. This species generally forages in shallow water and on bare soft mud at the edges of wetlands; often where obstacles project from substrate, e.g. rocks or mangrove roots. Birds sometimes venture into grassy areas adjoining wetlands. Roost sites are typically on rocks or in roots or branches of vegetation, especially mangroves (Dept. Environment 2012). Suitable habitat for this species occurs along Raff Creek.
Adelotus brevis	Tusked frog	**Possible.** This species prefers rainforests, wet sclerophyll forests and grasslands. It is generally found under logs and leaf-litter along streams and dams (NSW OEH 2014). Suitable habitat for this species may occur along Raff Creek and adjacent flood prone pasture in the melon holes This species has been previously observed in the wider NEBP area.
Anthochaera phrygia	Regent honeyeater	**Unlikely**. The regent honeyeater is found from Dalby in Queensland, south to Bendigo in Victoria, especially along the ranges and the western slopes. However, its distribution is extremely patchy with only a small number of known breeding sites. The estimated total population is between 350 and 400 mature individuals. In south-east Queensland it is found ranging from Cooloola, Great Sandy National Park to near the Queensland-New South Wales border. In Queensland, breeding occurs regularly west of Warwick by a small number of individual regent honeyeaters. Potential habitat for this species includes dry eucalypt woodland and open forest, rural and urban areas with mature eucalypts. It favours ironbark-box associations, mugga ironbark *Eucalyptus sideroxylon*, white box (*E. albens*), and yellow box (E*. melliodora*). Other habitat includes swamp mahogany (*E. robusta*), or spotted gum (*Corymbia maculata*) or river she-oak (*Casuarina cunninghamiana*) with associated needle-leaf mistletoe (*Amyema cambagei*). This species generally prefers wetter, more fertile sites that are reliable nectar producers (both in timing and quantity),

Scientific Name	Common Name	Likelihood of Occurring on the Site
		such as creek flats, river valleys and lower slopes (NSW OEH 2014). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Ardea alba	Great egret	**Likely**. This species inhabits a wide range of wetland habitats including swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs. This species usually frequents shallow waters (Dept. Environment 2012). Suitable habitat for this species occurs throughout the subject site.
Ardea ibis	Cattle egret	**Likely**. This species inhabits tropical and temperate grasslands, wooded lands and terrestrial wetlands. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. This species often forages away from water on low lying grasslands, improved pastures and croplands. It is commonly found in cattle fields and other farm areas that contain livestock. This species roosts in trees or amongst ground vegetation in or near lakes and swamps (Dept. Environment 2012). Suitable habitat for this species occurs throughout the subject site.
Arenaria interpres	Ruddy turnstone	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species has not been observed on site.
Botaurus poiciloptilus	Australian bittern	**Possible**. This species occurs in terrestrial freshwater wetlands and, rarely, estuarine habitats. It favours wetlands with tall, dense vegetation, where it forages in still, shallow water up to 0.3m deep, often at the edges of pools or waterways, or from platforms or mats of vegetation over deep water. The species favours permanent and seasonal freshwater habitats, particularly those dominated by sedges, rushes and/or reeds (e.g. *Phragmites, Cyperus, Eleocharis, Juncus, Typha, Baumea, Bolboschoenus*) or cutting grass (*Gahnia*) growing over muddy or peaty substrate (Dept. Environment 2012). Suitable habitat for this species exists along Raff Creek.
Calidris acuminata	Sharp-tailed sandpiper	**Possible**. Suitable habitat for this species includes tidal mudflats, saltmarshes, mangroves, shallow fresh, brackish or saline inland wetlands, floodwaters,

Scientific Name	Common Name	Likelihood of Occurring on the Site
		irrigated pastures and crops, sewage ponds and salt fields (Dept. Environment 2012). Suitable habitat for this species exists along Raff Creek.
Calidris alba	Sanderling	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Calidris canutus	Red knot	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Calidris ferruginea	Curlew sandpiper	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Calidris ruficollis	Red-necked stint	**Unlikely**. Suitable habitat for this species includes tidal mudflats, saltmarshes, sandy or shelly beaches, saline and freshwater wetlands, coastal and inland, salt fields, and sewage ponds (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Calidris tenuirostris	Great knot	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Caretta caretta	Loggerhead turtle	**Unlikely**. This species occurs in marine habitats. It occurs in the waters of coral and rocky reefs, seagrass beds and muddy bays throughout eastern, northern and western Australia. Loggerhead turtles require sandy beaches to nest, with sand temperatures between 25–33°C are needed for successful incubation. Nesting populations are known from southern Queensland and Western Australia. The main nesting locations for Queensland are Mon Repos and Wreck Rock beaches

Scientific Name	Common Name	Likelihood of Occurring on the Site
		on the mainland; Wreck Island, Erskin Island, Tryon Island, Heron Island and Lady Musgrave Island in the Capricorn Bunker Group; and Price, Frigate, Thomas and Bacchi Cays in the Swain Reefs. Low density and sporadic nesting also occurs along the Sunshine Coast beaches and on the northern ends of Fraser, Moreton and North Stradbroke Islands and southwards into northern NSW (Dept. Environment 2012). It is considered that no suitable habitat for this species occurs on site. This species was not observed on site.
Chalinolobus dwyeri	Large-eared pied bat	**Unlikely**. This species requires a combination of sandstone cliff/escarpment to provide roosting habitat that is adjacent to higher fertility sites, particularly box gum woodlands or river/rainforest corridors which are used for foraging. Almost all records have been found within several kilometres of cliff lines or rocky terrain. Roosting has also been observed in disused mine shafts, caves, overhangs and disused Fairy Martin (*Hirundo ariel*) nests. It also possibly roosts in the hollows of trees. The structure of primary nursery roosts appears to be very specific, i.e. arch caves with dome roofs (that need to be deep enough to allow juvenile bats to learn to fly safely inside) and with indentations in the roof (presumably to allow the capture of heat). These physical characteristics are not very common in the landscape and therefore a limiting factor (Dept. Environment 2012). It is considered that no suitable habitat for this species occurs on site. This species was not observed on site.
Charadrius bicinctus	Double-banded plover	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Charadrius leschenaultii	Great sand plover	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Charadrius mongolus	Lesser sand plover	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this

Scientific Name	Common Name	Likelihood of Occurring on the Site
		species does not occur within the subject site. This species was not observed on site.
Charadrius veredus	Oriental plover	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Chelonia mydas	Green turtle	**Unlikely**. This species occurs in marine and estuarine habitats. Green turtles spend the first five (5) to ten (10) years drifting on ocean currents. Once green turtles reach 30 to 40cm curved carapace length, they settle in shallow benthic foraging habitats such as tropical tidal and sub-tidal coral and rocky reef habitat or inshore seagrass beds (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Coeranoscincus reticulatus	Three-toed snake-tooth skink	**Unlikely**. This species inhabits rainforest and occasionally moist eucalypt forest, on loamy or sandy soils. This species feeds on earthworms and beetle grubs and is found in leaf litter, often immediately adjacent to fallen tree trunks (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Crinia tinnula	Wallum froglet	**Likely**. This species inhabits acidic wetlands (pH 4.3-5.2) within Melaleuca swamps, sedgeland, wet or dry heathland and wallum/woodland areas in the sandy coastal lowlands (<100m ASL) of south-east Queensland. Occasionally animals occur in adjacent forests with a heathy understorey, and are known to persist in disturbed wallum habitat such as 4WD-impacted sites, roadsides, quarry site, and exotic pine plantations and partly cleared areas (DEHP 2013). Suitable habitat for this species exists along Raff Creek and adjacent grassland melon hole areas. This species has previously been observed in the broader NEBP site.
Cyclopsitta diophthalma coxeni	Coxen's fig-parrot	**Unlikely**. This species inhabits a spectrum of rainforest types (Araucarian rainforest, warm subtropical rainforest, cool subtropical rainforest and cool temperate rainforest) from sea level to approximately 1000m altitude. This species also use thin strips of gallery rainforest, littoral rainforest and coastal bloodwood, melaleuca and cabbage palm forest where fig densities are high.

Scientific Name	Common Name	Likelihood of Occurring on the Site
		This species has also been reported from riparian corridors through woodland, open woodland and cleared land where fig or other food trees occur, as well as from isolated fruiting trees in gardens and cultivated farmlands (DEHP 2013). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Dasyornis brachypterus	Eastern bristlebird	**Unlikely**. This species inhabit moist, mountain ranges within about 100km of the coast. In Queensland most sightings have been within localised pockets of relatively open eucalypt forest in close proximity to denser vegetation along creek lines and rainforest. Soils are relatively fertile, derived from basalts of the Main Range Volcanics and Mt Warning Shield. The ground stratum of the eucalypt forests favoured by the eastern bristlebird is a mosaic of dense clumped grasses interspersed with patches of shrubs, ferns, tangled vines and fallen logs. The more common grasses include wild sorghum (*Sarga leiocladum*), kangaroo grass (*Themeda triandra*) and tussock grass (*Poa labillardieri*). The presence of mature wild sorghum tussocks is thought to be a good indicator of high quality bristlebird habitat (DEHP 2013). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Dasyurus hallucatus	Northern quoll	**Unlikely**. This species is found within most treed habitats and is most abundant in broken, rocky country and in open eucalypt forest within 150 km of the coast. Northern quoll habitat generally encompasses some form of rocky area for denning purposes. In Queensland Northern quolls are more likely to be present in high relief areas that have shallower soils, greater cover of boulders, less fire impact and were closer to permanent water (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Delma torquata	Collared delma	**Unlikely**. Due to specific habitat requirements, this species distribution is highly fragmented and restricted to only a few locations. The Collared Delma is known from the western suburbs of Brisbane, QLD and the following sites: Bunya Mountains, Blackdown Tableland National Park (NP), Bullyard Conservation Park, D'Aguilar Range NP, Expedition NP, Naumgna and Lockyer Forest Reserves, Western Creek near Millmerran and the Toowoomba Range (Dept. Environment 2012). This species inhabits eucalypt dominated woodland and open forest

Scientific Name	Common Name	Likelihood of Occurring on the Site
		where it is associated with suitable micro-habitats (exposed rocky outcrops). The ground cover is predominantly native grasses, such as Kangaroo Grass (*Themeda triandra*), Barbed-wire Grass (*Cymbopogon refractus*), Wiregrass (*Aristida* sp.) and Lomandra (*Lomandra* sp.) (Dept. Environment 2012). The presence of rocks, logs, bark and other coarse woody debris, and mats of leaf litter (typically 30–100mm thick) appears to be an essential characteristic of the collared delma microhabitat and is always present where the species occurs (Dept. Environment 2012). Whilst Collared delmas are often found associated with small rocks, the presence of small rocks is not an essential habitat characteristic (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Dermochelys coriacea	Leatherback turtle	**Unlikely**. This species occurs in marine habitats. This species is highly pelagic, found in tropical, subtropical and temperate waters throughout the world. It is known from waters all around Australia and can be found foraging year round in Australian waters over Australian continental shelf waters. This species may venture close to shore mainly during the nesting season. Leatherback Turtles require sandy beaches to nest, with sand temperatures between 24–34°C needed for successful incubation. No major nesting sites have been recorded in Australia, although scattered isolated nesting (one to three nests per annum) occurs in southern Queensland and the Northern Territory (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Diomedea exulans (sensu lato)	Wandering albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds on Macquarie Island where nesting occurs in open patchy vegetation on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground. This species forages widely in open water in the Southern Ocean. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Diomedea exulans antipodensis	Antipodean albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds in New Zealand where nesting occurs in open patchy vegetation, such as

Scientific Name	Common Name	Likelihood of Occurring on the Site
		among tussock grassland or shrubs on ridges, slopes and plateaus. This species forages widely in open water in the south-west Pacific Ocean, Southern Ocean and the Tasman Sea. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Diomedea exulans exulans	Tristan albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds on Inaccessible Island and Gough Island in the Atlantic Ocean where nesting occurs in open patchy vegetation among tussocks grassland on coastal plains, swampy valley floors, and crests of broad ridges or gentle slopes. This species forages in open water in the Atlantic Ocean near the Cape of Good Hope, South Africa. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Diomedea exulans gibsoni	Gibson's albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds in New Zealand where nesting occurs in open or patchy vegetation on coastal or inland ridges, slopes, plateaux and plains, often on marshy ground. This species forages widely in open water in the Tasman Sea, the south-Pacific Ocean and the mid-Pacific Ocean. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Epinephelus daemelii	Black rockcod	**Unlikely**. This species generally inhabits near-shore rocky and offshore coral reefs at depths down to 50 m. In coastal waters suitable habitat includes rock caves, rock gutters, and on rock reefs. Juvenile rock cods utilise estuaries. It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.
Eretmochelys imbricata	Hawksbill turtle	**Unlikely**. This species occurs in marine and estuarine habitats. Nesting occurs on sandy beaches (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site. This species was not observed on site.

Scientific Name	Common Name	Likelihood of Occurring on the Site
Erythrotriorchis radiatus	Red goshawk	**Possible**. This species occupies open forests and woodlands along rivers and wetlands and rainforest fringes. In NSW favoured habitat includes *Melaleuca* forest along coastal rivers (Debus 1991, 1993). Melaleuca swamp forest associated with Raff Creek within and adjacent to the subject site, as well as riparian woodland fringing the Caboolture River may provide suitable habitat for this species. This species was not observed on site.
Furina dunmalli	Dunmall's snake	**Unlikely**. Suitable habitat for this species includes forests and woodlands dominated by *Acacia harpophylla* on black alluvial cracking clays and Eucalypt-Bulloak associations on sandstone derived soils (Dept. Environment 2012). No suitable habitat for this species occurs on site. This species was not observed on site.
Gallinago hardwickii	Latham's snipe	**Possible**. This species generally occupies flooded meadows, seasonal or semi-permanent swamps, or open waters bogs, waterholes, billabongs, lagoons, lakes, creek or river margins, river pools and floodplains. Dense fringing vegetation is preferred by this species but it has been recorded in waterlogged paddocks (Dept. Environment 2012). Suitable habitat for this species occurs along Raff Creek and adjacent flood prone pasture. This species has been observed in the wider NEBP area.
Haliaeetus leucogaster	White-bellied sea-eagle	**Possible**. This species has a large distribution range throughout SE QLD and is found in association with coasts, large rivers and estuaries and prefers to nest in large trees adjacent watercourses (Dept. Environment 2012). Suitable nesting/roosting habitat exists along Raff Creek. This species has been observed within the wider NEBP area.
Heteroscelus brevipes	grey-tailed tattler	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Hirundapus caudacutus	White-throated needletail	**Possible**. This species occurs flying over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. It is recorded in all coastal regions of Queensland and NSW and almost always forage aerially (Dept. Environment 2012). This species may forage above the subject site.

Scientific Name	Common Name	Likelihood of Occurring on the Site
Lathamus discolor	Swift parrot	**Possible**. The Swift parrot migrates from its Tasmanian breeding grounds to overwinter in the box-ironbark forests and woodlands of Victoria, NSW and southern Queensland. In south-eastern Queensland, Narrow-leaved ironbark and Forest red gum forests are commonly utilized (Kennedy and Tzaros 2005, Swift Parrot Recovery Team 2001). *Eucalyptus tereticornis* trees on site may provide suitable overwintering habitat for the Swift parrot.
Lepidochelys olivacea	Olive ridley turtle	**Unlikely**. Female Olive Ridley Turtles lay clutches of eggs on sandy beaches; hatchlings disperse into offshore currents and have a pelagic phase of unknown length. Small juveniles through to adults reside in coastal zones along the northern coast of Australia and historical bycatch data indicates that large immature and adult-sized Olive Ridleys are present all year round over soft bottomed habits of northern Australian continental shelf waters. Successful incubation of eggs requires the nesting sand temperature to be between 25–33 ºC (Dept. Environment 2012). Suitable nesting habitat does not occur on site.
Limicola falcinellus	Broad-billed sandpiper	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Limosa lapponica	Bar-tailed godwit	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Limosa limosa	Black-tailed godwit	**Unlikely**. Suitable habitat for this species includes tidal reefs and pools, weed-covered rocks, pebbly, shelly and sandy shores with stranded seaweed, and mudflats (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Litoria olongburensis	Wallum sedge frog	**Unlikely**. This species inhabits and breeds in acidic, permanent to ephemeral, freshwater wetlands with emergent reeds, ferns and/or sedges in undisturbed coastal wallum. This species may also be found around creeks and freshwater lakes in coastal wallum. This species is typically found below 20m ASL, and always above tidal influence. Water is typically nutrient poor, acidic (pH between 3.5 and 6.0), clear, still and tannin stained. In general, vegetation types where the species may occur include wet and dry heathlands, sedgelands,

Scientific Name	Common Name	Likelihood of Occurring on the Site
		woodlands and forests. Under wet conditions (i.e. resulting from significant rainfall events), this species is also known to utilize heathlands, grasslands, woodlands and forests adjoining breeding habitats in wallum environments and on near-coastal alluvial (clay) plains (Dept. Environment 2012). It is considered suitable habitat for this species does not occur on site. This species was not observed on site.
Macronectes giganteus	Southern giant-petrel	**Unlikely**. This species is pelagic and breeds in the Antarctic and Subantarctic regions (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Macronectes halli	Northern giant-petrel	**Unlikely**. This species is pelagic and breeds in the Antarctic and Subantarctic regions (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Merops ornatus	Rainbow bee-eater	**Possible**. This species occurs in open forests and woodlands, shrublands, and in various cleared or semi-cleared habitats, including farmland and areas of human habitation. Usually occurs in open, cleared or lightly-timbered areas that are often, but not always, located in close proximity to permanent water. Also occurs in inland and coastal sand dune systems, and in mangroves (Dept. Environment 2012). This species was not observed on site but may forage within the subject site.
Mixophyes iteratus	Giant barred frog	**Unlikely**. This species occurs along shallow rocky streams in rainforest, wet sclerophyll forest and farmland from 100 to 1000m altitude or deep, slow moving streams with steep banks in the lowlands (DEHP 2013). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Monarcha melanopsis	Black-faced monarch	**Unlikely**. This species occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. During winter or migration, this species also occurs in marginal habitats such as 20-30 years old regrowth rainforest, nearby open eucalypt forest (mainly wet sclerophyll forests), especially in gullies with a dense, shrubby understorey as well as dry sclerophyll forests and woodlands, often with a patchy understorey. (Dept. Environment 2012). It is considered that

Scientific Name	Common Name	Likelihood of Occurring on the Site
		suitable habitat for this species does not occur on site. This species was not observed on site.
Monarcha trivirgatus	Spectacled monarch	**Possible**. This species occupies the understorey of mountain/lowland rainforests, thickly wooded gullies, and waterside vegetation; mostly well below the canopy, and occasionally mangroves (Pizzey and Knight 1997). Mangrove vegetation adjacent to the subject site along Raff Creek may provide suitable habitat for this species.
Myiagra cyanoleuca	Satin flycatcher	**Possible**. This species occurs in heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occurs in coastal forests, woodlands, mangroves and drier woodland and open forests (Dept. Environment 2012). Mangrove vegetation adjacent to the subject site along Raff Creek may provide suitable migratory habitat for this species.
Natator depressus	Flatback turtle	**Unlikely**. This species occurs in marine and estuarine habitats. Adults inhabit soft bottom habitat over the continental shelf of northern Australia. Feeding occurs in turbid, shallow inshore water north of latitude 25°S in depths of less than 10m to depths of over 40m. Nesting habitat includes sandy beaches in the tropics and subtropics with sand temperatures between 25°C and 33°C at nest depth (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Numenius madagascariensis	Eastern curlew	**Unlikely**. Suitable habitat for this species includes estuaries, tidal mudflats, sandpits, saltmarshes, mangroves, occasionally fresh or brackish lakes, bare grasslands near water. No suitable habitat exists within the subject site.
Numenius minutus	Little curlew	**Unlikely**. Suitable habitat for this species includes estuaries, tidal mudflats, sandpits, saltmarshes, mangroves, occasionally fresh or brackish lakes, bare grasslands near water. No suitable habitat exists within the subject site.
Numenius phaeopus	Whimbrel	**Unlikely**. This species occurs on intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. It has been infrequently recorded using saline or brackish lakes near coastal areas. It also used salt flats with saltmarsh, or saline grasslands with standing water left after high spring-tides, and in similar habitats in sewage farms and salt fields (Dept. Environment 2012). It is considered that suitable

Scientific Name	Common Name	Likelihood of Occurring on the Site
		habitat for this species does not occur on site. This species was not observed on site.
Phascolarctos cinereus	Koala	**Known**. This species inhabits a range of temperate, sub-tropical and tropical forest, woodland and semi-arid communities where suitable food trees are present. The Koala is a leaf-eating specialist that feeds primarily during dawn, dusk or night. Its diet is restricted mainly to foliage of *Eucalyptus* spp; however, it may also consume foliage of related genera, including *Corymbia* spp., *Angophora* spp. and *Lophostemon* spp. The Koala may, at times, supplement its diet with other species, including *Leptospermum* spp. and *Melaleuca* spp. (Dept. Environment 2012). Evidence of habitat use by the Koala has been recorded on site (Cardno 2014).
Phyllodes imperialis smithersi	Pink underwing moth	**Unlikely**. This species is found below the altitude of 600 m in undisturbed, subtropical rainforest and occurs in association with the vine *Carronia multisepalea*. It is considered that suitable habitat for this species does not occur on site. This species was not observed on site.
Pluvialis fulva	Pacific golden plover	**Possible**. This species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as *Sarcocornia,* or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in salt works. The species is also sometimes recorded on islands, sand and coral cays and exposed reefs and rocks. They are less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet clay pans, especially those with muddy margins and often with submerged vegetation or short emergent grass. Other terrestrial habitats inhabited include short (or, occasionally, long) grass in paddocks, crops or airstrips, or ploughed or recently burnt areas, and they are very occasionally recorded well away from water (Dept. Environment 2012). Wetland associated with Raff Creek may provide suitable habitat for this species.
Pluvialis squatarola	Grey plover	**Possible**. This species occurs almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial

Scientific Name	Common Name	Likelihood of Occurring on the Site
		wetlands such as near-coastal lakes and swamps, or salt-lakes. The species is also very occasionally recorded further inland, where they occur around wetlands or salt-lakes (Dept. Environment 2012). Swamp wetland vegetation associated with Raff Creek may provide suitable habitat for this species.
Poephila cincta cincta	Black-throated finch (southern)	**Unlikely**. The black-throated finch (southern) occurs at two general locations: in the Townsville region and at scattered sites in central-eastern Queensland (between Aramac and Great Basalt Wall National Park). This species occurs mainly in grassy, open woodlands and forests, typically dominated by *Eucalyptus*, *Corymbia* and *Melaleuca*, and occasionally in tussock grasslands or other habitats (for example freshwater wetlands), often along or near watercourses, or in the vicinity of water. The species is thought to require a mosaic of different habitats in which it can find seed during the wet season. Some of the more common species of eucalypts in woodlands and forests frequented by the subspecies include Narrow-leaved Ironbark (*E. crebra*), River Red Gum (*E. camaldulensis*), Silver-leaved Ironbark (*E. melanophloia*), Reid River Box (*E. brownii*), Yellow jacket (*E. similis*) and Forest Red Gum (*E. tereticornis*). The subspecies occasionally occurs in Melaleuca woodlands, or in grasslands comprised of genera such as *Astrebla*, *Dichanthium* or *Panicum* (Dept. Environment 2012). It is considered that suitable habitat does not occur within the subject site. This species was not observed on site.
Pteropus poliocephalus	Grey-headed flying-fox	**Likely**. This species occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops (NSW OEH 2014). This species feeds on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia*, and fruits of rainforest trees and vines. It also feeds on commercial fruit crops and on introduced tree species in urban areas (NSW OEH 2014). The grey-headed flying-fox roosts in aggregations of various sizes on exposed branches. Roost sites are generally located within 20 km of a regular food source (NSW OEH 2014) and are typically located near water, such as lakes, rivers or the coast (Dept. Environment 2012). Roost vegetation includes rainforest patches, stands of *Melaleuca*, mangroves and riparian vegetation, but colonies also use highly modified vegetation in urban and suburban areas (Dept. Environment 2012). The species can maintain fidelity to roost sites for extended periods, although new

Scientific Name	Common Name	Likelihood of Occurring on the Site
		sites have been colonised (NSW OEH 2014, Dept. Environment 2012). Suitable foraging and roosting habitat for this species occurs along Raff Creek.
Rhipidura rufifrons	Rufous fantail	**Possible**. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests; for example near Bega in south-east NSW, where they are recorded in temperate Lilly Pilly (*Acmena smithi*) rainforest, with Grey Myrtle (*Backhousia myrtifolia*), Sassafras (*Doryphora sassafras*) and Sweet Pittosporum (*Pittosporum undulatum*) subdominants. They occasionally occur in secondary regrowth, following logging or disturbance in forests or rainforests. When on passage, they are sometimes recorded in drier sclerophyll forests and woodlands, including Spotted Gum (*Eucalyptus maculata*), Yellow Box (*E. melliodora*), ironbarks or stringybarks, often with a shrubby or heath understorey. They are also recorded from parks and gardens when on passage. In north and north-east Australia, they often occur in tropical rainforest and monsoon rainforests, including semi-evergreen mesophyll vine forests, semi-deciduous vine thickets or thickets of Paperbarks (*Melaleuca* spp.) (Dept. Environment 2012). Melaleuca woodland along Raff Creek may provide suitable migratory habitat for this species.
Rostratula australis	Australian painted snipe	**Possible**. This species inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and clay pans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). The species sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber. Breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands , provided that these islands

Scientific Name	Common Name	Likelihood of Occurring on the Site
		are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Dept. Environment 2012). Wetland associated with Raff Creek may provide suitable habitat for this species.
Rostratula benghalensis (sensu lato)	Painted snipe	**Possible**. This species inhabits shallow terrestrial freshwater (occasionally brackish) wetlands, including temporary and permanent lakes, swamps and clay pans. They also use inundated or waterlogged grassland or saltmarsh, dams, rice crops, sewage farms and bore drains. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or sometimes tea-tree (*Melaleuca*). The species sometimes utilises areas that are lined with trees, or that have some scattered fallen or washed-up timber. Breeding habitat requirements may be quite specific: shallow wetlands with areas of bare wet mud and both upper and canopy cover nearby. Nest records are all, or nearly all, from or near small islands in freshwater wetlands , provided that these islands are a combination of very shallow water, exposed mud, dense low cover and sometimes some tall dense cover (Dept. Environment 2012). Wetland associated with Raff Creek may provide suitable habitat for this species.
Thalassarche cauta	Shy albatross	**Unlikely**. This species is a marine species occurring in subantarctic and subtropical waters, reaching the tropics in the cool Humboldt Current off South America. Preference for sea-surface temperatures is poorly known. In the southern Indian Ocean the species has been observed over waters of 6.4-13.5°C. Birds have been noted in shelf-waters around breeding islands and over adjacent rises. During the non-breeding season, this species occurs over continental shelves around continents. The species occurs both inshore and offshore and enters harbours and bays. Nesting occurs on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks, usually in broken terrain with little soil and vegetation (Dept. Environment 2012). It is considered that suitable habitat does not occur within the subject site. This species was not observed on site.
Thalassarche cauta salvini	Salvin's albatross	**Unlikely**. This species is a marine species occurring in subantarctic and subtropical waters, reaching the tropics in the cool Humboldt Current off South America. Preference for sea-surface temperatures is poorly known. In the southern Indian Ocean the species has been observed over waters of 6.4-13.5°C.

Scientific Name	Common Name	Likelihood of Occurring on the Site
		Birds have been noted in shelf-waters around breeding islands and over adjacent rises. During the non-breeding season, this species occurs over continental shelves around continents. The species occurs both inshore and offshore and enters harbours and bays. Nesting occurs on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks, usually in broken terrain with little soil and vegetation (Dept. Environment 2012). It is considered that suitable habitat does not occur within the subject site. This species was not observed on site.
Thalassarche cauta steadi	White-capped albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds on a number of sub-Antarctic islands where nesting occurs on slopes vegetated with tussock and succulents. This species forages in open water and is common off the coast of south-east Australia throughout the year. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat does not occur within the subject site. This species was not observed on site.
Thalassarche eremita	Chatham albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds at the Chatham Islands, off the coast of New Zealand where nesting occurs on level or gently sloping ledges, summits, slopes and caves of rocky islets and stacks, usually in broken terrain with little soil and vegetation. The principal foraging range for this species is in coastal waters off eastern and southern New Zealand and Tasmania. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat does not occur within the subject site. This species was not observed on site.

Scientific Name	Common Name	Likelihood of Occurring on the Site
Thalassarche melanophris	Black-browed albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds on sub-Antarctic Campbell Island, south of New Zealand where nesting occurs on tussock-covered ledges and terraces of cliffs, slopes and hills, overlooking the sea or valleys, and on the summits of rocky islets. This species forages in temperate shelf waters of New Zealand, Australia, and the central and western Pacific Islands. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat does not occur within the subject site. This species was not observed on site.
Thalassarche melanophris impavida	Campbell albatross	**Unlikely**. This species is migratory, marine, pelagic and aerial. This species breeds on sub-Antarctic Campbell Island, south of New Zealand where nesting occurs on tussock-covered ledges and terraces of cliffs, slopes and hills, overlooking the sea or valleys, and on the summits of rocky islets. This species forages in temperate shelf waters of New Zealand, Australia, and the central and western Pacific Islands. Due to this species ability to cover vast oceanic distances, all waters within Australian jurisdiction can be considered foraging habitat (Dept. Environment 2012). It is considered that suitable habitat does not occur within the subject site. This species was not observed on site.
Tringa glareola	Wood sandpiper	**Possible**. This species uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially *Melaleuca* and River Red Gums *Eucalyptus camaldulensis* and often with fallen timber. They also frequent inundated grasslands, short herbage or wooded floodplains, where floodwaters are temporary or receding, and irrigated crops. They are also found at some small wetlands only when they are drying. They are rarely found using brackish wetlands, or dry stunted saltmarsh. Typically they do not use coastal flats, but are occasionally recorded in stony wetlands. This species uses artificial wetlands, including open sewage ponds, reservoirs, large farm dams, and bore drains (Dept. Environment 2012). Suitable habitat for this species occurs along Raff Creek and the adjacent flood prone pasture.

Scientific Name	Common Name	Likelihood of Occurring on the Site
Tringa stagnatilis	Marsh sandpiper	**Possible**. This species occurs in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and salt works. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes (Dept. Environment 2012). Suitable habitat for this species occurs along Raff Creek.
Turnix melanogaster	Black-breasted button-quail	**Unlikely.** This species is restricted to rainforests and forests, mostly in areas with 770-1200 mm rainfall per annum. They prefer drier low closed forests, particularly semi-evergreen vine thicket, low microphyll vine forest, Araucarian microphyll vine forest and Araucarian notophyll vine forest. This species may also be found in low, dense acacia thickets and, in littoral area, in vegetation behind sand dunes. An extensive dense leaf-litter layer is required for foraging and possibly also roosting. Fallen logs and a dense, heterogeneously distributed shrub layers are also considered to be important habitat characteristics for shelter and breeding (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur within the subject site.

Scientific Name	Common Name	Likelihood of Occurring on the Site
Xenus cinereus	Terek sandpiper	**Unlikely**. The Terek Sandpiper mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons. The species has also been recorded on islets, mud banks, sandbanks and spits, and near mangroves and occasionally in samphire (*Halosarcia* spp.). Birds are seldom near the edge of water; however, birds may wade into the water. Occasionally, on sandy beaches, among seaweed and other debris and in rocky areas, Terek Sandpipers will use the supralittoral or upper littoral zone, where a film of water covers the sand. However, on exposed rock platforms, the species forages in the lower littoral zone and not the supralittoral or upper littoral zones. Less often seen on sandy or shingle beaches, or on rock or coral reefs or platforms, Terek Sandpipers are occasionally sighted around drying sewage ponds and saltpans if surrounded by mudflats. The species is also found around brackish coastal swamps, lagoons and dune-lakes; and also on gravel or rocky edges of estuarine pools and freshwater river-pools. Very occasionally, birds use swampy, grassy or cultivated paddocks near the coast. Preferring to roost in or among mangroves, birds may perch in branches or roots up to 2m from the ground, or beneath them in the shade on hot days. Occasionally, they roost in dead trees or among tangled driftwood. They may roost with other waders on flat shores, on muddy spits, islets or banks, and sometimes on sandy and pebbly beaches (Dept. Environment 2012). It is considered that suitable habitat for this species does not occur on site.
Xeromys myoides	Water mouse	**Unlikely**. This species inhabits mangrove communities and associated saltmarsh, sedgelands, clay pans, and heathlands as well as adjacent freshwater wetlands (NSW OEH 2014). Suitable habitat for this species occurs along Raff Creek, specifically the mangrove communities adjacent to the subject site. However, this species has never been recorded within the Caboolture River catchment.

APPENDIX 3 – CABOOLTURE SHIRE PLAN 2005 - NATURE CONSERVATION OVERLAY CODE ASSESSMENT

Specific Outcomes	Probable Solutions	Response
Assessment and Retention of Nature Conservation Areas and Ecological Corridors		
SO1 Development does not adversely affect Significant Vegetation, Wetlands, ecological corridors or habitat for endangered, vulnerable or rare species and other values of biodiversity significance. **Note:** An ecological assessment may be required in accordance with the Planning Scheme Policy 6 Ecological Assessment. **Note:** Applicants should consult with the relevant State Agency regarding vegetation clearing.	**S1.1** Development is sited on existing cleared land and is not located within an ecological corridor. **S1.2** Significant Vegetation, Wetlands, habitats for endangered, vulnerable and rare species within nature conservation areas and ecological corridors indicated on the overlay map, are not disturbed.	Areas of biodiversity significance are mapped on the site loosely aligned with remnant vegetation on the site in the south west of the site. Minor impacts will occur to remnant vegetation through the installation of swale drains to help manage stormwater runoff into Raff Creek from the compensatory cut areas. These drains are necessary to protect the wetland ecosystems from sedimentation and maintain water quality. Please refer to Cardno's Water Quality Monitoring Plan (Cardno 2014a). The majority of Raff Creek will be preserved. Any areas impacted will be rehabilitated during future phases of the site development as the open space precinct. These areas will support maturing vegetation and Koala habitat. Rehabilitation efforts will include revegetation and weed control (JWA 2015).
SO2 Development layout and planning maximizes the functioning of ecological corridors which: a) ensures low intensity land uses are situated directly adjacent to the corridor; b) ensures viability and functionality of the corridor; c) maximises connectivity to neighbouring ecological corridors; d) maximises connectivity to other large	**S2.1** A core ecological corridor of at least 100.0 metres in width is provided. **S2.2** Revegetation or rehabilitation occurs in degraded or weed infested areas. **S2.3** Local native species that reflect the structural and floristic diversity of	There are no state or regional corridors mapped on the site. Rehabilitation will result in a vegetated waterway corridor of at least 100m wide along Raff Creek. Rehabilitation efforts will include revegetation and weed control. Local native species will be used to supplement or recreate previously cleared regional ecosystems on the site. Revegetation will aim to consolidate existing remnant vegetation within the RWA (JWA

Specific Outcomes	Probable Solutions	Response
areas of habitat retained on-site or on neighbouring sites; e) ensures retained vegetation is configured to provide low edge to area ratios and avoid narrowing or bottlenecks within the corridor; and f) ensure road infrastructure avoids core corridor vegetation, or where not possible, provides for wildlife under / overpasses and minimises the intrusion, length and width.	vegetation on the site or surrounds are used to rehabilitate and revegetate ecological corridors and Nature Conservation Areas. **S2.4** Revegetation assists in consolidating and linking existing Significant Vegetation. **Note:** Revegetation should be undertaken progressively during construction and be completed within one (1) month after construction is completed.	2015).
SO3 Ecological corridors are retained and protected from development to facilitate wildlife movement and link significant vegetation, wetlands, habitat for endangered, vulnerable or rare species and other values of biodiversity significance.	**S3.1** No solution provided.	There are no state or regional corridors mapped on the site. The main arm of Raff Creek provides good quality corridor habitat. These areas will be maintained and protected during development with the exception of small areas required to be disturbed for the installation of water quality control devices (swale drains). These drains will not dissect the corridor so linkages will be maintained.
Buffering of Nature Conservation Areas		
SO4 Separation buffers are provided to protect Nature Conservation Areas, ecological corridors and areas of coastal hazard from the edge effects of development.	**S4.1** Developed areas should be separated from Nature Conservation Areas by a vegetated access way or park of at least 20.0 metres. **S4.2** Developed areas should be separated from the Conservation Estate by a vegetated access way or park of at least 100.0 metres.	The final development layout once rehabilitation is complete will provide a 20m buffer area between corridor areas and areas of development. There are no conservation estates on the site.

Specific Outcomes	Probable Solutions	Response
	S4.3 Ecological corridors are separated from development by a vegetated access way or park of at least 20.0 metres.	
Works Associated with the Development		
SO5 The location of infrastructure does not disturb Significant Vegetation and Wetlands.	**S5.1** Infrastructure does not traverse Significant Vegetation and Wetlands. **S5.2** Roads adjacent to Significant Vegetation and Wetlands incorporate traffic calming devices to minimise disturbance to wildlife. **S5.3** Wildlife under/overpasses are provided to facilitate wildlife movement.	Roads located within Phase 2 of the development will not traverse any remnant vegetation. An anabranch of Raff Creek will be filled in or isolated from it water source for the development of Phase 2. This water course is of poor habitat quality. The remainder of Raff Creek will be rehabilitated during future phases of the development to mitigate this impact.

APPENDIX 4 - CABOOLTURE SHIRE PLAN 2005 - CATCHMENT PROTECTION OVERLAY CODE ASSESSMENT

Specific Outcomes	Probable Solutions	Response
Assessment of Retention of Significant Vegetation		
SO1 Significant Vegetation is retained and consolidated so as to: a) protect the Shire's nature conservation and aesthetic values; b) maintain a healthy and productive agricultural environment including protection from salinity, erosion and land degradation; c) maintain and enhance water quality, in-stream and riparian habitat, to protect Potable Water Catchments; d) maintain and enhance water quality and riparian vegetation in order to protect freshwater aquatic ecosystems and receiving systems, particularly estuarine and marine environments; e) provide a linkage with existing Nature Conservation areas; and f) maintain natural ecosystem functions and assist in the control of weeds and pests. **Note:** To fulfil the vegetation retention solutions, a Property Vegetation Management Plan, prepared in accordance with Planning Scheme Policy 6 Ecological Assessment may be required.	**S1.1** No solution provided.	There is significant vegetation on the site. Minor impacts will occur to remnant vegetation through the installation of swale drains to help manage stormwater runoff into Raff Creek. These drains are necessary to protect the wetland ecosystems from sedimentation and maintain water quality (Cardno 2014a). The majority of Raff Creek will be preserved any areas impacted will be rehabilitated during future phases of the site development as the open space precinct. These areas will support maturing vegetation and Koala habitat. Rehabilitation efforts will include revegetation and weed control (JWA 2015).
SO2 The environmental values of Significant Vegetation, Wetlands and Waterways are maintained by:	**S2.1** Revegetation utilises local native species that reflect the structural and floristic diversity of Significant Vegetation, Waterway	While a small anabranch of Raff Creek will be filled in (in Phase 2) or isolated from its water source, the majority of Raff Creek will be preserved and rehabilitated during future

Specific Outcomes	Probable Solutions	Response
a) retention of Significant Vegetation and vegetation associated with Wetlands and Waterways; b) consolidating and linking existing Significant Vegetation.	or Wetland vegetation on the site or surrounds and assists in consolidating and linking existing Significant Vegetation. **Note:** Revegetation should be undertaken progressively during construction and completed one (1) month after construction is completed.	phases of the site development as the open space precinct (JWA 2015). Revegetation will use local native species that reflect the structural and floristic diversity of remnant vegetation on the site or pre-clear RE's and will assist in consolidating the retained remnant vegetation on the RWA.
Bank Stability and In-Stream Habitat		
SO3 Bank stability and in-stream habitat is protected from degradation and maintained or improved at a standard commensurate with pre-development environmental conditions.	**S3.1** No solution provided.	A small anabranch of Raff Creek will be filled in for the development of Phase 2. The majority of Raff Creek will be preserved and rehabilitated during future phases to a better condition than prior to development.
Buffering of Waterways and Wetlands		
S04 Protect and maintain waterway corridors and their hydrologic, water quality and ecological function by: a) providing adequate buffers to waterways; and b) protecting natural drainage channels and riparian habitat; and c) providing adequate habitat connectivity between waterways.	**S4.1** Development is set back from the edge of the top of the bank or HAT level (whatever is greater) of a Waterway or Wetland a distance of: a) at least forty (40) metres to all Catchment Protection Minor Waterways; b) at least one hundred (100) metres to Wetland Protection Areas. c) at least one hundred (100) metres to Catchment Protection Major Waterways. **S4.2** Constructed or artificial waterways that are to discharge into existing waterways should have a minimum vegetated buffer width of: a) 10.0 metres for a constructed	There are no state or regional corridors mapped on the site. The major section of Raff Creek provides a good quality waterway habitat corridor across the RWA. The Raff Creek anabranch waterway corridor that transects the northern portion of the proposed residential subdivision and the constructed wetland forms a degraded corridor connecting to the major arm of Raff Creek. There is no remnant vegetation on this creek line and the quality of the corridor in low. This waterway will be filled as part of the development. Other areas of Raff Creek support remnant vegetation and Koala habitat and will be rehabilitated and extended in future phases (JWA 2015).

Specific Outcomes	Probable Solutions	Response
	freshwater, marine, estuarine or brackish waterway. b) 40.0 metres for freshwater constructed waterways greater than 1.0 metre excavation depth. c) 100.0 metres for marine or estuarine constructed waterways greater than 1.0 metre excavation depth. **Note:** It may be appropriate for the setback to incorporate vegetated areas or areas to be rehabilitated. Refer to Planning Scheme Policy 14 Landscaping for details to include in revegetation plans. **Note:** Classification of a constructed waterway, with regard to determining buffer width, is dependent upon the type of waterway that the constructed waterway discharge will be received by [i.e. if a constructed waterway discharges directly into a marine or estuarine waterway the constructed waterway will be considered a marine/estuarine waterway (regardless of water quality attributes of the constructed waterway)]. When a constructed waterway is to discharge into another currently unmapped constructed waterway the buffer width is determined by the buffer width of the receiving constructed waterway.	
SO5 Protect and maintain the environmental values of receiving environments by:	**S5.1** No solution provided.	Suitable erosion and sediment control will be implemented. As part of the operational works approval packages a detailed Erosion

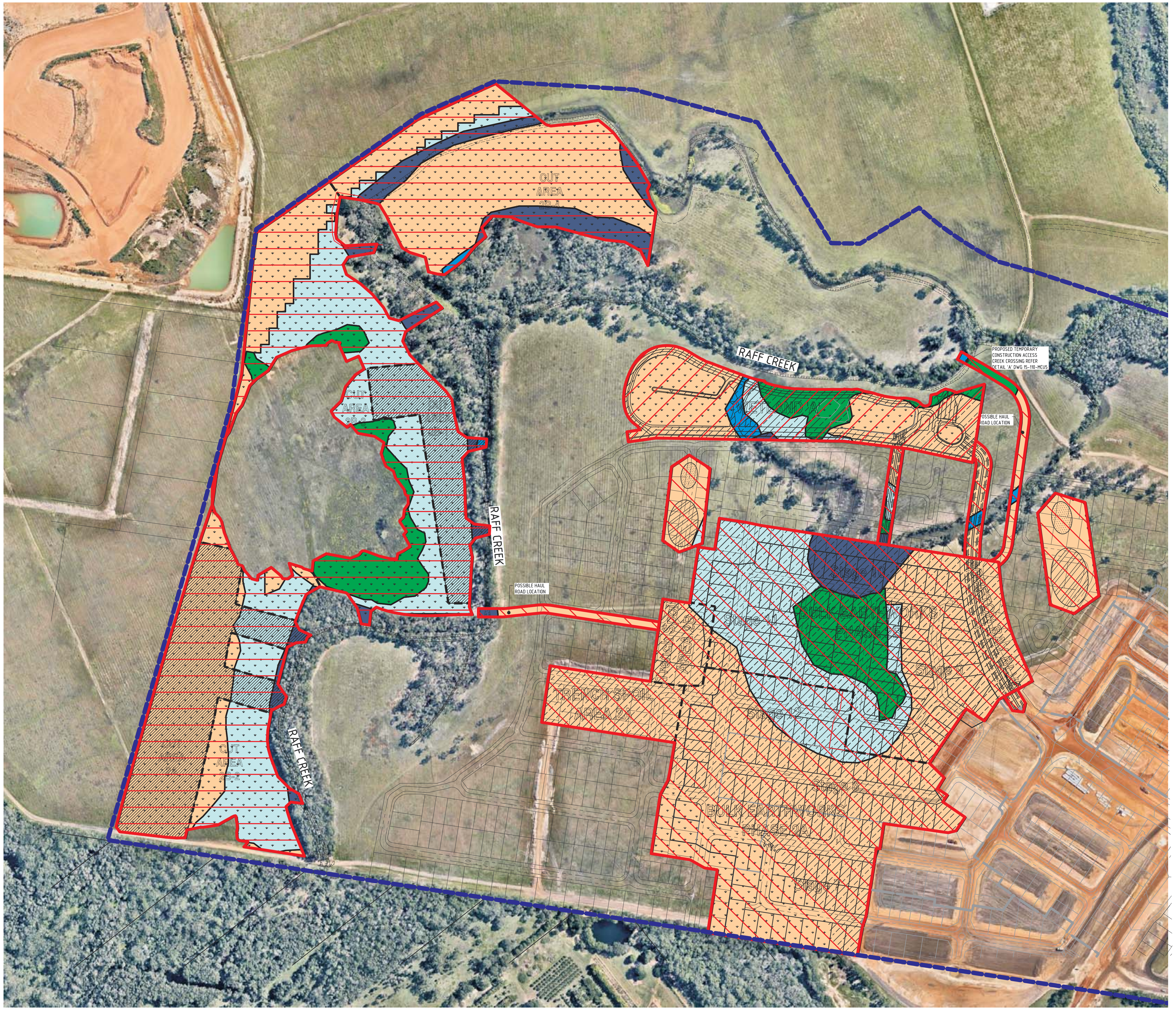
Specific Outcomes	Probable Solutions	Response
a) Reducing the cumulative impact of pollutant transport and deposition; b) Protecting higher order streams and ephemeral waterways; and c) Providing successive buffering of waterways between freshwater, estuarine and marine environments.		and Sediment Control Plan (ESCP) will be produced. Stormwater quantity and quality management during both the construction and interim catchment build out phases will be undertaken in accordance with the provisions of Cardno's Water Quality Monitoring Plan (Cardno 2014a).
Drainage and Other Works		
SO6 The natural hydrological regimes of Waterways and Wetlands, are maintained. **Note:** Natural hydrological regimes include natural water quality, quantity and groundwater conditions including sub-surface drainage paths. The purpose of maintaining these regimes is to protect and encourage natural recharge rates to aquifers and contributions to base flow in streams (environmental flows). **Note:** Development should be carried out in accordance with an approved hydrological assessment report that ensures any changes to overland flow or groundwater do not adversely affect the hydrological conditions or water quality within a waterway or receiving waterway. A site based stormwater management plan may be required in accordance with Planning Scheme Policy 19 Stormwater.	**S6.1** The height of groundwater tables is not altered and natural seasonal height fluctuations maintained.	An anabranch of Raff Creek will be filled in or isolated from it water source for the development of Phase 2. The remainder of Raff Creek will be rehabilitated and not be impacted by future development.
SO7 Development does not increase the discharge	**S7.1** Development works maintains or enhances	Development works will maintain or enhance groundwater aquifer interactions with

Specific Outcomes	Probable Solutions	Response
or movement of groundwater and associated contaminants, such as iron, aluminium, nutrients or total organic carbon, to a waterway or to a place where contaminants may be transported to a waterway.	groundwater aquifer interactions with waterways to a standard commensurate with pre-development environmental conditions.	waterways to a standard commensurate with pre-development environmental conditions through the retention and rehabilitation of the majority of Raff Creek.
SO8 The natural water quality of specific waterway types is protected. **Note:** The natural water quality characteristics of individual waterways vary between waterway types. In order to protect and maintain the environmental values of individual waterways, these characteristics need to be considered when determining water quality management solutions.	**S8.1** No solution provided.	Natural water quality will be maintain or enhance through the retention and rehabilitation of the majority of Raff Creek.
SO9 Significant Vegetation and Wetlands are retained.	**S9.1** Infrastructure does not traverse Significant Vegetation. **S9.2** Roads adjacent to Significant Vegetation and Wetlands incorporate traffic calming devices to minimise disturbance to wildlife. **S9.3** Wildlife under/overpasses are provided to facilitate wildlife movement. **Note:** Refer to the Planning Scheme Policy 6 Ecological Assessment which contains information about designing infrastructure to facilitate wildlife movement.	Small sections or remnant vegetation will be cleared for the installation of swale drains to help manage stormwater runoff into Raff Creek and preserve water quality. No infrastructure will traverse the significant vegetation.

Specific Outcomes	Probable Solutions	Response
SO10 The biodiversity of specific vegetation types associated habitat values, in particular endangered, vulnerable or rare species is protected or enhanced.	**S10.1** Vegetation corridors between significant vegetation and other vegetation are maintained or provided.	There are areas supporting koala food trees identified on the site that may be impacted. Koala trees within the residential subdivision and the constructed wetland will be removed. These trees will be replaced at a 5:1 ratio in a more suitable location within the rehabilitation area along Raff Creek.
Erosion Prone Areas		
SO11 Natural coastal processes are able to be managed and life and property are protected from development by ensuring that: a) development does not occur within Erosion Prone Areas, except for temporary or relocatable structures for safety or recreational purposes (e.g. picnic tables, barbeques, walking trails, bikeways, lookouts and elevated decks) associated with a development can be located within erosion prone areas; b) existing intensities of development are not exceeded; and c) existing building alignments of neighbouring properties are not exceeded. **Note:** Statutory erosion prone area plans made under the Coastal Protection and Management Act 1995 can be viewed at Council.	**S11.1** No solution provided.	The site is just within the state coastal management district. It is mapped as "Storm Tide Inundation Area - Medium hazard area (less than 1.0m water depth)" (**FIGURE 10**). The presence of salt scalds in the north of the site supports this assessment. The area currently periodically inundated would be filled to a height where inundation would not occur. Please refer to the North East Business Park Residential West Stormwater Management Plan and Flooding Assessment Report (Cardno 2014a).
Protection of Potable Water Catchments		
SO12 Development within a Potable Water	**S12.1** No solution provided.	The site is not located within a Potable Water Catchment.

Specific Outcomes	Probable Solutions	Response
Catchment (as identified in Schedule 3) maintains or enhances the water quality and integrity of water resources by: a) minimising land degradation and disturbance to dispersive soils; b) preventing the release of sediment and nutrients into waterways; c) maximising groundcover retention and retaining and where possible consolidating and linking significant vegetation adjoining waterway buffers, on ridge lines, vegetated slopes and in stormwater recharge areas.		

APPENDIX B – VEGETATION CLEARANCE PLAN



N

LEGEND

Proposed Phase 2 Works
- Extent of Cut to be Rehabilitated
- Extent of Fill
- Topsoil Stockpile Location
- Mulch Stockpile Location
- Sediment & Diversion Fence (Temporary)

Vegetation to be Impacted by Phase 2 Works
- Community 1: Coastal and subcoastal floodplain, grass, sedge herb swamps (**3.0ha to be impacted**)
- Community 2: Coastal and subcoastal floodplain tree swamps – melaleuca and eucalypt (**2.0ha to be impacted**)
- Community 3: Mangrove and casuarina estuarine wetlands (**0.3ha to be impacted**)
- Community 4: Disturbed wet-terrestrial grassland/sedgeland mosaic (**10.3ha to be impacted**)
- Community 5: Disturbed terrestrial grassland/woodland (**24.6ha to be impacted**)

- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary

0 150m
1 : 5000

SOURCE: JWA Site Investigations; Near Map March 2015 Aerial Photo; KN Group (Ref: 15-110 -MCU.PDF)
SCALE: 1 : 5000 @ A3

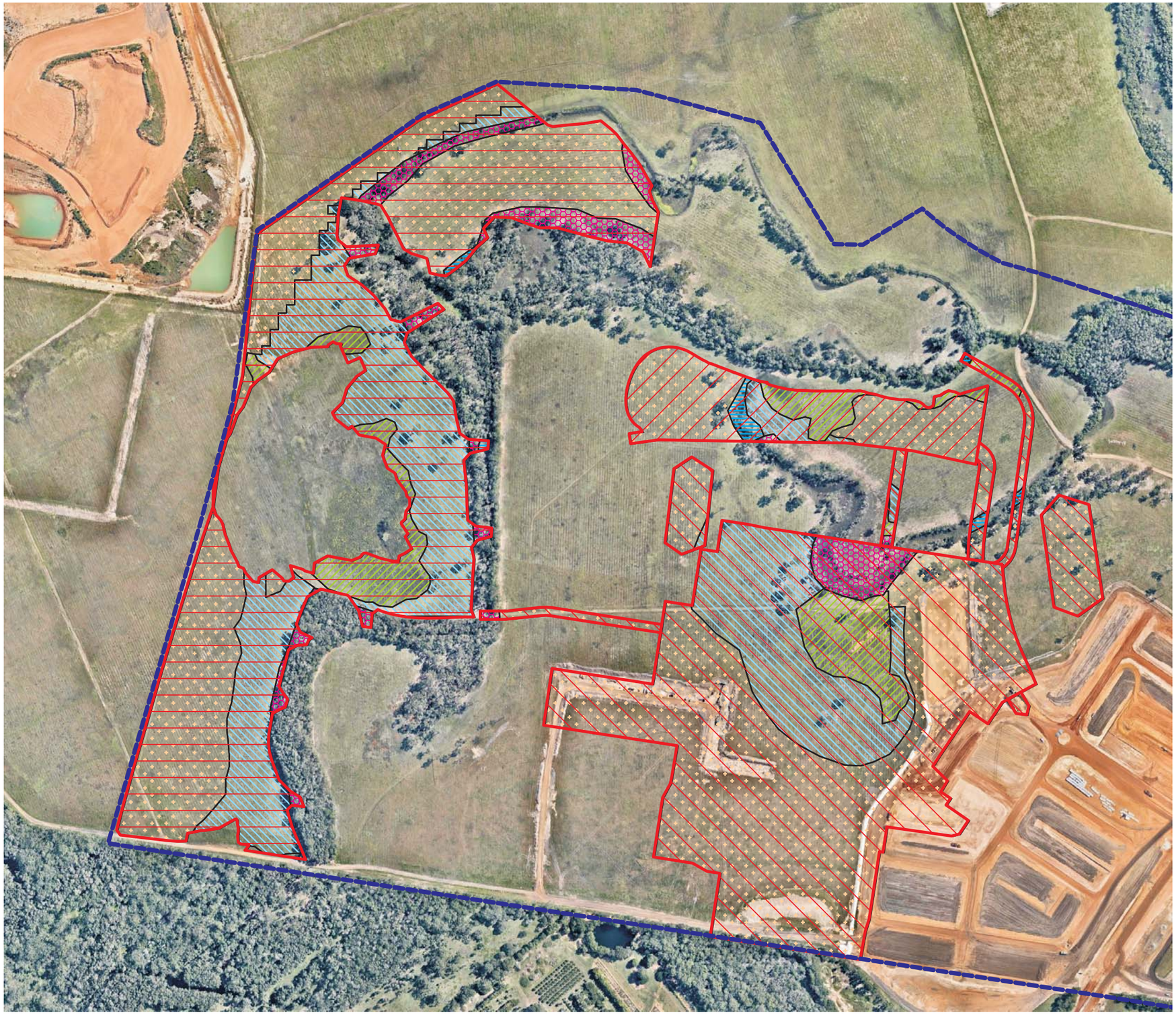
JWA PTY LTD
Ecological Consultants

CLIENT
North East Business Park Pty Ltd
PROJECT
Land Based Environmental Management Plan
Sub-Plan 03: NEBP RWA Phase 2;
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

APPENDIX B
FIGURE 1

PREPARED: BW
DATE: 08 June 2015
FILE: Q15003_Veg Clearance.cdr

TITLE
VEGETATION CLEARANCE PLAN



LEGEND

Vegetation to be Impacted by Phase 2 Works

- Community 1: Coastal and subcoastal floodplain, grass, sedge herb swamps (**3.0ha to be impacted**)
- Community 2: Coastal and subcoastal floodplain tree swamps – melaleuca and eucalypt (**2.0ha to be impacted**)
- Community 3: Mangrove and casuarina estuarine wetlands (**0.3ha to be impacted**)
- Community 4: Disturbed wet-terrestrial grassland/sedgeland mosaic (**10.3ha to be impacted**)
- Community 5: Disturbed terrestrial grassland/woodland (**24.6ha to be impacted**)

- Phase 2 Residential Lots & Associated Earthworks
- Phase 2 Constructed Wetland
- Phase 2 Compensatory Cut / Restoration Area
- RWA Boundary

0 150m

1 : 5000

SOURCE: JWA Site Investigations; Near Map March 2015 Aerial Photo; KN Group (Ref: 15-110 -MCU.PDF)

SCALE: 1 : 5000 @ A3

JWA PTY LTD
Ecological Consultants

CLIENT
North East Business Park Pty Ltd

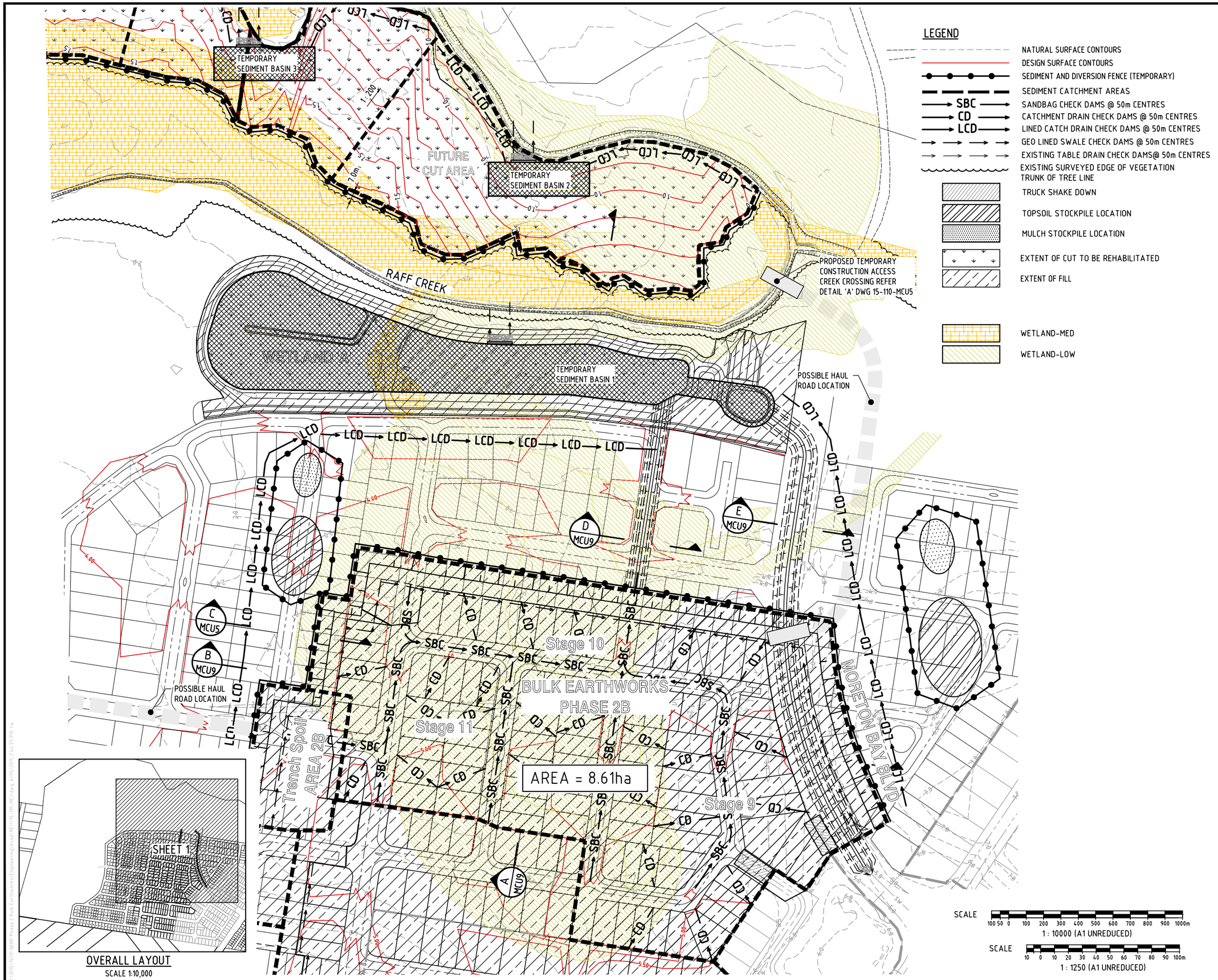
PROJECT
Land Based Environmental Management Plan
Sub-Plan 03: NEBP RWA Phase 2;
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

APPENDIX B
FIGURE 2

PREPARED: BW
DATE: 08 June 2015
FILE: Q15003_Veg Clearance.cdr

TITLE
VEGETATION CLEARANCE PLAN OVERLAID ON AERIAL

APPENDIX C – BULK EARTHWORKS DRAWINGS



LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- SEDIMENT CATCHMENT AREAS
- SBC — SANDBAG CHECK DAMS @ 50m CENTRES
- CD — CATCHMENT DRAIN CHECK DAMS @ 50m CENTRES
- LCD — LINED CATCH DRAIN CHECK DAMS @ 50m CENTRES
- GEO LINED SWALE CHECK DAMS @ 50m CENTRES
- EXISTING TABLE DRAIN CHECK DAMS@ 50m CENTRES
- EXISTING SURVEYED EDGE OF VEGETATION TRUNK OF TREE LINE
- TRUCK SHAKE DOWN
- TOPSOIL STOCKPILE LOCATION
- MULCH STOCKPILE LOCATION
- EXTENT OF CUT TO BE REHABILITATED
- EXTENT OF FILL
- WETLAND-MED
- WETLAND-LOW

OVERALL LAYOUT
SCALE 1:10,000

SCALE
100 50 0 100 200 300 400 500 600 700 800 900 1000m
1 : 10000 (A1 UNREDUCED)

SCALE
10 0 10 20 30 40 50 60 70 80 90 100m
1 : 1250 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW

NORTH

Client

NorthEast BUSINESS PARK

Project

North Harbour feel right at home

Project

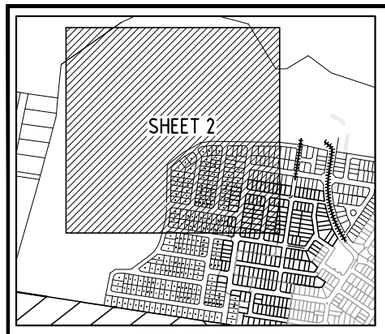
BULK EARTHWORKS
MCU
PHASE 2B

KN GROUP PTY LTD CONSULTING ENGINEERS
LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au
ABN 35 112 053 611

Approved Director - RPEQ 1988

Drawing Title
EARTHWORKS SEDIMENTATION & EROSION CONTROL PLAN
SHEET 1 OF 2

Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15
Scale: AS SHOWN			Sheet: 1 of 8
A1	Drawing No: 15-110-MCU1		Revision: A



OVERALL LAYOUT
SCALE 1:10,000

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Drawing Title
EARTHWORKS SEDIMENTATION
& EROSION CONTROL PLAN
SHEET 2 OF 3

Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15

Scale	Sheet
AS SHOWN	2 of 8

A1	Drawing No	Revision
	15-110-MCU2	A

LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- SEDIMENT CATCHMENT AREAS
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- CD — CATCHMENT DRAIN CHECK DAMS @ 50m CENTRES
- LCD — LINED CATCH DRAIN CHECK DAMS @ 50m CENTRES
- GEO LINED SWALE CHECK DAMS @ 50m CENTRES
- EXISTING TABLE DRAIN CHECK DAMS@ 50m CENTRES
- EXISTING SURVEYED EDGE OF VEGETATION
  TRUNK OF TREE LINE
- WETLAND-MED
- WETLAND-LOW
- TRUCK SHAKE DOWN
- TOPSOIL STOCKPILE LOCATION
- MULCH STOCKPILE LOCATION
- EXTENT OF CUT TO BE REHABILITATED
- EXTENT OF FILL

SCALE 1 : 10000 (A1 UNREDUCED)
SCALE 1 : 1250 (A1 UNREDUCED)

OVERALL LAYOUT
SCALE 1:10,000

CUT AREA 2B-3
CUT AREA 2B-1
TEMPORARY SEDIMENT BASIN 7
TEMPORARY SEDIMENT BASIN 8
TEMPORARY SEDIMENT BASIN 9
TEMPORARY SEDIMENT BASIN 10
TEMPORARY SEDIMENT BASIN 11
TEMPORARY SEDIMENT BASIN 12
CUT AREA 2B
CUT AREA 2A
RAFF CREEK
E MCU5
× RL 0.82
× RL 0.83
× RL 0.73
× RL 0.85
× RL 0.81
× RL 0.88
POSSIBLE HAUL ROAD LOCATION
PROPOSED TEMPORARY CREEK CROSSING LOCATED IN EXISTING CLEARED CORRIDOR REFER DETAIL 'A' KN DWG 15-110-MCU5

LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- SEDIMENT CATCHMENT AREAS
- SBC — SANDBAG CHECK DAMS @ 50m CENTRES
- CD — CATCHMENT DRAIN CHECK DAMS @ 50m CENTRES
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- EXTENT OF CUT TO BE REHABILITATED
- EXTENT OF FILL
- WETLAND-MED
- WETLAND-LOW

SCALE 100 50 0 100 200 300 400 500 600 700 800 900 1000m
1 : 10000 (A1 UNREDUCED)

SCALE 10 0 10 20 30 40 50 60 70 80 90 100m
1 : 1250 (A1 UNREDUCED)

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REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW

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BULK EARTHWORKS
MCU
PHASE 2B

KN GROUP PTY LTD CONSULTING ENGINEERS
LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au
ABN 35 112 053 611

Approved Director - RPEQ 1988

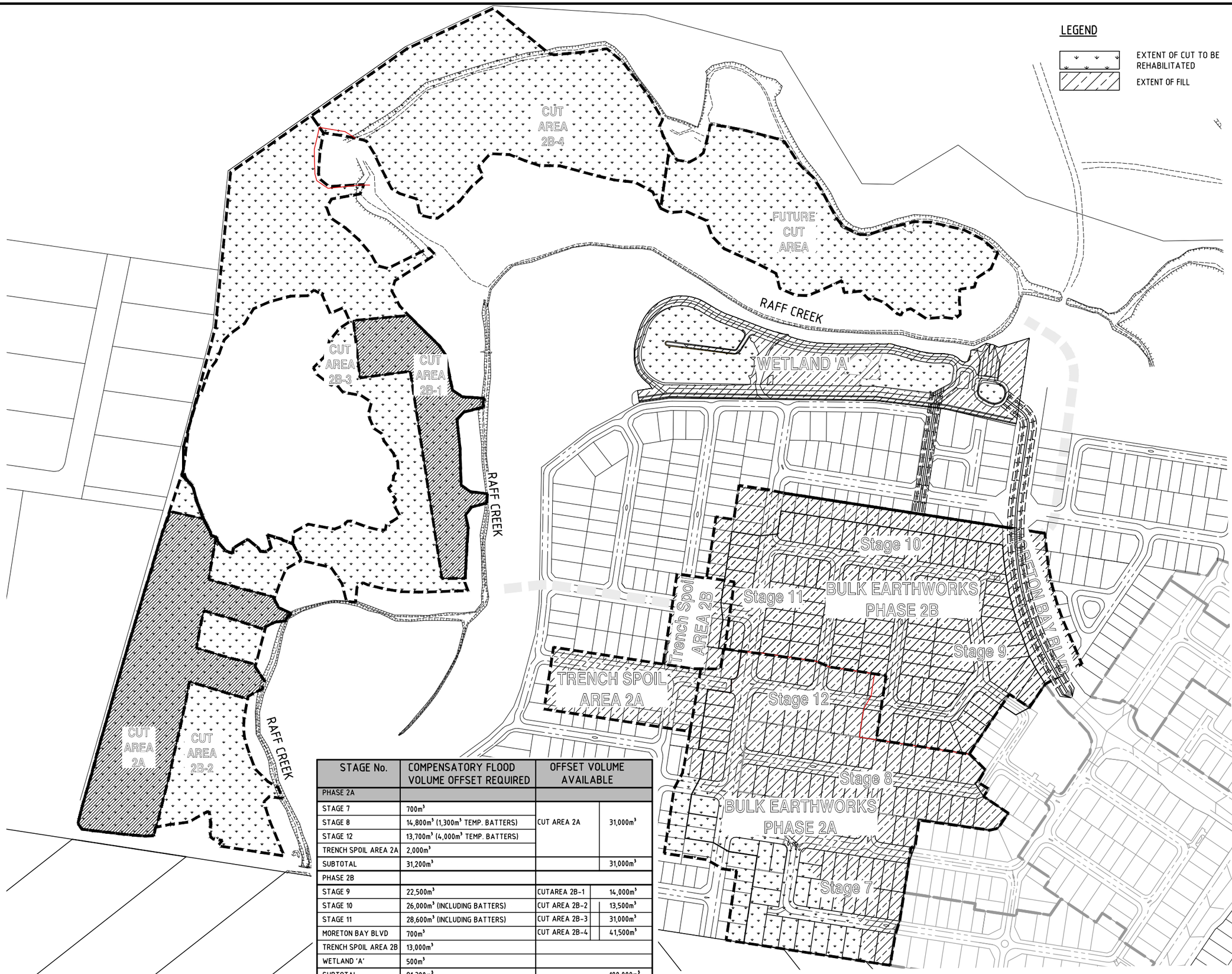
Drawing Title
EARTHWORKS SEDIMENTATION & EROSION CONTROL PLAN
SHEET 3 OF 3

Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15

Scale	Sheet
AS SHOWN	3 of 8

	Drawing No	Revision
A1	15-110-MCU3	A

T:\2015\15110 NEBP Phase 2 Bulk Earthworks\Engineering\Acad\MCU\15-110-MCU1.dwg, 6/05/2015 2:45:08 PM, rw



STAGE No.	COMPENSATORY FLOOD VOLUME OFFSET REQUIRED	OFFSET VOLUME AVAILABLE	
PHASE 2A			
STAGE 7	700m³		
STAGE 8	14,800m³ (1,300m³ TEMP. BATTERS)	CUT AREA 2A	31,000m³
STAGE 12	13,700m³ (4,000m³ TEMP. BATTERS)		
TRENCH SPOIL AREA 2A	2,000m³		
SUBTOTAL	31,200m³		31,000m³
PHASE 2B			
STAGE 9	22,500m³	CUTAREA 2B-1	14,000m³
STAGE 10	26,000m³ (INCLUDING BATTERS)	CUT AREA 2B-2	13,500m³
STAGE 11	28,600m³ (INCLUDING BATTERS)	CUT AREA 2B-3	31,000m³
MORETON BAY BLVD	700m³	CUT AREA 2B-4	41,500m³
TRENCH SPOIL AREA 2B	13,000m³		
WETLAND 'A'	500m³		
SUBTOTAL	91,300m³		100,000m³
TOTAL	122,500m³		131,000m³
		FUTURE CUT AREA	21,000m³

SCALE
20 10 0 20 40 60 80 100 120 140 160 180 200m
1 : 2000 (A1 UNREDUCED)

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Drawing Title
COMPENSATORY FLOOD VOLUME OFFSET

Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15

Scale	Sheet
AS SHOWN	4 of 8

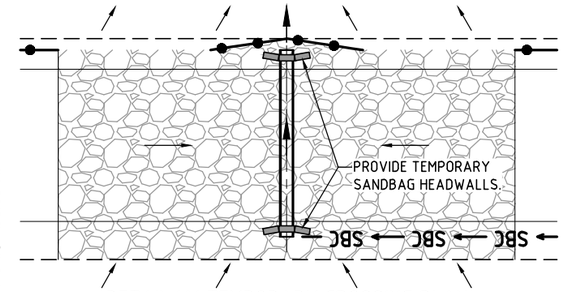
A1	Drawing No	Revision
	15-110-MCU4	A

EROSION AND SEDIMENT CONTROL PROGRAM

1. THIS PROGRAM AND ASSOCIATED PLANS SHOULD BE READ IN CONJUNCTION WITH THE SITE MANAGEMENT SPECIFICATION INCORPORATED IN THE CONTRACT DOCUMENTS. THE PROVISIONS OF THE SPECIFICATION ARE TO BE STRICTLY ADHERED TO.
2. THE BASIC OBJECTIVES OF THE EROSION AND SEDIMENT CONTROL ARE:
   I. IDENTIFY CRITICAL AREAS AND PROVIDE APPROPRIATE ATTENTION TO THOSE AREAS.
   II. PLAN SITE LAYOUTS SO THAT ACCESS TO ALL REQUIRED DRAINAGE EROSION AND SEDIMENT CONTROL MEASURE IS MAINTAINED.
   III. LIMIT EXPOSURE TIME BY PROGRAMMING TO MINIMISE THE AREA OF LAND EXPOSED TO POTENTIALLY ADVERSE WEATHER CONDITIONS AT ANY ONE TIME. I.E. PROGRESSIVELY CLEAR AND REVEGETATE.
   IV. PROVIDE CONTROL MEASURES INCLUDING TEMPORARY AND PERMANENT DRAINAGE, EROSION AND SEDIMENT CONTROLS.
3. THE EROSION AND SEDIMENT CONTROL SHALL COMPLY WITH BEST PRACTICE FOR EROSION AND SEDIMENT CONTROL, THE POLLUTION CONTROL MANUAL FOR URBAN STORMWATER MANAGEMENT, THE QUEENSLAND URBAN DRAINAGE MANUAL, AND THE SOIL EROSION AND SEDIMENT CONTROL - ENGINEERING GUIDELINES FOR QUEENSLAND (CURRENT EDITIONS).
4. CONSTRUCTION SEQUENCE THE CONSTRUCTION SEQUENCE WILL GENERALLY BE:
   I. OBTAIN ALL NECESSARY PERMITS AND APPROVALS BEFORE SITE ESTABLISHMENTS.
   II. HOLD A PRE-CONSTRUCTION CONFERENCE.
   III. STABILISE ALL CONSTRUCTION ACCESS ROUTES AND ENTRY/EXIT POINTS.
   IV. ESTABLISH SEDIMENT CONTROL STRUCTURES AND TEMPORARY DRAINAGE CONTROL MEASURES AS NECESSARY.
   V. CARRY OUT BULK EARTHWORKS.
   VI. MAINTAIN AND REPAIR DRAINAGE, EROSION AND SEDIMENT CONTROL MEASURES.
   VII. REMOVE SEDIMENT CONTROL MEASURES WHEN THE SITE IS STABILISED. I.E. >70% GROUND COVER
   VIII. THE CONTRACTOR SHALL PREPARE A SUPPLEMENTARY EROSION AND SEDIMENT CONTROL PLAN TO SUIT HIS/HER CONSTRUCTION METHODOLOGY, AND SUBMIT THIS PLAN FOR APPROVAL TO THE SUPERINTENDENT. IT SHOULD BE NOTED THAT ANY SIGNIFICANT VARIATION TO THIS PLAN MAY REQUIRE RESUBMISSION TO COUNCIL FOR APPROVAL. THE CLIENT SHALL NOT BE RESPONSIBLE FOR ANY SUCH ASSOCIATED DELAY.
5. ALL ESC DEVICES ARE TO BE INSPECTED WEEKLY, PRIOR TO EXPECTED AND AFTER RAINFALL ANY DAMAGE IS TO BE REPAIRED AS REQUIRED TO MAINTAIN THEIR EFFICACY.
6. ALL TEMPORARY EROSION AND SEDIMENT CONTROL (ESC) MEASURE TO BE MAINTAINED AND FULLY OPERATIONAL DURING THE MAINTENANCE PERIOD AND ARE TO BE REMOVED AFTER THE SATISFACTORY COMPLETION OF AN OFF-MAINTENANCE INSPECTION BY COUNCIL AND PRIOR TO FORMAL ACCEPTANCE "OFF MAINTENANCEö BY COUNCIL.
7. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR IS TO PROVIDE A DETAILED PROGRAM TO THE SUPERINTENDENT SHOWING THE TIMING FOR ALL WORKS ASSOCIATED WITH THE PROJECT, NOMINATING, IN PARTICULAR, THE PROGRAM FOR INSTALLATION OF SOIL AND EROSION CONTROL SYSTEMS.
8. EARTHWORKS SHALL BE CARRIED OUT IN SUCH A MANNER THAT THE SITE IS MAINTAINED IN A WELL DRAINED CONDITION, AREAS OF LOOSE SOIL ARE MINIMISED AND CONCENTRATIONS OF STORMWATER ARE MINIMISED. BULK EARTHWORKS WILL BE CARRIED OUT OVER THE ENTIRE SITE IN ONE STAGE.
9. CONSTRUCTION AREAS SHALL BE AT ONE NOMINATED POINT ON SOUTH DEEBING CREEK ROAD. A SHAKE DOWN AS DETAILED ON THE PLAN COMPRISING FREE DRAINAGE GRAVEL SHALL BE LOCATED ADJACENT TO THE POINT OF ACCESS WHERE VEHICLES CAN BE WASHED DOWN PRIOR TO EXIT TO THE STREET SYSTEM IF REQUIRED. THE WASH DOWN AREA SHALL BE KEPT FREE OF MUD.
10. FOR DETAILS OF ENTRY/EXIT SEDIMENT PAD REFER TO BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.48, FIGURE 2.6.
11. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVICES MAY BE REQUIRED AT THE DISCRETION OF THE SUPERINTENDENT.
12. SEDIMENTATION FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
13. WHERE SEDIMENT FENCES ARE SHOWN TO BE CONSTRUCTED IN AREAS OF SIGNIFICANT EARTHWORKS, ERECTION OF THE FENCE MAY BE DEFERRED UNTIL COMPLETION OF THE BULK EARTHWORKS, SUBJECT TO ABSENCE OF RAIN.

TREES

1. ENSURE COMPLIANCE WITH THE REQUIREMENTS OF AS4970 - TREES ON CONSTRUCTION SITES. THIS MAY REQUIRE CONSULTATION AND GUIDANCE FROM A CLASS V CERTIFIED ARBORIST AS TREES OUTSIDE THE IMMEDIATE WORK AREA MAY BE AFFECTED.



DETAIL 'A' TEMPORARY CROSSING PLAN
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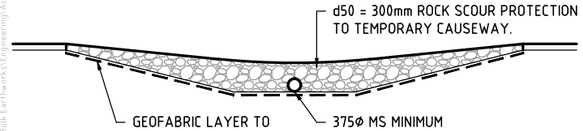

DETAIL 'A' TEMPORARY CROSSING SECTION
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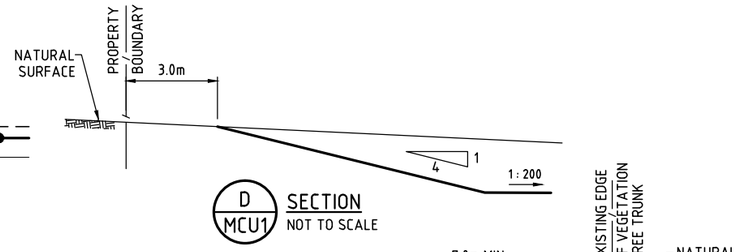

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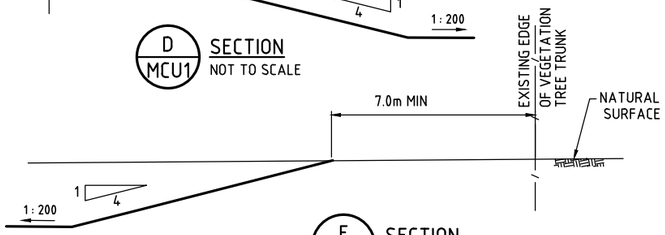
NOT TO SCALE



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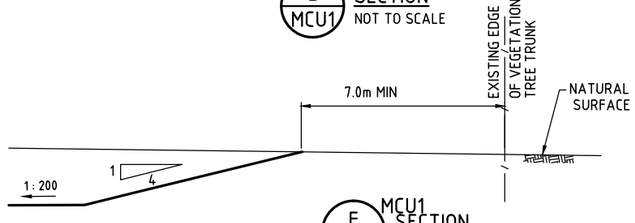

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NOT TO SCALE

EROSION AND SEDIMENTATION CONTROL NOTES:

TOPSOIL

1. STRIP AND STOCKPILE AVAILABLE TOPSOIL (ASSUMED AVERAGE DEPTH 150MM) FROM ALL DISTURBED AREAS PRIOR TO BULK EARTHWORKS. GRADE EVENLY BETWEEN ALLOTMENT FINISHED SURFACE LEVELS AND ENSURE LOTS ARE FREE DRAINING.
2. MINIMUM SLOPE ACROSS ALLOTMENTS TO BE 1%.
3. ALL FOOTPATHS, BATTERS, AND EARTHWORKS AFFECTED ALLOTMENTS ARE TO BE TOPSOILED TO A MINIMUM DEPTH OF 150MM (LIGHTLY COMPACTED) AND TURFED WHERE SPECIFIED.
4. SEDIMENT FENCES TO BE PLACED AS SHOWN. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.7. SEDIMENT FENCED TO BE REPAIRED AND EXCESSIVE SEDIMENT DEPOSITS SHALL BE REMOVED ONCE CAPACITY FALLS BELOW 75%

SEDIMENT FENCES

1. FOR DETAILS OF SEDIMENT FENCE REFER BEST PRACTICE EROSION & SEDIMENT CONTROL BOOK 1, PAGE 2.50, FIGURE 2.8.
2. SEDIMENT FENCES TO BE REPAIRED AS REQUIRED AND EXCESSIVE SEDIMENT DEPOSITS SHOULD BE REMOVED.
3. INSTALL KERB INLETS WITH GRAVEL RANGING FROM 50MM TO 75MM IN SIZE SHALL BE INSTALLED AT ALL COMPLETED INLETS. REFER IPWEAQ STANDARD DRAWING D-0041. THESE SHALL BE MAINTAINED IN A CLEAN CONDITION. IN THE EVENT OF HEAVY RAIN THEY SHALL BE REMOVED TO MINIMISE THE POTENTIAL FOR FLOODING.
4. CHECKS OF SILT CONTROL DEVICES ARE TO BE MADE WEEKLY, OR AFTER ANY SIGNIFICANT STORM EVENT TO ENSURE INTEGRITY AND PERFORMANCE.

TURFING

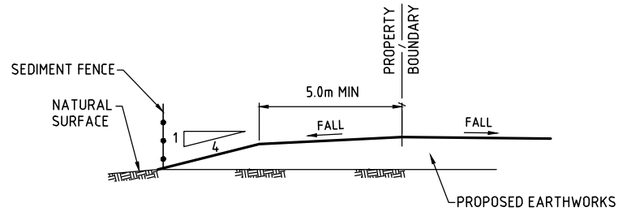
1. PROVIDE TURFING TO ENTIRE WIDTH OF ALL SWALES, FOOTPATHS, AND 1 IN 4 CUT AND FILL BATTERS.
2. FOOTPATH BATTERS ARE TO BE STABILISED WITH TOPSOIL (AND TURFED) AS SOON AS PRACTICAL AFTER THE BATTERS HAVE BEEN COMPLETED.

DURING CONSTRUCTION SEQUENCE:

1. TOPSOIL STOCKPILES SHALL BE LESS THAN 1M DEEP AND UNCOMPACTED. A SEDIMENTATION FENCE SHALL BE CONSTRUCTED ON THE D/S SIDE, OR THE STOCKPILE STABILISED WITH VEGETATION, MULCH, OR A SOIL STABILISER.
2. SEDIMENTATION FENCES TO BE PLACED AS SHOWN.
3. REGULARLY INSPECT BANKS AND REPAIR ANY SLUMPS, WHEEL TRACK DAMAGE OR LOSS OF FREEBOARD.
4. REMOVE SEDIMENT TO AVOID PONDING FROM CATCH DRAINS.
5. REMOVE EXCESSIVE SEDIMENT FROM UPSTREAM OF CHECK DAM.
6. ROAD RESERVE TO BE USED AS HAUL ROAD.
7. A CATCH DRAINOR DIVERSION BANK IS TO BE PROVIDED ON THE TOP SIDE OF ALL CUTS, WITH DISCHARGE EITHER TO UNDISTURBED GRASS LANDS OR TO THE CROSS ROAD DRAINAGE.
8. SUPPLEMENTARY EROSION AND SEDIMENT CONTROL DEVISED MAY BE REQUIRED AT THE DISCRETION OF THE ENGINEER.
9. WATER QUALITY SAMPLES MUST BE TAKEN AND ANALYSED PRIOR TO THE RELEASE OF ANY WATER FROM THE SEDIMENT POND. WATER QUALITY MUST SATISFY THE FOLLOWING CRITERIA: TSS<50MG/L PH BETWEEN 6.5 AND 8.5.
10. ALL WATER QUALITY DATA INCLUDING DATES OF RAINFALL, TESTING AND WATER RELEASE MUST BE MAINTAINED IN AN ON-SITE REGISTER. THIS REGISTER IS TO BE MAINTAINED FOR THE DURATION OF THE APPROVED WORKS AND BE AVAILABLE ON SITE FOR INSPECTION BY COUNCIL OFFICERS ON REQUEST.
11. EXPOSED AREAS ON LOTS ARE TO BE SEEDED AND MULCHED (E.G. HYDROMULCHED). MULCH SHALL BE APPLIED AT A MINIMUM RATE OF 2.5T/HA. ALTERNATIVELY THEY SHALL BE DRILL-SEEDED AND IRRIGATED SO AS TO ENSURE >70% GROUND COVER WITHIN 14 DAYS FROM NOVEMBER TO APRIL, OR 30 DAYS FROM MAY TO OCTOBER.

FOLLOWING CONSTRUCTION:

1. SEDIMENTATION FENCES TO BE MAINTAINED UNTIL TURFING IS COMPLETED.
2. SEDIMENT BASINS TO BE CHECKED AFTER EVERY SIGNIFICANT STORM AND DESILTED ONCE THE SETTLEMENT LIMIT HAS BEEN REACHED.



C MCU1 SECTION
NOT TO SCALE

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REVISIONS

No	Description	Date	By
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NORTH

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MCU
PHASE 2B

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ABN 35 112 053 611

Approved Director - RPEQ 1988

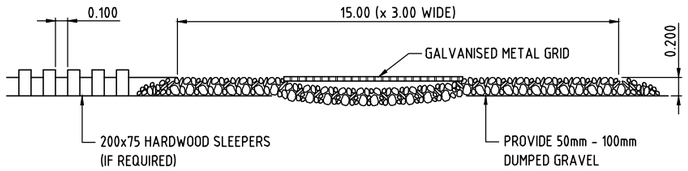
Drawing Title

SEDIMENT & EROSION CONTROL NOTES

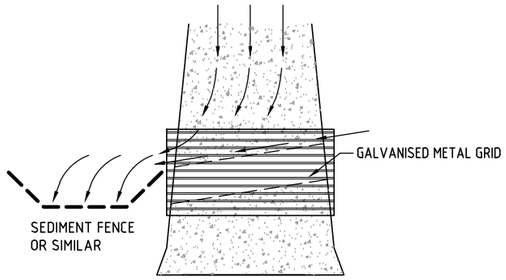
Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15

Scale	Sheet
AS SHOWN	5 of 8

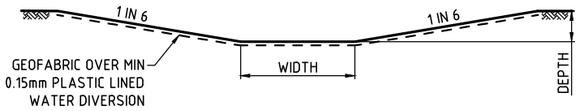
A1	Drawing No	Revision
	15-110-MCU5	A



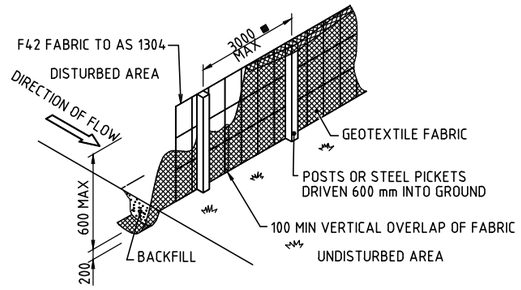
SITE ACCESS POINT SHAKEDOWN FACILITY
N.T.S.



SITE ACCESS POINT ENTRY/EXIT PAD
N.T.S.



TYPICAL LINED CATCH DRAIN
SCALE 1 : 40



SEDIMENT FENCE
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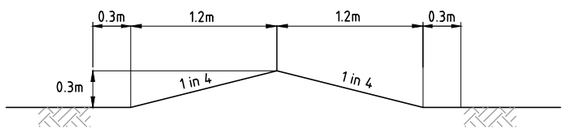

BUND SECTION
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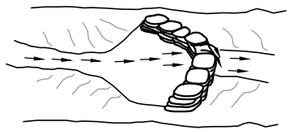
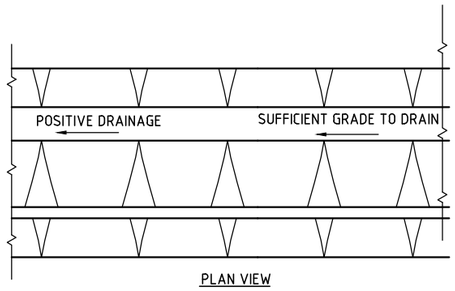
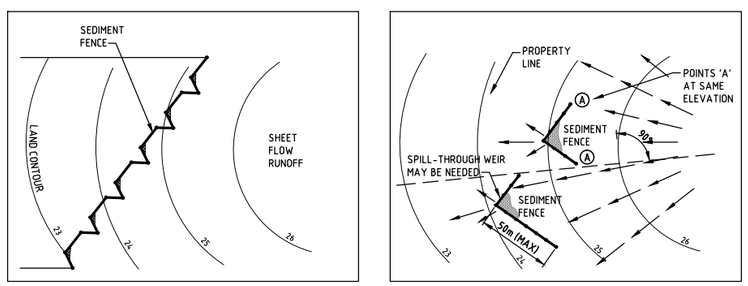


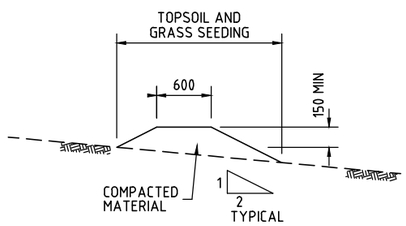
SANDBAG CHECK DAM
N.T.S.



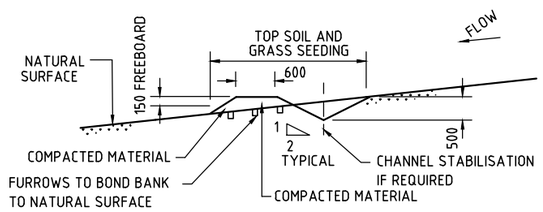
PLAN VIEW



SILT FENCE DETAILS



DIVERSION DRAINAGE BANK
N.T.S.



PLACE FILTER FABRIC ACROSS DRAIN AT 30m MAXIMUM INTERVALS AND AT OUTLET OF DRAIN, OR AS REQUIRED TO CONTROL SEDIMENT MOVEMENT ALONG DRAIN.

CROSS SECTION

CATCHMENT DRAIN
N.T.S.

SCALE 0.4 0.2 0 0.4 0.8 1.2 1.6 2.0 2.4 2.8 3.2 3.6 4.0m
1 : 40 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW

NORTH

Client

NorthEast BUSINESS PARK

Project

North Harbour
feel right at home

Project

BULK EARTHWORKS
MCU
PHASE 2B

KN GROUP PTY LTD
CONSULTING ENGINEERS
LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au
ABN 35 112 053 611

Approved Director - RPEQ 1988

Drawing Title
SEDIMENT & EROSION CONTROL DETAILS

Drawn	Designed	Checked	Date
ND	JB	GBG	APR 15

Scale	Sheet
AS SHOWN	of 8

	Drawing No	Revision
A1	15-110-MCU6	A

BASIN NOTES

1. ALL BASINS SHALL BE CONSTRUCTED PRIOR TO THE COMMENCMENT OF MAJOR EARTHWORKS IN THE RELEVANT CATCHMENT.
2. AN APPROPRIATELY MARKED (E.G. PAINTED) DE-SILTING MARKER POST MUST BE INSTALLED IN THE BASIN TO INDICATE THE TOP OF THE SEDIMENT STORAGE ZONE. THE BASIN MUST BE DE-SILTED. IF THE SEDIMENT IS ALREADY ABOVE THIS MARKER POINT, OR IF THE NEXT STORM IS LIKELY TO CAUSE SEDIMENT TO SETTLE ABOVE THIS MARKER POINT.
3. PRIOR TO DISCHARGE OF WATER FROM A SEDIMENT BASIN, IT IS ESSENTIAL FOR THE WATER QUALITY TO COMPLY WITH ALL SPECIFIED WATER QUALITY OBJECTIVES (WQOS) (E.G. WATER PH IN THE RANGE OF 6.5 – 8.5).
4. THE RECOMMENDED WATER QUALITY STANDARD FOR SEDIMENT BASINS IS PRESENTED IN TABLE B18.

TABLE B18 – RECOMMENDED DISCHARGE STANDARD FOR DE-WATERING OPERATIONS

SITE CONDITIONS	DISCHARGE WATER QUALITY STANDARD
POST-STORM DE-WATERING OF SEDIMENT BASINS (E.G. TYPE F AND D BASINS, AND TYPE C BASINS OPERATING AS WET-BASINS).	90 PERCENTILE TOTAL SUSPENDED SOLIDS (TSS) CONCENTRATION NOT EXCEEDING 50MG/L.

TECHNICAL NOTES B5 – BASIN FLOCCULATION

THE CONTRACTOR SHALL, IN CONJUNCTION WITH THE SITE EROSION AND SEDIMENT CONTROL SPECIALIST, DETERMINE THE MOST APPROPRIATE FLOCCULANT FOR THE SITE. A PROCEDURE FOR THE MANUAL DOSING OF GYPSUM OR SIMILAR (DEVELOPED FROM LANDCOM, 2004) IS AS FOLLOWS:

1. PLACE REQUIRED GYPSUM QUANTITY (SAY 32KG/100M3 OF WATER) IN APPROXIMATELY 50L DRUM PERFORATED WITH 25MM HOLES AT 150MM SPACING.
2. SUSPEND THE SCREENED, RECIRCULATING PUMP INTAKE INTO THE DRUM.
3. LIFT THE DRUM INTO THE BASIN SUCH THAT BASIN WATER CAN ENTER AND CIRCULATED THROUGH THE DRUM.
4. USING THE PUMP, SPRAY THE GYPSUM-RICH SOLUTION EVENLY OVER THE SURFACE OF THE BASIN UNTIL THE GYPSUM IS FULLY REMOVED FROM THE DRUM. THE PUMP OUTLET MUST SPRAY THE MIXTURE OVER A WIDE AREA RATHER THAN JUST DISCHARGING AS A CONFINED "JET".
5. ALTERNATIVELY, IF TWO PUMPS ARE AVAILABLE, USE THE TWO PUMPS TO CIRCULATE BASIN WATER FIRST TO THE ON-SHORE TANK, AND THEN FROM THE TANK OVER THE SURFACE OF THE BASIN. A LARGE MIXING TANK WILL USUALLY BE REQUIRED.
6. ALTERNATIVE PRODUCTS INCLUDE POLYALUMINIUM CHLORIDE (PAC), POLYACRYLAMIDE (PAC).

B3 BASIN CONSTRUCTION AND MAINTENANCE MATERIALS

- EARTH FILL: CLEAN SOIL WITH EMERSON CLASS 2(1), 3, 4, OR 5, AND FREE OF ROOTS, WOODY VEGETATION, ROCKS AND OTHER UNSUITABLE MATERIAL. SOIL WITH EMERSON CLASS 4 AND 5 MAY NOT BE SUITABLE DEPENDING ON PARTICLE SIZE AND DISTRIBUTION AND DEGREE OF DISPERSION. CLASS 2(1) SHOULD ONLY BE USED UPON RECOMMENDATION FROM GEOTECHNICAL SPECIALIST. [ALTERNATIVELY, SET A STANDARD BASED ON EXCHANGEABLE SODIUM PERCENTAGE – SEEK EXPERT ADVICE.]
- RISER PIPE: MINIMUM 250MM DIAMETER.
- SPILLWAY ROCK: HARD, ANGULAR, DURABLE, WEATHER RESISTANT AND EVENLY GRADED ROCK WITH 50% BY WEIGHT LARGER THAN THE SPECIFIED NOMINAL (D50) ROCK SIZE. LARGER ROCK SHOULD DOMINATE, WITH SUFFICIENT SMALL ROCK TO FILL THE VOIDS BETWEEN THE LARGER ROCK. THE DIAMETER OF THE LARGEST ROCK SIZE SHOULD BE NO LARGER THAN 1.5 TIMES THE NOMINAL ROCK SIZE. THE SPECIFIC GRAVITY SHOULD BE AT LEAST 2.5.
- GEOTEXTILE FABRIC: HEAVY-DUTY, NEEDLE-PUNCHED, NON-WOVEN FILTER CLOTH, MINIMUM BIDIM A24 OR EQUIVALENT.

CONSTRUCTION

1. NOTWITHSTANDING ANY DESCRIPTION CONTAINED WITHIN THE APPROVED PLANS OR SPECIFICATIONS, THE CONTRACTOR SHALL BE RESPONSIBLE FOR SATISFYING THEMSELVES AS TO THE NATURE AND EXTENT OF THE SPECIFIED WORKS AND THE PHYSICAL AND LEGAL CONDITIONS UNDER WHICH THE WORKS WILL BE CARRIED OUT. THIS SHALL INCLUDE MEANS OF ACCESS, EXTENT OF CLEARING, NATURE OF MATERIAL TO BE EXCAVATED, TYPE AND SIZE OF MECHANICAL PLAN REQUIRED, LOCATION AND SUITABILITY OF WATER SUPPLY FOR CONSTRUCTION AND TESTING PURPOSES, AND ANY OTHER LIKE MATTERS AFFECTING THE CONSTRUCTION OF THE WORKS.
2. REFER TO APPROVED PLANS FOR LOCATION, DIMENSIONS, AND CONSTRUCTION DETAILS. IF THERE ARE QUESTIONS OR PROBLEMS WITH THE LOCATION, DIMENSIONS, OR METHOD OF INSTALLATION, CONTACT THE ENGINEER OR RESPONSIBLE ON-SITE OFFICER FOR ASSISTANCE.
3. BEFORE STARTING ANY CLEARING OR CONSTRUCTION, ENSURE ALL THE NECESSARY MATERIALS AND COMPONENTS ARE ON THE SITE TO AVOID DELAYS IN COMPLETING THE POND ONCE WORKS BEGIN.
4. INSTALL REQUIRED SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE PROPOSED EARTHWORKS TO CONTROL SEDIMENT RUNOFF DURING CONSTRUCTION OF THE BASIN.
5. THE AREA TO BE COVERED BY THE EMBANKMENT, BORROW PITS AND INCIDENTAL WORKS, TOGETHER WITH AN AREA EXTENDING BEYOND THE LIMITS OF EACH FOR A DISTANCE NOT EXCEEDING FIVE (5) METRES ALL AROUND MUST BE CLEARED OF ALL TREES, SCRUB, STUMPS, ROOTS, DEAD TIMBER AND RUBBISH AND DISPOSED OF IN A SUITABLE MANNER. DELAY CLEARING THE MAIN POND AREA UNTIL THE EMBANKMENT IS COMPLETE. [MODIFY AS NECESSARY TO LIMIT TOTAL AREA OF DISTURBANCE AND ANY DAMAGE TO PROTECTED VEGETATION].
6. ENSURE ALL HOLES MADE BY GRUBBING WITHIN THE EMBANKMENT FOOTPRINT ARE FILLED WITH SOUND MATERIAL, ADEQUATELY COMPACTED, AND FINISHED FLUSH WITH THE NATURAL SURFACE.
7. IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

CUT-OFF TRENCH:

1. BEFORE CONSTRUCTION OF THE CUT-OFF TRENCH OR ANY ANCILLARY WORKS WITHIN THE EMBANKMENT FOOTPRINT, ALL GRASS GROWTH AND TOPSOIL MUST BE REMOVED FROM THE AREA TO BE OCCUPIED BY THE EMBANKMENT AND MUST BE DEPOSITED CLEAR OF THIS AREA AND RESERVED FOR TOPDRESSING THE COMPLETING EMBANKMENT.
2. EXCAVATE A CUT-OFF TRENCH ALONG THE CENTRE LINE OF THE EARTH FILL EMBANKMENT. CUT THE TRENCH TO STABLE SOIL MATERIAL, BUT IN NO CASE MAKE IT LESS THAN 600MM DEEP. THE CUT-OFF TRENCH MUST EXTEND INTO BOTH ABUTMENTS TO AT LEAST THE ELEVATION OF THE RISER PIPE CREST. MAKE THE MINIMUM BOTTOM WIDTH WIDE ENOUGH TO PERMIT OPERATION OF EXCAVATION AND COMPACTION EQUIPMENT, BUT IN NO CASE LESS THAN 600MM. MAKE THE SIDE SLOPES OF THE TRENCH NO STEEPER THAN 1:1 (H:V).
3. ENSURE ALL WATER, LOOSE SOIL, AND ROCK ARE REMOVED FROM THE TRENCH BEFORE BACKFILLING COMMENCES. THE CUT-OFF TRENCH MUST BE BACKFILLED WITH SELECTED EARTH-FILL OF THE TYPE SPECIFIED FOR THE EMBANKMENT, AND THIS SOIL MUST HAVE A MOISTURE CONTENT AND DEGREE OF COMPACTION THE SAME AS THAT SPECIFIED FOR THE SELECTED CORE ZONE.
4. MATERIAL EXCAVATED FROM THE CUT-OFF TRENCH MAY BE USED IN CONSTRUCTION OF THE EMBANKMENT PROVIDED IT IS SUITABLE AND IT IS PLACED IN THE CORRECT ZONE ACCORDING TO ITS CLASSIFICATION.

EMBANKMENT:

1. SCARIFY AREAS ON WHICH FILL IS TO BE PLACED BEFORE PLACING THE FILL.
2. ENSURE ALL FILL MATERIAL USED TO FORM THE EMBANKMENT MEETS THE SPECIFICATIONS CERTIFIED BY A GEOTECHNICAL SPECIALIST.
3. THE FILL MATERIAL MUST CONTAIN SUFFICIENT MOISTURE SO IT CAN BE FORMED BY HAND INTO A BALL WITHOUT CRUMBLING. IF WATER CAN BE SQUEEZED OUT OF THE BALL, IT IS TOO WET FOR PROPER COMPACTION. PLACE FILL MATERIAL IN 150 TO 250MM CONTINUOUS LAYERS OVER THE ENTIRE LENGTH OF THE FILL AREA THEN COMPACT BEFORE PLACEMENT OF FURTHER FILL.
4. PLACE RISER PIPE OUTLET SYSTEM, IF SPECIFIED, IN APPROPRIATE SEQUENCE WITH THE EMBANKMENT FILLING. REFER TO SPECIFICATIONS SUPPLIED BELOW.
5. UNLESS OTHERWISE SPECIFIED ON THE APPROVED PLANS, COMPACT THE SOIL AT ABOUT 1% TO 2% WET OF OPTIMUM AND TO 95% MODIFIED OR 100% STANDARD COMPACTION.
6. WHERE BOTH DISPERSIVE AND NON-DISPERSIVE CLASSIFIED EARTH-FILL MATERIALS ARE AVAILABLE, NON-DISPERSIVE EARTH-FILL MUST BE USED IN THE CORE ZONE. THE REMAINING CLASSIFIED EARTH-FILL MATERIALS MUST ONLY BE USED AS DIRECTED BY [INSERT TITLE].
7. WHERE SPECIFIED, CONSTRUCT THE EMBANKMENT TO AN ELEVATION 10% HIGHER THAN THE DESIGN HEIGHT TO ALLOW FOR SETTLING; OTHERWISE FINISHED DIMENSIONS OF THE EMBANKMENT AFTER SPREADING OF TOPSOIL MUST CONFORM TO THE DRAWING WITH A TOLERANCE OF 75MM FORM THE SPECIFIED DIMENSIONS.
8. ENSURE DEBRIS AND OTHER UNSUITABLE BUILDING WASTE IN NOT PLACED WITHIN THE EARTH EMBANKMENT.
9. AFTER COMPLETION OF THE EMBANKMENT ALL LOOSE UNCOMPACTED EARTH-FILL MATERIAL OF THE UPSTREAM AND DOWNSTREAM BATTER MUST BE REMOVED PRIOR TO SPREADING OF TOPSOIL.
10. TOPSOIL AND REVEGETATE/STABILISED ALL EXPOSED EARTH AS DIRECTED WITHIN THE APPROVED PLANS.
11. WHERE THE SITE IS TO BE REVEGETATED, THE TOPSOIL AND UPPER 500MM OF THE SUBSOIL SHALL MEET THE SPECIFICATIONS SET BY A SOIL SCIENTIST.

ESTABLISHMENT OF SETTLING POND:

1. THE AREA TO BE COVERED BY THE STORED WATER OUTSIDE THE LIMITS OF THE BORROW PITS MUST BE CLEARED OF ALL SCRUB AND RUBBISH. TREES MUST BE CUT DOWN STUMP HIGH AND REMOVED FROM THE IMMEDIATE VICINITY OF THE WORK.
2. ESTABLISH ALL REQUIRED INFLOW CHUTES AND INLET BAFFLES, IF SPECIFIED, TO ENABLE WATER TO DISCHARGE INTO THE BASIN IN A MANNER THAT WILL NOT CAUSE SOIL EROSION NOR THE RE-SUSPENSION OF SETTLED SEDIMENT.
3. INSTALL A SEDIMENT STORAGE LEVEL MARKER POST WITH A CROSS MEMBER SET JUST BELOW THE TOP OF THE SEDIMENT STORAGE ZONE (AS SPECIFIED ON THE APPROVED PLANS). USE AT LEAST A 75MM WIDE POST FIRMLY SET INTO THE BASIN FLOOR.
4. IF SPECIFIED, INSTALL INTERNAL SETTLING POND BAFFLES. ENSURE THE CREST OF THESE BAFFLES IS SET LEVEL WITH OR JUST BELOW, THE ELEVATION OF THE EMERGENCY SPILLWAY CREST.
5. INSTALL ALL APPROPRIATE MEASURE TO MINIMISE SAFETY RISK TO ON-SITE PERSONNEL AND THE PUBLIC CAUSED BY THE PRESENCE OF THE SETTLING POND. AVOID STEEP, SMOOTH INTERNAL SLOPES. APPROPRIATELY FENCE THE SETTLING POND AND POST WARNING SIGNS IF UNSUPERVISED ACCESS IS LIKELY OR THERE IS CONSIDERED TO BE AN UNACCEPTABLE RISK TO THE PUBLIC.

SPILLWAY CONSTRUCTION:

1. THE SPILLWAY MUST BE EXCAVATED AS SHOWN ON THE PLANS, AND THE EXCAVATED MATERIAL IF CLASSIFIED AS SUITABLE, MUST BE USED IN THE EMBANKMENT, AND IF NOT SUITABLE IT MUST BE DISPOSED OF INTO SPOIL HEAPS.
2. ENSURE EXCAVATED DIMENSIONS ALLOW ADEQUATE BOXING-OUT SUCH THAT THE SPECIFIED ELEVATIONS, GRADES, CHUTE WIDTH, AND ENTRANCE AND EXIT SLOPES FOR THE EMERGENCY SPILLWAY WILL BE ACHIEVED AFTER PLACEMENT OF THE ROCK OR OTHER SCOUR PROTECTION MEASURES AS SPECIFIED IN THE PLANS.
3. PLACE SPECIFIED SCOUR PROTECTION MEASURES ON THE EMERGENCY SPILLWAY. ENSURE THE FINISHED GRADE BLENDS WITH THE SURROUNDING AREA TO ALLOW A SMOOTH FLOW TRANSITION FROM SPILLWAY TO DOWNSTREAM CHANNEL.
4. IF A SYNTHETIC FILTER FABRIC UNDERLAY IS SPECIFIED, PLACE THE FILTER FABRIC DIRECTLY ON THE PREPARED FOUNDATION. IF MORE THAN 1 SHEET OF FILTER FABRIC IS REQUIRED, OVERLAP THE EDGES BY AT LEAST 300MM AND PLACE ANCHOR PINS AT MINIMUM 1M SPACING ALONG THE OVERLAP. BURY THE UPSTREAM END OF THE FABRIC A MINIMUM 300MM BELOW GROUND AND WHERE NECESSARY, BURY THE LOWER END OF THE FABRIC OR OVERLAP A MINIMUM 300MM OVER THE NEXT DOWNSTREAM SECTION AS REQUIRED. ENSURE THE FILTER FABRIC EXTENDS AT LEAST 1000MM UPSTREAM OF THE SPILLWAY CREST.
5. TAKE CARE NOT TO DAMAGE THE FABRIC DURING OR AFTER PLACEMENT. IF DAMAGE OCCURS, REMOVE THE ROCK AND REPAIR THE SHEET BY ADDING ANOTHER LAYER OF FABRIC WITH A MINIMUM OVERLAP OF 300MM AROUND THE DAMAGED AREA. IF EXTENSIVE DAMAGE IS SUSPECTED, REMOVE AND REPLACE THE ENTIRE SHEET.
6. WHERE LARGE ROCK IS USED, OR MACHINE PLACEMENT IS DIFFICULT, A MINIMUM 100MM LAYER OF FINE GRAVEL, AGGREGATE, OR SAND MAY BE NEEDED TO PROTECT THE FABRIC.
7. PLACEMENT OF ROCK SHOULD FOLLOW IMMEDIATELY AFTER PLACEMENT OF THE FILTER FABRIC. PLACE ROCK SO THAT IF FORMS A DENSE, WELL-GRADED MASS OF ROCK WITH A MINIMUM OF VOIDS. THE DESIRED DISTRIBUTION OF ROCK THROUGHOUT THE MASS MAY BE OBTAINED BY SELECTIVE LOADING AT THE QUARRY AND CONTROLLED DUMPING DURING FINAL PLACEMENT.
8. THE FINISHED SLOPE SHOULD BE FREE OF POCKETS OF SMALL ROCK OR CLUSTERS OF LARGE ROCKS. HAND PLACING MAY BE NECESSARY TO ACHIEVE THE PROPER DISTRIBUTION OF ROCK SIZES TO PRODUCE A RELATIVELY SMOOTH, UNIFORM SURFACE. THE FINISHED GRADE OF THE ROCK SHOULD BLEND WITH THE SURROUNDING AREA. NO OVERFALL OR PROTRUSION OF ROCK SHOULD BE APPARENT.
9. ENSURE THAT THE FINAL ARRANGEMENT OF THE SPILLWAY CREST WILL NOT PROMOTE EXCESSIVE FLOW THROUGH THE ROCK SUCH THAT THE WATER CAN BE RETAINED WITHIN THE SETTLING BASIN AN ELEVATION NO LESS THAN 50MM ABOVE OR BELOW THE NOMINATED SPILLWAY CREST ELEVATION.

MAINTENANCE OF SEDIMENT BASIN

1. INSPECT THE SEDIMENT BASIN DURING THE FOLLOWING PERIODS:
   (i) DURING CONSTRUCTION TO DETERMINE WHETHER MACHINERY, FALLING TREES, OR CONSTRUCTION ACTIVITY HAS DAMAGED ANY COMPONENTS OF THE SEDIMENT BASIN. IF DAMAGE HAS OCCURRED, REPAIR IT.
   (ii) AFTER EACH RUNOFF EVENT. INSPECT THE EROSION DAMAGE AT FLOW ENTRY AND EXIT POINTS. IF DAMAGE HAS OCCURRED, MAKE THE NECESSARY REPAIRS.
   (iii) AT LEAST WEEKLY DURING THE NOMINATED WET SEASON (IF ANY) OTHERWISE AT LEAST FORTNIGHTLY.
   (i) PRIOR TO, AND IMMEDIATELY AFTER, PERIOD OF "STOP WORK" OR SITE "SHUTDOWN".
2. CLEAN OUT ACCUMULATED SEDIMENT WHEN IT REACHES THE MARKER BOARD/POST, AND RESTORE THE ORIGINAL STORAGE VOLUME. PLACE SEDIMENT IN A DISPOSABLE AREA OR, IF APPROPRIATE, MIX WITH DRY SOIL ON THE SITE.
3. DO NOT DISPOSE OF SEDIMENT IN A MANNER THAT WILL CREATE AN EROSION OR POLLUTION HAZARD.
4. CHECK ALL VISIBLE PIPE CONNECTIONS FOR LEAKS, AND REPAIR AS NECESSARY.
5. CHECK FILL MATERIAL IN THE DAM FOR EXCESSIVE SETTLEMENT, SLUMPING OF THE SLOPES OR PIPING BETWEEN THE CONDUIT AND THE EMBANKMENT; MAKE ALL NECESSARY REPAIRS.
6. REMOVE ALL TRASH AND OTHER DEBRIS FROM THE BASIN AND RISER.
7. SUBMERGED INFLOW PIPES MUST BE INSPECTED AND DE-SILTED (AS REQUIRED) AFTER EACH INFLOW EVENT.

REMOVAL OF SEDIMENT BASIN

1. WHEN GRADING AND CONSTRUCTION IN THE DRAINAGE AREA ABOVE A TEMPORARY SEDIMENT BASIN IS COMPLETED AND THE DISTURBED AREAS ARE ADEQUATELY STABILISED (>70% GROUND COVER), THE BASIN MUST BE REMOVED OR OTHERWISE INCORPORATED INTO THE PERMANENT STORMWATER DRAINAGE SYSTEM. IN EITHER CASE, SEDIMENT SHOULD BE CLEARED AND PROPERLY DISPOSED OF AND THE BASIN AREA STABILISED.
2. BEFORE STARTING ANY MAINTENANCE WORK ON THE BASIN OR SPILLWAY, INSTALL ALL NECESSARY SHORT-TERM SEDIMENT CONTROL MEASURES DOWNSTREAM OF THE SEDIMENT BASIN.
3. ALL WATER AND SEDIMENT MUST BE REMOVED FROM THE BASIN PRIOR TO THE DAM'S REMOVAL. DISPOSE OF SEDIMENT AND WATER IN A MANNER THAT WILL NOT CREATE AN EROSION OR POLLUTION HAZARD.
4. BRING THE DISTURBED AREA TO A PROPER GRADE, THEN SMOOTH, COMPACT, AND STABILISE AND/OR REVEGETATE AS REQUIRED TO ESTABLISH A STABLE LAND SURFACE.

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW

NORTH

Client

NorthEast BUSINESS PARK

Project

North Harbour feel right at home

Project

BULK EARTHWORKS
MCU
PHASE 2B

KN GROUP PTY LTD CONSULTING ENGINEERS
LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au
ABN 35 112 053 611

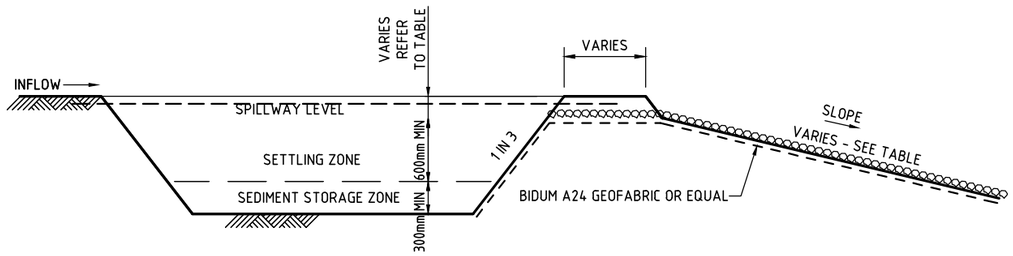
Approved Director - RPEQ 1988

Drawing Title
SEDIMENT & EROSION CONTROL NOTES

Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15

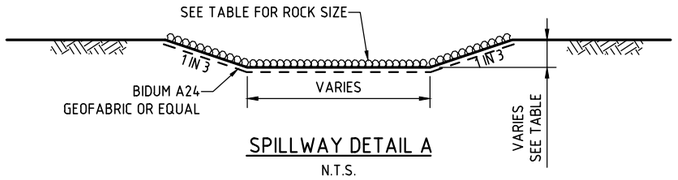
Scale	Sheet
AS SHOWN	7 of 8

A1	Drawing No	Revision
	15-110-MCU7	A



TYPE C BASIN DETAIL

N.T.S.



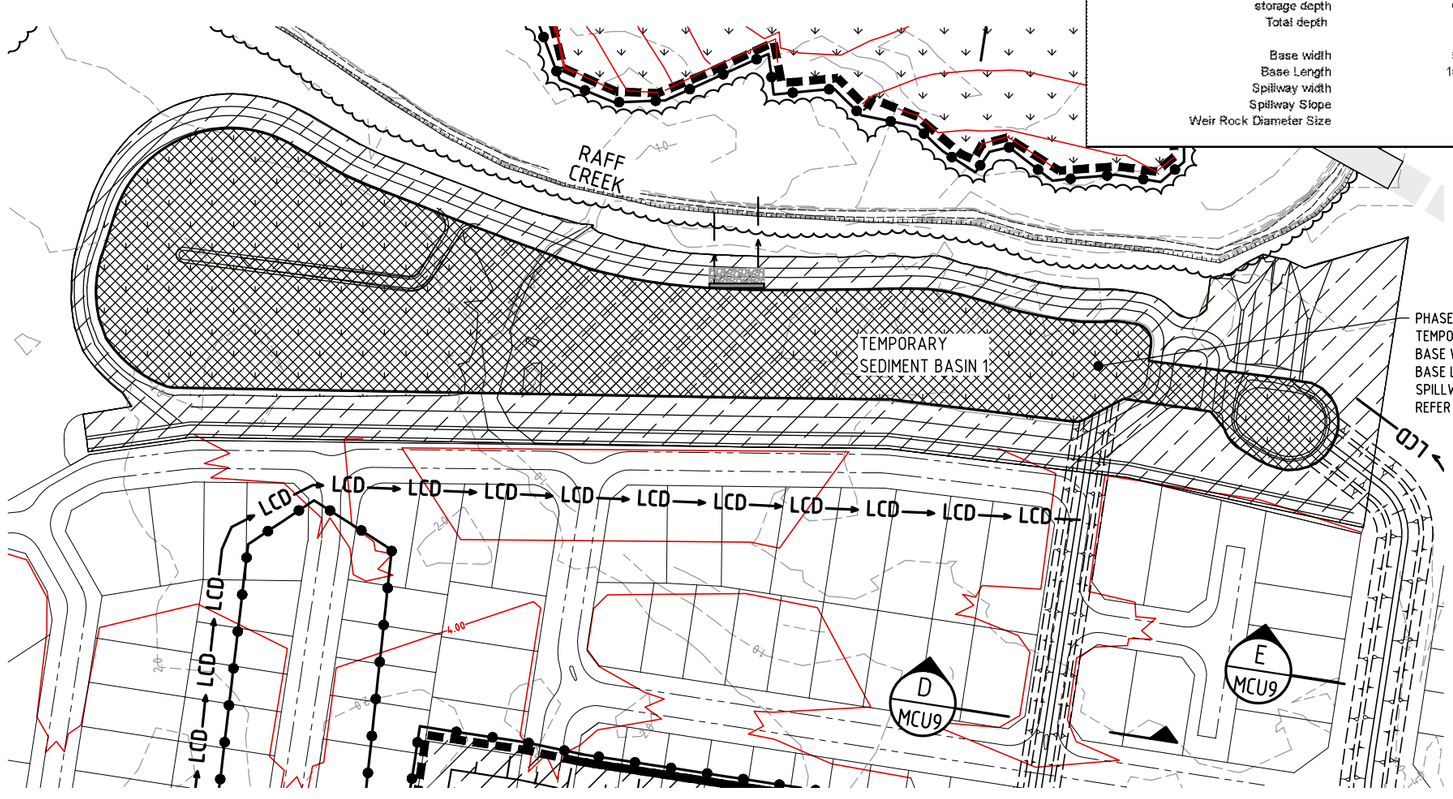
SPILLWAY DETAIL A

N.T.S.

Job No. 15-110
Client: Port Binnli
Project: North Harbour - North East Business Park

	Basin	Basin	Basin	Basin	Basin		
Basin	**1**	**5,7,8,9,10**	**11**	**2,3,6,12**	**4**		
Basin Design	Type D	Type D	Type D	Type D	Type D		
Contributing Stages							
R(y%5day)	63	63	63	63	63	mm	Table B5 (90th%-sensitive receiving water)
Soil Type	Clay	Clay	Clay	Clay	Clay		
Cv	0.67	0.67	0.67	0.67	0.67		Table B7 (interpolated)
Effective catchment area (A)	11.00	1.50	2.00	2.50	3.50	Ha	
Vs (volume of settling zone)	4643.1	633.2	844.2	1055.3	1477.4	m3	Vs = 10.R(y%5day).Cv.A
settling depth	0.6	0.6	0.6	0.6	0.6	m	
Area of basin	7738.5	1055.3	1407.0	1758.8	2462.3	m2	
Base width	50.8	18.8	21.7	24.2	28.6	m	
Base length	152.4	56.3	65.0	72.6	85.9	m	
settling zone Volume check	4643.1	633.2	844.2	1055.3	1477.4	m3	= required volume therefore ok
Spillway Design							
Less than 3month operation	Q10	Q10	Q10	Q10	Q10		
3-12month operation	Q20	Q20	Q20	Q20	Q20		Life of basin Chosen
greater than 12 months	Q100	Q100	Q100	Q100	Q100		
Intensity for a 20 year, 6 min event	227.0	227.0	227.0	227.0	227.0	mm/hr	(MBRC - Caboolture)
C10 value	0.88	0.88	0.88	0.88	0.88		Factor by 1.05 for C20
Effective catchment area (a)	11.0	1.5	2.0	2.5	3.5	Ha	
Q (flow rate)	**6.41**	**0.87**	**1.17**	**1.46**	**2.04**	m3/s	flow to design for weir and spillway
(n)	0.025	0.025	0.025	0.025	0.025		Mannings value for rock rip rap
width of spillway	18.0	18.0	18.0	18.0	18.0	m	
yc = 2/3H depth of flow over spillway	0.13	0.13	0.13	0.13	0.13	m	(Maximum 0.45m, IECA 2008, Page B.35)
gradient of spill way "wings"	2.0	2.0	2.0	2.0	2.0	:1	
area spillway (using gradient 2:1)	2.44	2.44	2.44	2.44	2.44		area (cross section) of spillway
perimeter	18.6	18.6	18.6	18.6	18.6	m	wetted perimeter
Slipway outlet slope (S)	0.100	0.100	0.100	0.100	0.100		
(R)	0.13	0.13	0.13	0.13	0.13	m	(area/wetted perimeter)
Velocity (V)	3.3	3.3	3.3	3.3	3.3	m/s	V=R^(2/3) * S^(1/2) / n
Check against design flow (Q)	**7.9**	**7.9**	**7.9**	**7.9**	**7.9**	m3/s	OK
Bottom velocity (V)	2.3	2.3	2.3	2.3	2.3	m/s	
Weir Flow Calculation (H)	0.2	0.2	0.2	0.2	0.2	m	Maximum Depth above weir
Check on against design flow rate (Q)	**2.78**	**2.78**	**2.78**	**2.78**	**2.78**	m3/s	OK refer Table A21 IECA

Summary	Basin	Basin	Basin	Basin	Basin		
Basin to be constructed in Cut/Fill	Cut	Cut	Cut	Cut	Cut		
Minimum required depth of weir	0.35	0.35	0.35	0.35	0.35	m	
settling depth	0.60	0.60	0.60	0.60	0.60	m	
storage depth	0.60	0.60	0.60	0.60	0.60	m	
Total depth	1.55	1.55	1.55	1.55	1.55	m	
Base width	50.8	18.8	21.7	24.2	28.6	m	
Base Length	152.4	56.3	65.0	72.6	85.9	m	
Spillway width	18.0	18.0	18.0	18.0	18.0	m	
Spillway Slope	10	10	10	10	10	1 in	
Weir Rock Diameter Size	200	200	200	200	200	mm	Sized using QUDM figure 8.13



TEMPORARY SEDIMENT BASIN S1

SCALE 1:1000

LEGEND

- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- SBC — SANDBAG CHECK DAMS
- CD — CATCHMENT DRAIN
- GEO LINED SWALE
- LCD — LINED CATCH DRAIN
- TEMPORARY SEDIMENT BASIN

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100m

1 : 1000 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW

NORTH

Client

NorthEast BUSINESS PARK

Project

North Harbour feel right at home

Project

BULK EARTHWORKS
MCU
PHASE 2B

KN GROUP PTY LTD CONSULTING ENGINEERS
LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au
ABN 35 112 053 611

Approved Director - RPEQ 1988

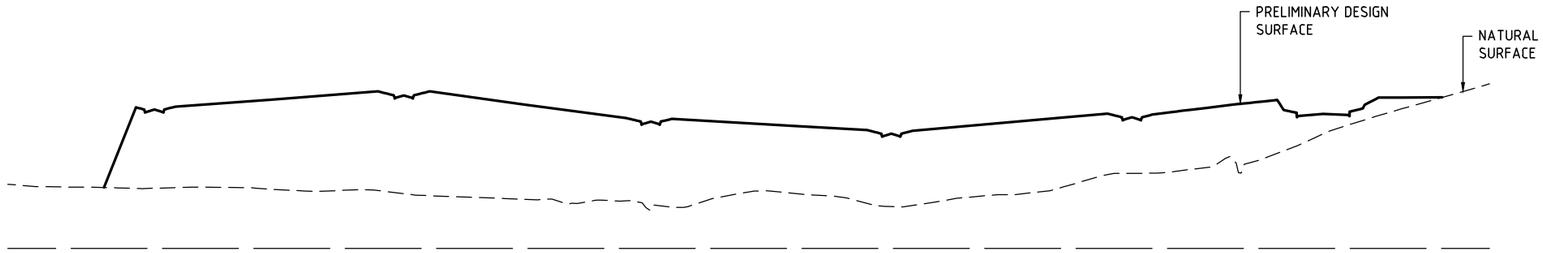
Drawing Title

SEDIMENT & EROSION CONTROL PLAN
BASINS DETAILS

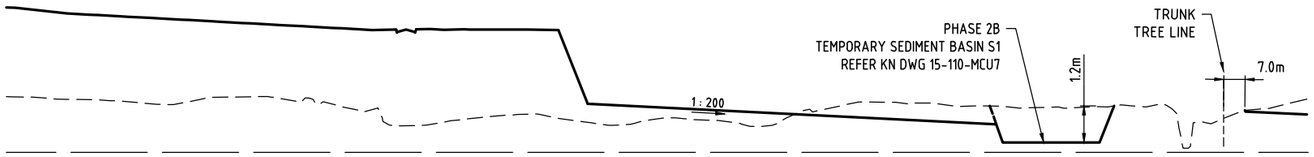
Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15

Scale	Sheet
AS SHOWN	8 of 8

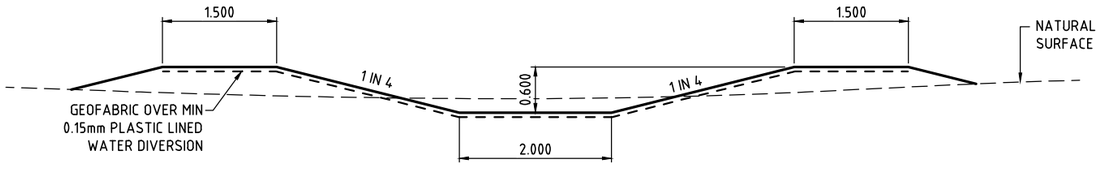
	Drawing No	Revision
A1	15-110-MCU8	A



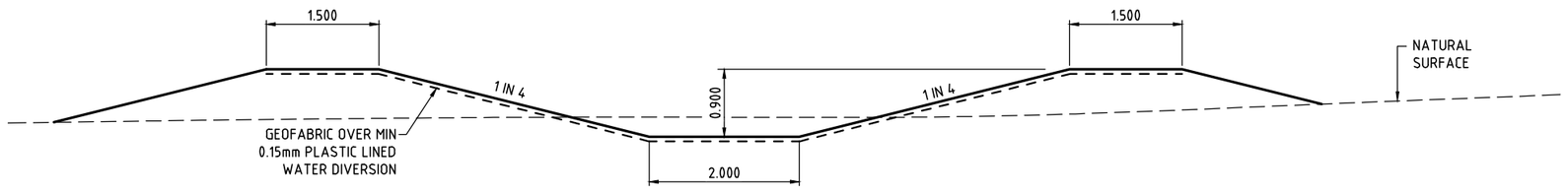
SECTION B-B
SCALE 1:1000 HORIZ
SACLE 1:100 VERT



SECTION A-A
SCALE 1:1000 HORIZ
SACLE 1:100 VERT



SECTION D-D
SCALE 1:40



SECTION E-E
SCALE 1:40

SCALE A 1:1000 (Horiz.)
10 5 0 10 20 30 40 50 60 70 80 90 100m

SCALE
0.4 0.2 0 0.4 0.8 1.2 1.6 2.0 2.4 2.8 3.2 3.6 4.0m
1 : 40 (A1 UNREDUCED)

B 1:100 (Vert.)
1 0.5 0 1 2 3 4 5 6 7 8 9 10m
(A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW

NORTH

Client

NorthEast BUSINESS PARK

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BULK EARTHWORKS
MCU
PHASE 2B

KN GROUP PTY LTD CONSULTING ENGINEERS

LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au

ABN 35 112 053 611

Approved Director - RPEQ 1988

Drawing Title

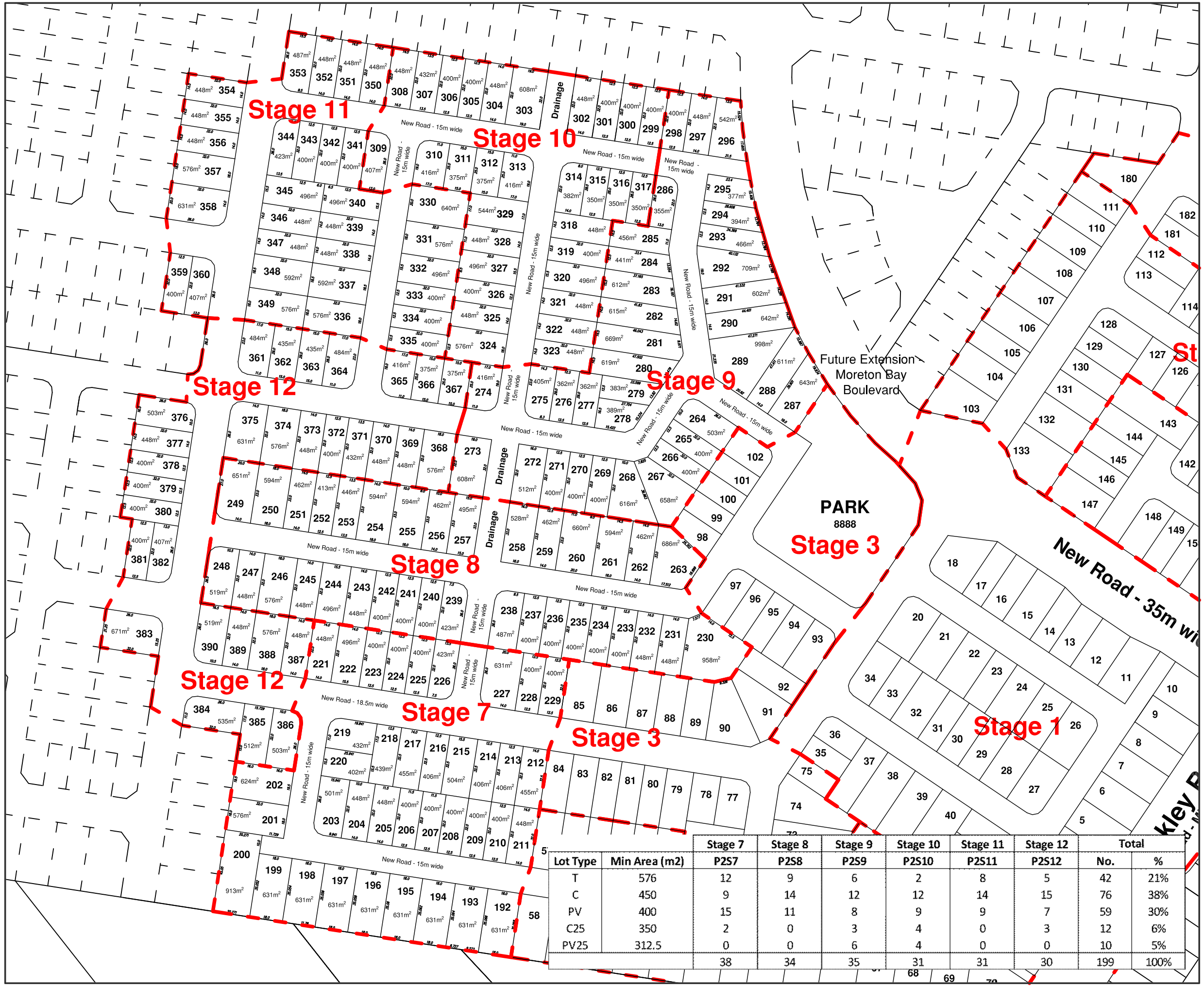
SITE CROSS SECTIONS PLAN

Drawn	Designed	Checked	Date
RW	JB	GBG	APR 15

Scale	Sheet
AS SHOWN	9 of 8

	Drawing No	Revision
A1	15-110-MCU9	A

APPENDIX D – SUBDIVISION LAYOUT PLANS



Lot Type	Min Area (m2)	Stage 7 P2S7	Stage 8 P2S8	Stage 9 P2S9	Stage 10 P2S10	Stage 11 P2S11	Stage 12 P2S12	Total No.	Total %
T	576	12	9	6	2	8	5	42	21%
C	450	9	14	12	12	14	15	76	38%
PV	400	15	11	8	9	9	7	59	30%
C25	350	2	0	3	4	0	3	12	6%
PV25	312.5	0	0	6	4	0	0	10	5%
		38	34	35	31	31	30	199	100%

DEVELOPMENT EVOLUTION
Property & Planning Consultants

A	UPDATED TABLE	14/04/15
B	STAGE BDY ADDED	21/04/15

revisions

North Harbour

content
BUILDING ENVELOPES
PHASE TWO STAGES 7-12

project
NORTH HARBOUR
RES. WEST PRECINCT

client
NORTH EAST
BUSINESS PARK

scale; 1:2000
@; A3

drawn by; MTM
checked by; MTM
date; 12/4/15
drawing no.

NH-CBE-P2

N

Filename: 150412_NH_Phase 2 Layout.dwg Plotted: 4/21/2015 10:41:39 AM Plot Device: Adobe PDF Page Setup: — Plotted by: Michael

APPENDIX E – RAFF CREEK RESTORATION CONCEPT PLAN

JWA PTY LTD
Ecological Consultants
ABN 18 862 767 739

RAFF CREEK RESTORATION CONCEPT PLAN
North East Business Park
Residential West Area

A Report Prepared for
North East Business Park Pty Ltd

MAY 2015

QUEENSLAND
Office 28, 115 Wickham Street
Fortitude Valley QLD 4006
p 07 3257 2703 **f** 07 3257 2708
e brisbane@jwaec.com.au

NEW SOUTH WALES
105 Tamar Street
PO Box 1465, Ballina NSW 2478
p 02 6686 3858 **f** 02 6681 1659
e ballina@jwaec.com.au

www.jwaec.com.au

DOCUMENT CONTROL

Document

Title	Raff Creek Restoration Concept Plan
Job Number	Q15003
File Reference	\\SERVER\data\QLD CLIENT FILES\15003_Northeast Business Park, Morayfield\Reports\Raff Creek Restoration Plan
Version and Date	RW4 08/05/15
Client	North East Business Park Pty Ltd

Revision History (office use only)

Issue	Version	Draft/ Final	Date Sent	Distributed To	No. Copies	Media	Delivery Method
1	RW2	DRAFT	23/04/15	JWA	1	PDF	Email
2	RW3	FINAL	07/05/15	NEBP	1	PDF	Email
3	RW4	FINAL	08/05/15	NEBP	1	PDF	Email
4							
5							

Client Issue

Version	Date	Author		Approved by	
		Name	Initials	Name	Initials
RW2	23/04/15	Kirsty Macpherson	KM	Adam McArthur	AM
RW3	07/05/15	Adam McArthur	AM	Adam McArthur	AM
RW4	08/05/15	Adam McArthur	AM	Adam McArthur	AM

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background

JWA Pty Ltd has been engaged by Northeast Business Park Pty Ltd to review the Raff Creek Restoration Concept Plan drafted by Cardno (2014). This Plan provides general specifications for the rehabilitation of those parts of the Raff Creek floodplain that will be retained in the Open Space Precinct of the approved North East Business Park (NEBP) Residential West Area (RWA) development. These parts are referred to as Habitat Protection Zones and Habitat Restoration Zones.

Subsequent to the lodgement of the development application, Moreton Bay Regional Council (MBRC) issued a Request for Further Information (RFI) that included the following:

> *"Prior to the issue of a Development Permit for Reconfiguring a Lot for Phase 2, Council require the submission of an Amended Restoration Concept plan for the Habitat Protection Units and Habitat Restoration Units to Council for approval. The report shall include at least the following:*
>
> > *i) key performance indicators for each unit (or sub-unit), that includes indices of ecosystem health, abundance of key species, abundance of threatened species, and where appropriate, water quality;*
> > *ii) (intervention) trigger values for each key performance indicator;*
> > *iii) a monitoring program that assesses these key performance indicators;*
> > *iv) management procedures should trigger values be reached;*
> > *v) management of the potential road corridor to ensure no negative impacts to adjoining areas of rehabilitation."*

This Plan provides details regarding the processes involved with works and management of the Habitat Protection Zones and Habitat Restoration Zones of the RWA Open Space Precinct, and aims to address the RFI issued by MBRC.

This Restoration Concept Plan (RCP) identifies and describes the particular types of ecosystems that are proposed to be established within the Open Space Precinct based on consideration of:

- the Regional Ecosystem (RE) character of areas of existing vegetation to be retained within the Open Space corridor;
- proposed location and extents of earthworks and resultant finished levels;
- the system's flood flow conveyance requirements (as informed by hydraulic modelling);
- the habitat requirements of rare and threatened flora and fauna that currently (or which potentially) occur within the Raff Creek catchment and a desire to achieve a long-term improvement in those habitat values;
- the provision of "offsets" for the loss of native vegetation and fauna habitats elsewhere within the RWA, including the southern Raff Creek anabranch;
- the maintenance of acceptable levels of bushfire hazard within adjacent residential areas;
- the minimisation of mosquito breeding habitats; and
- the management of public access to and enjoyment of sensitive areas.

1.2 The Subject Site

The RWA is located at Nolan Drive Morayfield and is formally described as Lots 2 and 3 on SP266287 (**FIGURE 1**). The RWA is approximately 174ha in area. The Open Space Precinct is approximately 87ha in area. The locations and extents of the NEBP site, the RWA and the Open Space Precinct are shown in **FIGURE 2.**

1.3 The Open Space Precinct Development

The NEBP RWA Open Space Precinct is centred on Raff Creek and will be a total of 87ha in extent and comprised of approximately:

- 8 hectares of land to be developed as formal parklands, generally located above the Q100 flood level (the Parkland Zone);
- 3 hectares of land that is to be maintained in its current condition to accommodate a potential regional road corridor;
- 11 hectares of land that will accommodate a total of seven (7) constructed wetlands that are proposed as part of the NEBP RWA development's stormwater treatment train (the Constructed Wetland Zone);
- 27 hectares of existing native vegetation and fauna habitats associated with Raff Creek that are to be retained and managed primarily for environmental purposes (the Habitat Protection Zone); and
- 41 hectares of land that is to be re-profiled to provide the required flood storage offsets and subsequently rehabilitated to a natural condition and managed for environmental purposes (the Habitat Restoration Zone).

The locations and extents of the above described zones within the Raff Creek Open Space Precinct are shown in **FIGURE 3**.

This Plan is specifically concerned with the Habitat Protection Zone and Habitat Restoration Zone of the RWA Open Space Precinct, which are to be the subject of a comprehensive program of rehabilitation works in general accordance with the specifications presented in **SECTIONS 4 and 5**. This Plan does not apply to:

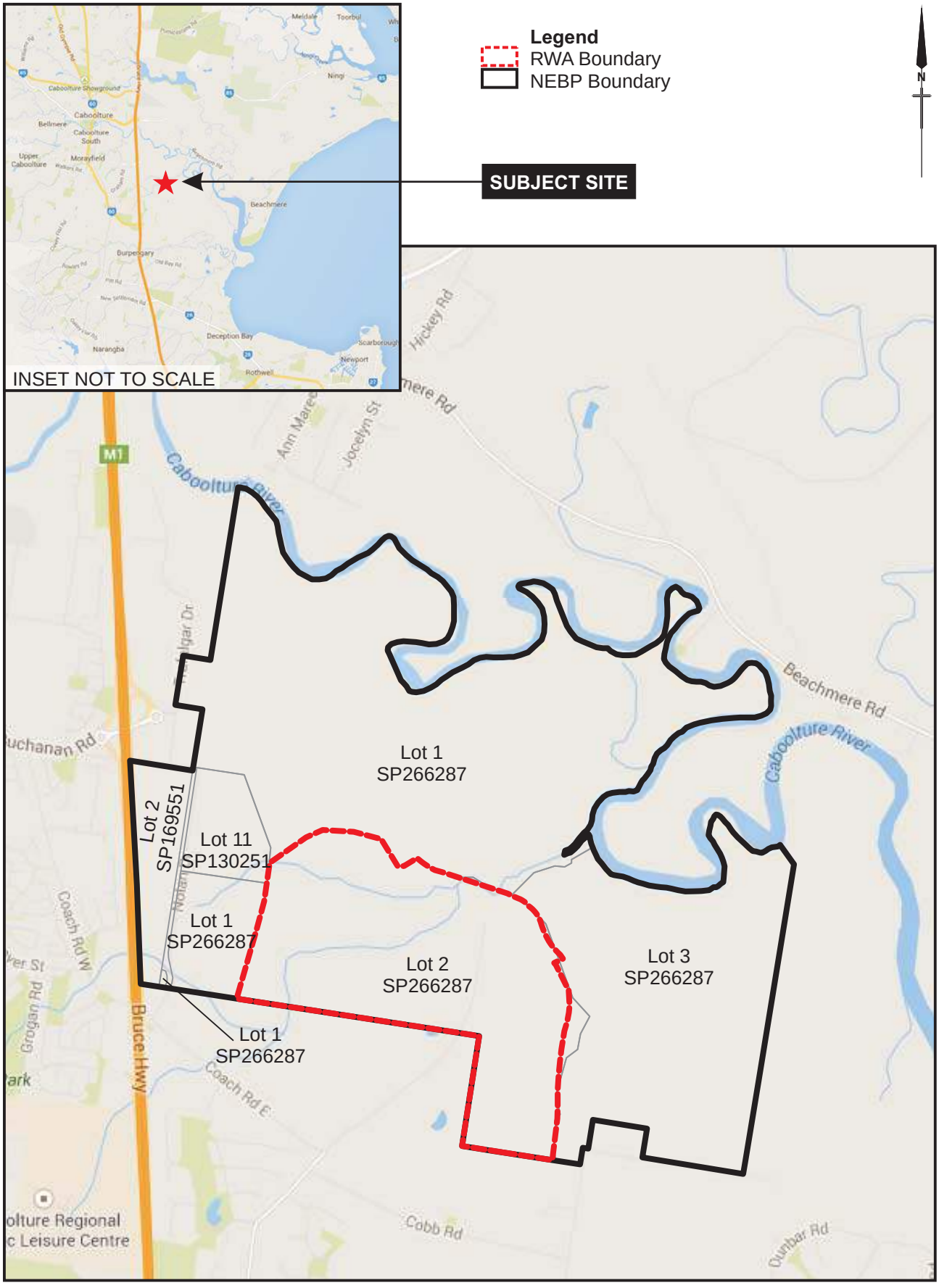
- any of the internal roads that traverse the Open Space Precinct; or
- any land this is located within the Constructed Wetland Zone or Parkland Zone.

1.4 Rehabilitation Objectives

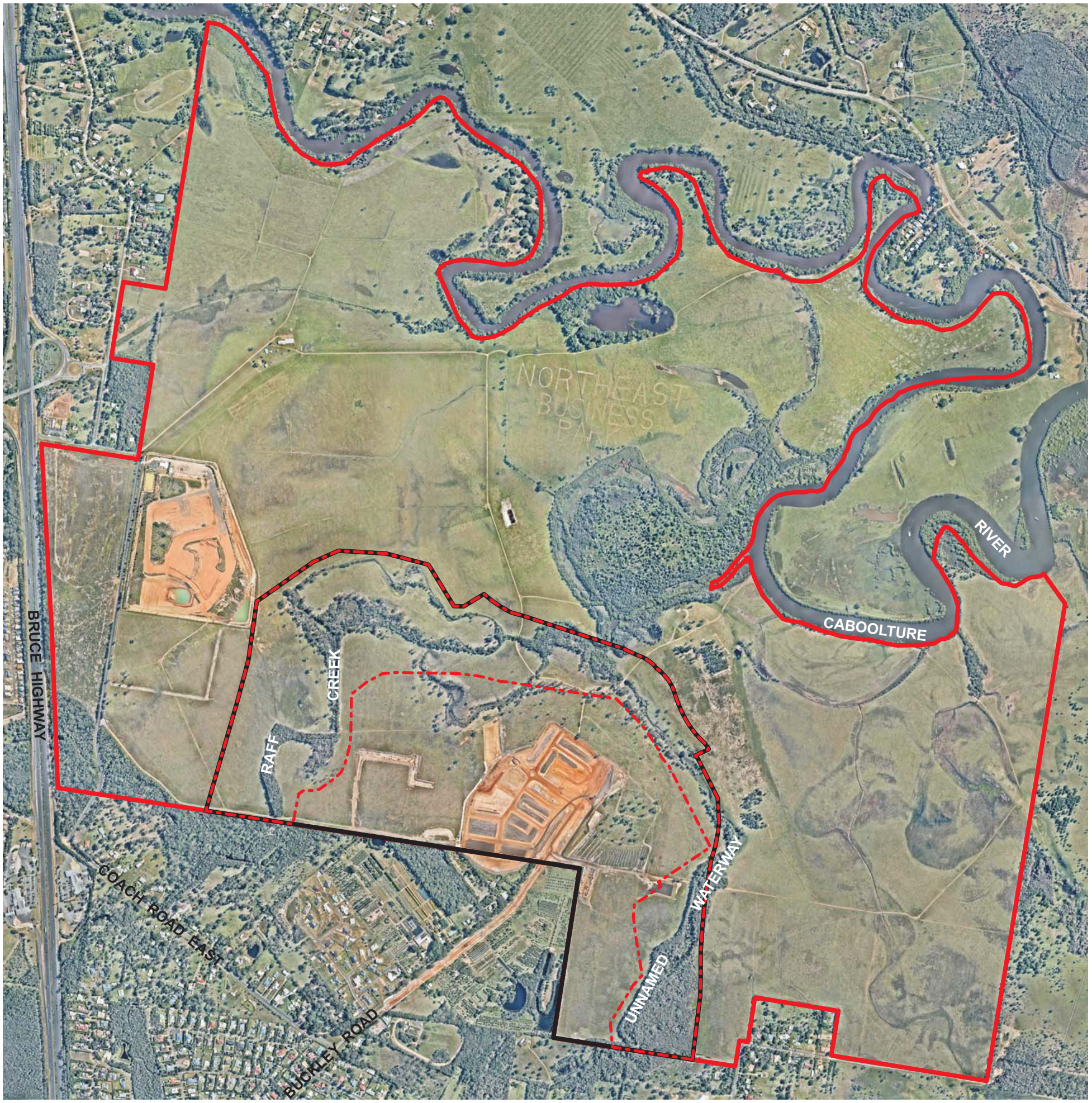
The overall objective of this Plan is to provide general specifications for the staged rehabilitation and management of the Habitat Protection Zones and Habitat Restoration Zones within Open Space corridor. The specific outcomes sought through implementation of this Plan are as follows:

- Objective 1: Protection of the bed and banks of the main Raff Creek channel, the Unnamed creek in the eastern portion of the RWA, and associated riparian vegetation and fauna habitats during the construction and occupation of the NEBP RWA development.

- Objective 2: Restoration of self-sustaining natural ecosystems within those parts of the Raff Creek flood plain contained within the RWA Open Space Precinct, that are re-profiled as part of the NEBP RWA development.



SOURCE: Google Maps SCALE: 1 : 30 000 @ A4 JWA PTY LTD Ecological Consultants	CLIENT North East Business Park Pty Ltd PROJECT Raff Creek Restoration Concept Plan North East Business Park - RWA Nolan Drive, Morayfield, QLD Moreton Bay Regional Council LGA	**FIGURE 1** PREPARED: BW DATE: 07 May 2015 FILE: Q15003_Locality.cdr	TITLE **LOCALITY PLAN**



Legend
Open Space Precinct
RWA Boundary
NEBP Boundary

N

0 500m
1 : 15 000

SOURCE: Near Map 2015 Aerial Photograph

SCALE: 1 : 15 000 @ A3

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North East Business Park Pty Ltd

PROJECT
Raff Creek Restoration Concept Plan
North East Business Park - RWA
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

FIGURE 2

PREPARED: BW
DATE: 07 May 2015
FILE: Q15003_Aerial.cdr

TITLE

AERIAL PHOTOGRAPH

Legend

- Constructed (SWQI) Wetland Zone
- Parkland Zone
- Habitat Protection Zone
- Habitat Restoration Zone
- Regional Road Corridor
- Open Space Precinct
- RWA Boundary
- NEBP Boundary

N

0 100m 200m

1 : 8000

SOURCE: JWA; Cardno 2014 NEBP RWA Raff Creek RCP; Design Flow (SURF4270_DESIGN_v2010.dwg); KNPL (15-110-MCU_STG2B.dwg)

SCALE: 1 : 8000 @ A3

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PROJECT
Raff Creek Restoration Concept Plan
North East Business Park - RWA
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

FIGURE 3

PREPARED: BW
DATE: 08 May 2015
FILE: Q15003_Open Space Zone.cdr

TITLE

RWA OPEN SPACE ZONES

- Objective 3: Enhancement of the habitat values of the RWA Open Space Precinct for threatened native wildlife species that are known or likely to occur within the NEBP locality.

- Objective 4: Mitigate for the loss of ecological features located within those parts of the RWA that are to be developed for residential purposes.

- Objective 5: Effect a net improvement in the qualities of waters flowing through the Raff Creek system and discharging into the Caboolture River.

- Objective 6: Maintain acceptable bushfire hazard levels within urban areas having frontage to the RWA Open Space Precinct.

- Objective 7: Maintain acceptable levels of mosquito and biting midge breeding within the Raff Creek system such that future residents of and visitors to the RWA are not exposed to unacceptable levels of exposure to mosquito or biting midge.

- Objective 8: Provide opportunities for public access to and enjoyment of the Raff Creek system that are consistent with the ecological values of the system.

1.5 Format of this Plan

The plan is structured as follows:

1. Introduction;
2. Existing Environment;
3. Assessment and Identification of Rehabilitation Areas;
4. Staging of Restoration Works;
5. Site Rehabilitation Strategy; and
6. Performance Indicators, Monitoring and Adaptive Management.

2 EXISTING ENVIRONMENT

2.1 Physical Environment

The NEBP RWA Open Space Precinct is predominantly flat, ranging in elevation from Mean Sea Level (MSL) to 6.5m Australian Height Datum (AHD). The Mean High Water Springs (MHWS) level for the RWA is 0.82m AHD and the Highest Astronomical Tide (HAT) is 1.36m AHD.

Raff Creek, a tributary of the Caboolture River, traverses the NEBP RWA Open Space Precinct. The main channel of Raff Creek forms the western and northern boundary of the RWA, whilst an un-named tributary of Raff Creek forms the eastern boundary of the RWA. The existing peak 100 year ARI flood levels range from 3.29m AHD adjacent to Raff Creek in the south west corner down to 3.21m AHD at the confluence of Raff Creek and the unnamed eastern tributary.

The landform and drainage patterns of the RWA have been subjected to some modification as part of the past use of the land for agricultural, forestry and grazing purposes.

2.2 Ecosystems Characteristics

The ecosystems of the NEBP RWA are characterised by expanses of disturbed grassland, scattered trees, paperbark (*Melaleuca quinquenervia*) communities, Eucalypt open forest and areas of marine vegetation within tidally influenced reaches of Raff Creek. When considered from a pre-disturbance perspective much of the RWA is in poor condition and consists of highly modified vegetation communities that are a product of approximately 150 years of active use for agricultural, grazing and plantation forestry purposes.

No part of the RWA Open Space Precinct currently supports any areas of mapped remnant vegetation. It is considered that the entire RWA Open Space Precinct would have originally supported wetland areas comprised of the following ecosystem types:

- RE 12.1.1 - *Casuarina glauca* woodland on margins of marine clay plains;
- RE 12.1.2 - Saltpan vegetation including grassland, herbland and sedgeland on marine clay plains;
- RE 12.1.3 - Mangrove shrubland to low closed forest on marine clay plains and estuaries; and
- RE 12.3.5 - *Melaleuca quinquenervia* open forest on coastal alluvium.

A description of the broad ecosystem types that currently occupy the RWA Open Space Precinct is provided in **TABLE 1** and their distribution is illustrated in **FIGURE 4**.

Legend

1. Coastal and subcoastal floodplain, grass, sedge herb swamps
2. Coastal and subcoastal floodplain tree swamps – melaleuca and eucalypt
3. Coastal and subcoastal saline swamps
4. Mangrove and casuarina estuarine wetlands
5. Disturbed wet-terrestrial grassland/sedgeland mosaic
6. Disturbed terrestrial grassland/woodland

Open Space Precinct
RWA Boundary
NEBP Boundary

N

0 100m 200m

1 : 8000

SOURCE: JWA Site Investigations; Cardno 2014 NEBP RWA Raff Creek Restoration Concept Plan - Figure 3; Near Map 2015 Aerial Photograph
SCALE: 1 : 8000 @ A3

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Raff Creek Restoration Concept Plan
North East Business Park - RWA
Nolan Drive, Morayfield, QLD
Moreton Bay Regional Council LGA

FIGURE 4

PREPARED: BW
DATE: 07 May 2015
FILE: Q15003_Habitat Type.cdr

TITLE

BROAD HABITAT TYPES

TABLE 1
BROAD HABITAT TYPES RECORDED WITHIN THE RWA OPEN SPACE PRECINCT

Habitat Type	Characteristics
Mangrove wetlands	Dominated by mangrove species with characteristic aerial roots. Invariably located below HAT and often in most frequently tidally inundated areas. Occur on soils that are classically estuarine – fine dark silty clay which is highly saline and anaerobic. Within the RWA this community is confined to the tidally influenced reaches of Raff Creek and is generally dominated by Grey mangrove (*Avicennia marina*) and River mangrove (*Aegiceras corniculatum*) with a fringing band of Saltwater couch (*Sporobolus virginicus*), Swamp oak (*Casuarina glauca*) and other species such as *Suaeda* sp., Ruby saltbush (*Enchylaena tomentosa*). This community is recognised as being a marine wetland community.
Saline swamps	The most conspicuous feature of coastal grass-sedge wetlands is dominance by grasses (family Poaceae) and/or sedges (principally, family Cyperaceae). Inundation is usually temporary, ranging from a few weeks each year during periods of heavy rain and flash flooding, to many months. The geomorphologic setting for coastal grass-sedge wetlands is minor basins, small depressions and poorly drained flats on marine or alluvial plains with gentle or minimal slope. Soil of coastal grass-sedge wetlands typically is heavy, dark clay that was originally deposited by streams or the ocean. On marine plains the underlying substrate may have a high salt content but may be overlaid with more recent alluvial deposits that are not saline. Within the RWA this community occurs adjacent to the tidally influenced downstream reaches of Raff Creek and occupies an area that has been cleared in the past and is actively maintained in an open condition and subject to livestock grazing. The vegetation in this community is dominated by Saltwater couch (*Sporobolus virginicus*) and other saltmarsh species. This community is recognised as being a marine wetland community.
Coastal and sub-coastal floodplain tree swamps - melaleuca and eucalypt	Tree swamps are non-tidal, wooded wetlands generally occupying depressions and drainage lines. These communities are seasonally inundated with the period of inundation being highly variable but extending in some instances to 3–6 months of the year. They occur on a broad range of soil types, from the predominantly silty to loamy clays on the edges of water bodies to sandy alluvia soils on a floodplain and poorly oxygenated marine clays or the black soil plains. Within the RWA this community is represented by areas of non-

Habitat Type	Characteristics
	remnant paperbark (*Melaleuca quinquenervia*) open forest derived from RE 12.3.5, which would have occupied the majority of the Raff Creek flood plain prior to the commencement of broad scale vegetation clearance and subsequent use of the land for agricultural, forestry and grazing purposes. The vegetation is generally dominated by Broad-leaved paperbark (*Melaleuca quinquenervia*) to a height of approximately 20m with scattered Queensland blue gum (*Eucalyptus tereticornis*), Grey ironbark (*Eucalyptus siderophloia*) and Swamp box (*Lophostemon suaveolons*). The understorey is dominated by a combination of native species, exotic grasses and other introduced plants. Species that occur within this community include Poison peach (*Trema tomentosa*), Monkey rope vine, *Melaleuca linariifolia*, White passion flower (*Passiflora subpeltata*), Groundsel bush, Pink euodia (*Melicope elleryana*), *Glochidium sumatranum*, *Stephania japonica*, Red ash, *Pittosporum revolutum*, *Kennedia rubicunda*, Frogsmouth (*Philydrum lanuginosum*), Smartweed (*Persicaria* sp.), Water hyacinth (*Eichhornia crassipes*), Wild tobacco, Soft bracken (*Calochlaena dubia*), *Lomandra longifolia*, *Ludwigia peploides*, Camphor laurel (*Cinnamomum camphora*), Mile-a-minute, Fleabane (*Conzya* sp.) and *Passiflora* sp. However, *Phragmites australis* and *Blechnum indicum* become locally predominant in some areas of the communities associated with the drainage lines. This community is recognised as being a palustrine wetland community.
Coastal and sub-coastal floodplain, grass, sedge herb swamps	The most conspicuous feature of coastal grass-sedge wetlands is dominance by grasses (family Poaceae) and/or sedges (principally, family Cyperaceae). Inundation is usually temporary, ranging from a few weeks each year during periods of heavy rain and flash flooding, to many months. The geomorphologic setting for coastal grass-sedge wetlands is minor basins, small depressions and poorly drained flats on marine or alluvial plains with gentle or minimal slope. Soil of coastal grass-sedge wetlands typically is heavy, dark clay that was originally deposited by streams or the ocean. On marine plains the underlying substrate may have a high salt content but may be overlaid with more recent alluvial deposits that are not saline. Within the RWA this community is primarily represented by areas that would originally have supported RE 12.3.5 and which have been actively managed to suppress regrowth of an overstorey of paperbarks and allied species. Removal of disturbance pressures would see most of these areas transition over time to the community described as Coastal and sub-coastal floodplain tree swamps - melaleuca and eucalypt. This community is recognised as being a palustrine wetland

Habitat Type	Characteristics
	community.
Disturbed wet-terrestrial grassland mosaic	Whilst some portions of this community are not a wetland community class recognised in the QWP Guideline, this class applies to the balance of the RWA that is located below the Q100 flood contour. These areas: • have been subjected to substantial disturbance in the past as a consequence of initial broad scale vegetation clearance and subsequent agricultural, forestry and grazing uses; • would have originally supported wetland ecosystems prior to the broad scale clearance and development of the NEBP; and • currently supports a disturbed mosaic of terrestrial and ephemeral wetland (floodplain, grass, sedge herb swamps) areas that are difficult to map accurately.
Disturbed terrestrial Grassland/woodland	This community is characterised by species that are common to disturbed rural landscapes such as Pigeon grass (*Setaria* spp.), Rhodes grass (*Chloris gayana*), *Paspalum* sp., Guinea grass (*Panicum maximum*), Wild tobacco, Balloon cotton bush (*Gomphocarpus physocarpus*), Phasey bean (*Macroptilium lathyroides*), Siratro (*Macroptilium atropurpureum*), Blady grass (*Imperata cylindrica*), Cobblers peg (*Bidens pilosa*), Blue billygoat weed (*Ageratum houstonianum*), Scotch thistle (*Cirsium vulgare*), Groundsel (*Baccharis halimifolia*), Devils fig (*Solanum torvum*), Lantana (*Lantana camara*), and some scattered areas of Slash pine (*Pinus elliottii*) and Acacia regrowth. The disturbed woodland community was recorded from a narrow strip alongside the riparian zone and atop the isolated knoll on the eastern portion of the site. The overstorey consists of scattered canopy species such as Queensland blue gum (*Eucalyptus tereticornis*), Pink bloodwood (*Corymbia intermedia*), Moreton Bay ash (*Corymbia tessellaris*), Slash pine, *Acacia* sp. and Broad-leaved paperbark (*Melaleuca quinquenervia*). Owing to a history of disturbance and edges effects this community is currently subject to high levels of invasion by many of the exotic plant species described for the disturbed grassland community. These areas would in pre-disturbance condition have supported RE 12.5.3 which is characterised by a dominance of Scribbly gum (*Eucalyptus racemosa*) however this species was found to be conspicuously absent from the disturbed woodland community within the site.

3 ASSESSMENT AND IDENTIFICATION OF REHABILITATION AREAS

3.1 Introduction

In order to determine which areas of vegetation should be the focus of regeneration and revegetation activities, areas of the subject site proposed for rehabilitation were been mapped and divided into categories based on restoration potential. This was done to ensure that regeneration and revegetation resources could be utilised in the most efficient way by focusing on those areas that contain particular management issues (i.e. weed infestations, lack of canopy cover, poor species diversity) and matching the appropriate restoration measures for those issues.

The restoration potential is based on the condition of the current native vegetation, the level of weed infestation and the amount of work that will be required to return the area to a native vegetation community. The restoration potential of an area indicates the amount of work that is required to successfully rehabilitate the area.

3.2 Restoration Approaches

The South East Queensland Ecological Restoration Framework: Guideline (Chenoweth EPLA and Bushland Restoration Services, 2012) recognises the following broad approaches to restoration of native wildlife habitat, including:

- natural regeneration;
- assisted natural regeneration;
- reconstruction; and
- fabrication (type conversion).

The particular approach to be adopted in a given area will be determined by the existing characteristics of the area and the broader land use context of the locality within which the restored area will exist. Within a given area a combination of approaches may often be required. For example, when remnant native vegetation is surrounded by cleared and degraded lands, an assisted natural regeneration approach would be appropriate for the remnant areas and a reconstruction approach may be required for the surrounding lands that are intended to be restored to extend, or provide linkages between, remnant habitat areas. In areas where fundamental changes have been made to the landform and hydrology of the area to be restored it may be necessary to adopt either an assisted natural regeneration/reconstruction approach or a reconstruction/fabrication approach depending upon whether or not top soil containing native plant seed is available for use and/or seed is able to reach the site from nearby natural areas, through dispersal by birds or other animals, wind or water.

TABLE 2 provides a brief overview of the different restoration approaches upon which this RCP is based.

TABLE 2
SUMMARY OF DIFFERENT RESTORATION APPROACHES USED IN THIS RCP

Restoration Attributes	Approach	Description
Natural Regeneration	Situation Where Applicable	Relatively large, intact and weed-free areas of native vegetation. Areas where the native plants are healthy and capable of regenerating without human intervention. When native plant seed is stored in the soil or will be able to reach the site from nearby natural areas, through dispersal by birds or other animals, wind or water. Where the plant community has a high potential for recovery after any short lived disturbance, such as a fire or cyclonic winds. When preventative action is all that is required to avert on-going disturbance (e.g. erection of fencing to prevent intrusion by cattle).
	Restoration Objective	In the short-medium term, the re-establishing plant community will attain the same structure, species composition and habitat values as the original vegetation.
	Weed Control	Weed control should have a minor role to play.
	Supplementary Planting	Planting in such sites can work against the aims of restoration by interfering with natural regeneration.
Assisted Natural Regeneration	Situation Where Applicable	To natural areas where the native plant community is largely healthy and functioning. When native plant seed is still stored in the soil or will be able to reach the site from nearby natural areas, through dispersal by birds or other animals, wind or water. Where the natural regeneration processes (seedling germination, root suckering, etc.) are being inhibited by external factors, such as weed invasion, soil compaction, cattle grazing, mechanical slashing, etc. When limited human intervention, such as weed removal, minor amelioration of soil conditions, erection of fencing, cessation of slashing, etc. will be enough to trigger the recovery processes through natural regeneration.
	Restoration Objective	In the medium term, the re-establishing plant community will be similar in structure, composition and diversity to the original vegetation.
	Weed Control	Weed control will be a major component of the restoration program.
	Supplementary	Planting in such sites can work against the aims of

Restoration Attributes	Approach	Description
	Planting	restoration by interfering with natural regeneration.
Reconstruction	Situation Where Applicable	Where the site is highly degraded or altered. When the degree of disturbance has been so great and long-standing that the pre-existing native plant community cannot recover by natural means. Areas of fill, sites affected by storm-water flow, and areas that have been drastically cleared, either mechanically or by stock even though there may be a few remaining native trees or shrubs and no viable soil seed bank or pathways for seed recruitment from nearby natural areas. When a greater degree of human intervention is required, such as weed removal, cessation of grazing and/or slashing, amelioration of soil conditions such as importation of soils, drainage works or reshaping of the landscape. When a major component is re-establishment of community structure and composition through active planting programs.
	Restoration Objective	In the medium term natural regeneration processes should be re-established with the long-term objective that the plant community should will be similar in structure, composition and diversity to the original vegetation.
	Weed Control	Weed control will be a major component of the restoration program.
	Supplementary Planting	Planting will be a major component of the restoration (reconstruction) program.
Fabrication	Situation Where Applicable	Where site conditions have been irreversibly changed. When it is either not possible or appropriate to restore the original native plant community. Where a better-adapted local plant community can be established that will function within the changed conditions.
	Restoration Objective	The establishing planted community should be self-sustaining and similar to a naturally occurring plant community of the same type.
	Weed Control	Important, particularly during the initial stages of plant establishment.
	Supplementary Planting	Planting will be the dominant component of the restoration (fabrication) program.

3.3 Management Units

For the purposes of this RCP a total of fourteen (14) discrete Restoration Management Units (RMU) have been defined based on the nature of the subject areas and their associated restoration requirements. These RMUs fall into either of the following categories:

- Habitat Protection Units (HPU), which encompass approximately 27 hectares of existing native vegetation and fauna habitats associated with Raff Creek that are to be retained and managed to protect and enhance their habitat values; and
- Habitat Restoration Units (HRU), which encompass approximately 41 hectares of land that is to be re-profiled to provide the required flood storage offsets and then subsequently rehabilitated to a natural condition and managed for environmental purposes.

The locations and extents of the HPUs and HRUs within the Open Space Precinct are shown in **FIGURE 5**. The key attributes of each RMU are provided in **APPENDIX 1.**

3.4 Regional Road Corridor

The approved Structure Plan for the RWA envisages the future construction of a major arterial road corridor along the eastern boundary of the RWA (**FIGURE 3**). This area is to be maintained in its current condition to accommodate the road corridor, and for the purposes of this RCP the area will be treated as HPUs.

The potential impacts of the future roadway on adjacent HPUs and HRUs will be addressed within the RIP/s prepared for the relevant development Phase (i.e. prior to road construction).

Legend

n/y Habitat Protection Unit
- "n" = existing community type
- "y" = enhanced community type

n/y Habitat Restoration Unit
- "n" = existing community type
- "y" = enhanced community type

Community Type

1 Coastal and subcoastal floodplain, grass, sedge herb swamps
2 Coastal and subcoastal floodplain tree swamps – melaleuca and eucalypt
3 Coastal and subcoastal saline swamps
4 Mangrove and casuarina estuarine wetlands
5 Disturbed wet-terrestrial grassland/sedgeland mosaic
6 Disturbed terrestrial grassland/woodland

Constructed (SWQI) Wetland Zone
Parkland Zone
Regional Road Corridor
Open Space Precinct
RWA Boundary
NEBP Boundary

N

0 100m 200m

1 : 8000

SOURCE: JWA; Cardno 2014 NEBP RWA Raff Creek RCP; Design Flow (SURF4270_DESIGN_v2010.dwg); KNPL (15-110-MCU_STG2B.dwg)

SCALE: 1 : 8000 @ A3

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Moreton Bay Regional Council LGA

FIGURE 5

PREPARED: BW
DATE: 08 May 2015
FILE: Q15003_HPU & HRU.cdr

TITLE
HABITAT PROTECTION & HABITAT RESTORATION UNITS

4 STAGING OF RESTORATION WORKS

4.1 Introduction

This section describes the general nature and staging of restoration works within the identified HPUs and HRUs.

4.2 Habitat Protection Units

Restoration works within the HPUs will primarily be focused on the management of external pressures which may adversely affect natural ecosystem processes within the protected areas, including natural regeneration of native plant communities. Details concerning the general nature and sequencing of restoration tasks within HPUs are provided in **TABLE 3**.

TABLE 3
GENERAL SEQUENCING OF RESTORATION TASKS - HPUS

Task	Timing
The outer boundary between Habitat Protection Units and the balance of the RWA and adjacent Balance Area is to be fenced to exclude livestock and to restrict entry during the physical development of the RWA. The form of fencing to be used needs to provide for the unimpeded movement of native fauna.	Prior to the commencement of Operational Works for a phase of the RWA development that involves works within or adjacent to the Open Space Precinct.
The HPU boundary fencing is to be maintained.	Until the adjoining RWA and MIBA development have been completed.
A program of weed and pest monitoring and management is to be implemented and maintained within all HPUs to facilitate the natural regeneration of the various habitat types contained therein.	Concurrent with commencement of Operational Works within the Open Space Precinct and to be maintained for a period of at least twenty four (24) months following completion of works.
An ecosystem health monitoring program is to be developed and implemented throughout all HPUs to monitor changes in ecological conditions and any associated requirements for active intervention to assist natural ecological processes that may be under stress due to the nature and scale of the adjacent developments.	Concurrent with commencement of Operational Works and to be maintained as detailed in **Section 6.**

4.3 Habitat Restoration Units

The HRU will be the subject of a staged program of bulk earthworks carried out within the Open Space and Residential Precincts of the RWA, part of which will involve the re-profiling and subsequent restoration of HRUs. The precise sequencing of the bulk earthworks and residential development is still to be determined.

The primary approach to restoration of natural ecosystems within the HRUs will be via Fabrication supplemented by Assisted Natural Regeneration. Fabrication will primarily be achieved via:

- the re-profiling of the HRUs to an Interim Finished Level (IFL) that is 50-100mm lower than the Design Finished Level (DFL);
- the re-spreading (or translocation) of stripped topsoil sourced from an area that has a high natural regeneration potential for the prescribed habitat type for that HRU;
- the monitoring and management of weeds; and
- the design and implementation of a planting program if regeneration from the topsoil is not sufficient to achieve the restoration outcomes.

Stripping and translocating topsoil is a well-accepted means of carrying out post-mining restoration works and is well suited to the Raff Creek restoration works as the topsoil layer contains seeds, rootstock, rhizomes, tubers and soil micro-organisms. The restoration works will be sequenced in a manner that avoids, to the extent practicable, the stockpiling of stripped topsoil that has a high natural regeneration potential to:

- minimise the potential for the loss of viability of soil organisms and propagules, and the risk of decomposition; and
- maximise the potential for natural regeneration to occur from the translocated material.

Topsoil should be removed and respread with great care as both the nature of the equipment used and the soil moisture content influence the degree of soil compaction and structural breakdown that can occur during these procedures. The combined use of a front-end loader, truck and bulldozer for the removal, transport and spreading of topsoil is often the best combination to reduce compaction. If the amount of suitable topsoil available is limited, the available material will be spread to a thinner depth or in strips.

For the purposes of this RCP the general locations of areas within the RWA Open Space Precinct and RWA Residential Precinct that are potential sources of topsoil for use in the restoration the HRUs (i.e. Topsoil Source Areas) have been identified and are shown in **FIGURE 6**. The extents of identified Topsoil Source Areas for particular habitat types and the extent of the HRUs that are to be restored to that same habitat type are detailed in **TABLE 4**.

TABLE 4
APPROXIMATE EXTENTS OF TOPSOIL SOURCE AREAS AND HRUS FOR DIFFERENT HABITAT TYPES

Habitat Type	Extent of Identified Topsoil Source Areas (Ha)	Extent of HRUs (Ha)
Coastal and sub-coastal floodplain tree swamps - Melaleuca and Eucalypt	14.1	38.6
Coastal and sub-coastal saline swamps	1.4	2.6
Mangrove wetland	0.6	0.7

Based on the estimates presented in **TABLE 4**, there will be a deficit in the volume of topsoil material with a high natural regeneration potential relative to the project requirements for restoring particular vegetation types. This deficit will be managed by a combination of:

- identification of additional areas within the RWA development footprint that may be suited for use as Topsoil Source Areas and any associated management

Legend

Topsoil Source Area - Habitat Type

- Floodplain tree swamps
- Saline swamps
- Mangrove wetlands

- Habitat Protection Zone
- Constructed (SWQI) Wetland Zone
- Parkland Zone
- Regional Road Corridor
- Open Space Precinct
- RWA Boundary
- NEBP Boundary

N

0 100m 200m

1 : 8000

SOURCE: JWA; Cardno 2014 NEBP RWA Raff Creek RCP; Design Flow (SURF4270_DESIGN_v2010.dwg); KNPL (15-110-MCU_STG2B.dwg)

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Moreton Bay Regional Council LGA

FIGURE 6

PREPARED: BW
DATE: 08 May 2015
FILE: Q15003_HRU Topsoil.cdr

TITLE

HABITAT RESTORATION TOPSOIL SOURCE AREAS

requirements for such areas (e.g. selective treatment of weed infestations, removal of livestock grazing pressure);
- application of topsoil in a thinner layer (e.g. < 100mm) or spreading the topsoil in a strip pattern as part of a sequential restoration approach within individual HRUs; and/or
- the use of tube-stock planting or direct seeding.

Details concerning the general nature and sequencing of restoration tasks within HRUs are provided in **TABLE 5**.

TABLE 5
GENERAL SEQUENCING OF RESTORATION TASKS – HRUS

Task	General Specification	Timing
Environmental Management	A Construction Environmental Management Plan (CEMP), Land Based Environmental Management Plan (LBEMP) or equivalent is to be prepared and submitted for approval in support of each Operation Works application involving a HRU. The submitted plan is to make appropriate provisions for: • vegetation clearance, stockpiling, reuse or disposal with the aim of retrieving suitable material for reuse in revegetation areas, including hollow logs for habitat enhancement in the restored areas; • protection of native fauna, including the use of a fauna spotter catcher to supervise clearing works; • erosion and sedimentation control; and • acid sulphate soils management, taking into account the naturally acidic nature of the Raff Creek environments.	Plan to be submitted in support of Operational Works applications. Approved plan to be implemented.
Identification of Topsoil Source Areas	Each program of approved Operational Works will include Topsoil Source Areas located within either the RWA Open Space Precinct or the RWA Residential Precinct that can be used in the restoration of the HRUs that are also the subject of the approved Operational Works program.	Details to be submitted in support of Operational Works applications.
Identification of Topsoil Receive Area	Each program of approved Operational Works will include Topsoil Receive Areas located within the RWA Open Space Precinct that will receive material sourced from Topsoil Source Areas. (Note: In some instances the Topsoil Source Areas and Topsoil Receive Areas may coincide).	Details to be submitted in support of Operational Works applications.
Re-profiling of HRU.	The surface of the HRU (or part thereof) is to be re-profiled to the IFL in accordance with	Details to be submitted in support

Task	General Specification	Timing
	detailed engineering specifications in preparation for receipt of topsoil from the Topsoil Source Areas. (Note: HRU re-profiling is to commence in areas that are not identified as a Topsoil Source Area and the associated topsoil with a low regeneration potential is to be stockpiled for potential use elsewhere within the RWA development.)	of Operational Works applications.
Topsoil re-spreading / translocation.	Material from Topsoil Source Areas, sourced from within or external to the HRU, is to be transferred and spread across the surface of the re-profiled HRU to a depth no greater than 100mm.	Details to be submitted in support of Operational Works applications.
Access management	Upon completion of re-profiling and topsoil restoration works, the boundary of the HRU is to be fenced to exclude livestock and vehicular access. Fencing is not to impede the movement of native fauna.	Prior to completion of Operational Works.
	The HRU boundary fencing is to be maintained.	Until the adjoining RWA and MIBA developments have been completed.
Weed Management	A program of weed monitoring and management is to be implemented and maintained within restored HRUs to facilitate the natural regeneration of the various habitat types contained therein.	Concurrent with commencement of Operational Works in a particular area and to be maintained for a period of at least twenty four (24) months following completion of works.
Ecosystem Health Monitoring	An ecosystem health monitoring program is to be developed and implemented within HRUs to monitor changes in ecological conditions and any associated requirements for active intervention to assist natural ecological processes that may be under stress due to the nature and scale of the adjacent developments.	Concurrent with commencement of Operational Works in a particular area and to be maintained for a period of at least twenty four (24) months following completion of works.
Active Planting	If ecosystem health monitoring indicates that the outcomes of the RCP are not being achieved within a HRU or part thereof, via the translocation of high natural regeneration potential topsoil, then an active planting program must be developed and implemented for the subject area.	As required.

5 SITE REHABILITATION STRATEGY

5.1 Restoration Implementation Plans

A Restoration Implementation Plan (RIP) will be prepared in conjunction with the development of civil engineering plans for each relevant phase of the RWA development. It is essential that each RIP be prepared in conjunction with the preparation of plans detailing the design and sequencing of the civil engineering works as the success, or otherwise, of the restoration works will be strongly influenced by the manner in which the civil works program is designed and implemented.

Each RIP is to be based on the specifications of this RCP and the South East Queensland Ecological Restoration Framework: Manual (Chenoweth EPLA and Bushland Restoration Services, 2012). Each RIP is to include the following:

- a brief review of the progress, success and/or failures of the works that have been carried out as part of a previous stage of works and adaptations to previous restoration specifications that have been incorporated into the RIP to address identified failures or deficiencies in the previous;
- a statement of objectives;
- a description of the locations, extents and ecological characteristics of the areas that are to be the subject of restoration works, including the Topsoil Source Areas;
- engineering plans detailing the existing surface levels, interim finished levels and design finished levels within the restoration site;
- information concerning the soil profile throughout the restoration site and any treatments required to facilitate restoration;
- the nature and location of erosion and sediment controls;
- vegetation clearance, stockpiling, reuse and disposal specifications;
- topsoil stripping, stockpiling and translocation (respreading) specifications, including information concerning:
    - the types of machinery to be used;
    - the sequencing of works to avoid (or minimise) the stockpiling of topsoil with a high regeneration potential;
    - the strategies to be used to manage any potential deficiencies in the volume of suitable topsoil;
- details concerning any direct seeding or planting programs that are to be implemented as part of the restoration works;
- specific measures to be taken in respect of:
    - potential impacts on threatened species inhabiting the restoration site and Topsoil Source Areas, including consideration of:
        - pre-works capture and translocation strategies;
        - equipment hygiene and work practices to minimise the potential for the spread of Chytrid fungus and associated impacts on threatened frog species;
    - weeds and pests;
    - mosquito and biting midge breeding habitat;
    - bushfire;
- a set of quantifiable Performance Indicators that are related to the following:
    - the species composition, structure, density and height of the vegetation within the restoration area at time intervals detailed in **Section 6**;
    - the presence and abundance of weeds;

  - the presence of threatened fauna identified in **APPENDIX 1** as being likely to occur within the restoration area;
- monitoring specifications, including details on methodology, locations and frequency;
- a record keeping, reporting and review process; and
- an implementation schedule.

5.2 Threatened Species Management

The RWA provides habitat resources for a number of resident and vagrant threatened fauna species. The HPUs will provide a refuge for threatened fauna species within the RWA whilst the RWA development, including the re-profiling and restoration of HRUs, is occurring. It is anticipated that following the completion of the restoration works within each of the HRUs threatened species will recolonise these restored areas from:

- the adjacent HPUs;
- as yet undisturbed HRUs; and/or
- adjacent habitat areas located outside of the RWA boundaries.

As part of the conduct of the restoration works within each HRU, pre-clearance fauna surveys will be carried out and to the extent that is practicable resident threatened fauna will be captured and translocated to secure areas prior to the commencement of earthworks.

Further consideration of threatened species management during the conduct of development activities will be given in the CEMP (or equivalent) and the Restoration Implementation Plans that are to be prepared in support of requisite applications for Operational Works approval for each stage of the RWA development.

5.3 Mosquito and Biting Midge Management

The RWA and broader locality support extensive habitat resources for a mosquito and biting midge species that have the potential to impact on existing and future residents of locality. Existing habitat types present within the RWA and broader locality and the mosquito and biting midge species associated with those habitats are as follows.

The freshwater and saline wetlands and waterbodies within the locality presently provide a range of different habitat types for a variety of mosquito species known to be serious pests and vectors of communicable human viruses within the Moreton Bay Region. These habitats include the following:

- Slightly brackish and freshwater pools in Paperbark wetlands and mangroves provide habitat for *Verrallina funerea* and *Ochlerotatus vigilax*, which are known vectors of Ross River Virus and Barmah Forest fever. Both species are most frequently experienced at pest levels in areas situated within 5km of breeding grounds.
- Freshwater pools, provide habitat for *Culex annulirostris, Oclherotatus notoscriptus, Coquillettidia linealis* and *Culex quinquefasciatus*, which are known vectors of viruses such as Ross River Virus, Barmah Forest Virus, Australian Encephalitis, Japanese Encephailits, Murray Valley Encephalitis and Kunjin.
- Intertidal and brackish pools provide habitat for *Culex sitiens* and *Aedes alterans*, both known to be vectors of Ross River Virus.

Biting midges, which are small mosquito like insects that breed in a range of environments, ranging from rainforests to coastal foreshores and estuarine systems, are not known to transmit disease amongst humans and as such do not possess the same public health management significance as mosquitoes. Nevertheless biting midge may during periods of high abundance cause discomfort to people residing in close proximity to midge breeding/larval habitats. It is likely that the NEBP site provides habitat for the several pestiferous species of biting midge, namely *Culicoides subimmaculatus, C. molestus* and *C. longior*. In addition to these species, *C. ornatus*, which appears to be undergoing a range expansion south of the Hervey Bay region, is also likely to be encountered. The main areas of potential breeding habitat for these species are the tidally influenced flats and banks of the Caboolture River and Raff Creek.

The NEBP RWA development will remove substantial areas of existing breeding habitat for mosquitos and to a lesser extent biting midge and as such there is likely to be a net reduction in the extent of mosquito and biting midge breeding habitats as a consequence of the NEBP RWA development.

Notwithstanding the above, consideration will need to be given during the detailed design and construction phases of each stage of the NEBP RWA development to ensuring that the extent and productivity of potential mosquito and biting midge habitats is minimised whilst still providing the conditions required to maintain viable natural ecosystems within the Raff Creek Open Space Corridor. Of particular importance in this respect is the maintenance of a barrier zone between potential mosquito breeding habitats within the Open Space Precinct and adjacent residential dwellings. The barrier zone should be at least 40m in width and be a sparsely vegetated area that will interrupt the dispersal route of the biting insects from their breeding sites to residential area and reduce harbourage areas by removing the protection of vegetation for shelter. Esplanade roadways, daytime recreation areas, parking areas, parklands with small shrubs and flower beds, woodlands of tall trees with light foliage, or broad scale agricultural land can be used to create the barrier zone.

5.4 Bushfire Management

The layout of the RWA development and design of the restoration works within the Raff Creek Open Space Precinct seek to achieve the following outcomes with respect to bushfire management:

- The health, safety or property of future residents is not placed at an unacceptable risk in the event of a bushfire occurring within the Open Space Precinct.
- The role that bushfire plays in the functioning of natural ecosystems is recognised and catered for in the management of the Open Space precinct.

To ensure that these outcomes are achieved relevant consideration of bushfire management requirements for public health and safety and ecological purposes are incorporated into the overarching Open Space Management Plan for the RWA development and the Restoration Implementation Plans (RIPs) prepared for each stage of development in support of requisite applications for Operational Works approvals.

Public health and safety issues can primarily be met by providing an appropriate buffer between areas of potentially hazardous vegetation and adjacent residential areas.

To cater for ecological requirements it would be generally desirable to exclude fire from areas that are being actively regenerated. To facilitate future controlled burns within

areas of established vegetation a network of pedestrian and cycle ways that also function as fire trails will be established throughout the Raff Creek Open Space Precinct.

5.5 Access Management

During the conduct of restoration works associated with each phase of the RWA development, access to HPUs and HRUs will be prohibited except for approved construction related activities including:

- bulk earthworks;
- the establishment of approved infrastructure, including perimeter fencing;
- bushfire, vegetation and fauna management purposes; and
- the establishment of maintenance access tracks which will generally be aligned with perimeter fencing.

Public access to the HPUs and HRUs will be actively discouraged to enhance the ecological values and functions of the subject areas. Opportunities for public engagement with the HPUs and HRUs will be provided within the adjoining Parkland Reserves and in association with the future roadway crossing of Raff Creek.

5.6 Restoration Personnel and Contractors

The services of a restoration practitioner with the necessary qualifications, experience and resources will be engaged to design and implement the restoration program.

Minimum qualification for the restoration practitioner will be a certificate in Conservation Land Management - Natural Area Restoration from a TAFE college or a university degree in a related field such as ecology or vegetation management.

6 PERFORMANCE INDICATORS, MONITORING AND ADAPTIVE MANAGEMENT

6.1 Background

To achieve the objectives of the RCP it will be necessary to monitor changes in the ecological condition of the Raff Creek HPUs and HRUs. Each of the RIP will include:

- key performance indicators;
- (intervention) trigger values for each key performance indicator;
- a monitoring program that assesses these key performance indicators; and
- management procedures should trigger values be reached.

Data obtained from monitoring can be used to document the success or failure of the various management strategies and allow adaptation of the restoration techniques and implementation schedule to achieve the project objectives in a cost effective manner.

Monitoring of restoration works is to be carried out using a combination of:

- fixed point photographic monitoring;
- plot based quantitative monitoring within the HPUs and HRUs to measure changes in ecological equivalence or bio-condition overtime against the established benchmarks for the prescribed habitat (ecosystem type); and
- threatened fauna monitoring, to detect the presence or absence of threatened fauna within the different HPUs and HRUs.

Monitoring of the HPUs and HRUs will occur on a biannual basis for whichever is the longer of the following periods:

- five (5) years from the completion of restoration works within a given area; or
- until the RWA and adjacent MIBA developments have been completed; or
- the relevant Performance Indicators have been met.

6.2 HPU Monitoring

6.2.1 Items to be Monitored

HPU will be protected from impacts and allowed to naturally regenerate. HPU monitoring will include natural regrowth attributes such as:

- Crown cover (FPC);
- plant density;
- Species diversity;
- weed species and extent (to inform weed maintenance); and
- any issues that need to be rectified.

6.2.2 HPU Planting Criteria

Progress towards rehabilitation success will be measured against the criteria listed in **TABLE 6**.

TABLE 6
REHABILITATION CRITERIA

Item	6 months	12 months	Years 2 & 3	Years 4 & 5
Mulch	Applied where necessary to reduce weeds	Applied where necessary to reduce weeds	Applied where necessary to reduce weeds	Applied where necessary to reduce weeds
FPC	Maintained	Maintained /increased	Maintained /increased	Appropriate for the regional ecosystem
Trees density	Maintained	Maintained /increased	Maintained /increased	Appropriate for the regional ecosystem
Shrubs density	Maintained	Maintained /increased	Maintained /increased	Appropriate for the regional ecosystem
Ground cover density	Maintained	Maintained /increased	Maintained /increased	Appropriate for the regional ecosystem
Species diversity	Maintained	Maintained /increased	Maintained /increased	Appropriate for the regional ecosystem
Weeds	50% reduction in weeds	100% reduction in weeds	No weeds	No weeds
Protective fencing and sediment control devices	present and working	present and working	present and working	present and working

6.3 HRU Monitoring

6.3.1 Items to be Monitored

HRUs will be planted with species representing the ecosystems that would have been present on the site prior to clearing. The monitoring of the planted areas will include:

- height of canopy trees, T2 trees and shrubs;
- crown cover (FPC);
- weed species and extent (to inform weed maintenance);
- plant survival (to inform need for re-planting); and
- any issues that need to be rectified.

6.3.2 HRU Planting Criteria

Progress towards rehabilitation success will be measured against the criteria listed in **TABLE 7**.

TABLE 7
REHABILITATION CRITERIA

Item	6 months	12 months	Years 2 & 3	Years 4 & 5
Mulch	In place @ >10cm deep	In place @ >10cm deep	In place @ >10cm deep	In place @ 10cm deep
FPC	Increased from day of planting	Increased from 6 months monitoring	80-100%	Appropriate for the regional ecosystem being replicated
Canopy Trees	100% survival. 90% of trees have a minimum height of 40 cm	100% survival 90% Minimum height of 70 cm	90% survival. 80% Minimum height of 1-2 m	100% diversity of original planted species. 80% Minimum height of 3 m
T2 trees	100% survival. 90% Minimum height of 30 cm	100% survival 90% Minimum height of 50 cm	90% survival. 80% Minimum height of 0.7-1.2 m	100% diversity of original planted species. 80% Minimum height of 1.2+ m
Shrubs	100% survival. 90% Minimum height of 20 cm	100% survival 90% Minimum height of 35 cm	90% survival. 80% Minimum height of 55-70 cm	100% diversity of original planted species. 70% Minimum height of 70+ cm
Ground cover	100% survival Growth to form	100% survival Growth to form	80% survival Growth to form	100% diversity of original planted species. Growth to form
Plant density	Increased (from pre – planting)	Maintained	Maintained	Appropriate for the regional ecosystem being replicated
Species diversity	Increased (from pre – planting)	Maintained	Maintained	Appropriate for the regional ecosystem being replicated
Weeds	No weeds	No weeds	No weeds	No weeds
Protective fencing and sediment control devices	present and working	present and working	present and working	present and working

6.4 Performance Indicators and Corrective Actions

6.4.1 Introduction

To assess the effectiveness of each of the RIP the following performance indicators have been developed and will be included in each RIP. If the rehabilitation is not preforming as indicated the following corrective actions will be undertaken. Assessment of these indicators will be undertaken during the site monitoring visits and reported annually (refer **Section 6.5**).

6.4.2 Performance Indicators

TABLE 8 provides the items to be monitored, the performance indicators and the corrective actions to be undertaken should the performance indicators not be reached.

TABLE 8
PERFORMANCE INDICATORS AND CORRECTIVE ACTIONS

Items to be Monitored	Performance Indicator	Corrective Action
HRU planting attributes: • height of canopy trees, T2 trees and shrubs; • crown cover (FPC); • Plant survival (to inform need for re-planting); • Species diversity; • Mulch coverage.	1. At the indicated monitoring period the rehabilitation area will have achieved the growth and cover listed in Table 6. At the end of the minimum five (5) year monitoring period the planted areas will achieve a size, cover and species diversity consistent with the regional ecosystem being replicated. 2. At the indicated monitoring period the restoration area will include mulch at 10cm deep.	1a. If at the indicated monitoring period the HRU has not met the performance criteria then the plantings should be assessed by a qualified rehabilitation expert. Corrective steps could include: • additional planting; • addition of appropriate fertilisers; • additional of watering. 1b. If at the end of the minimum five (5) year monitoring period the HRU has not met the performance criteria then the monitoring period will continue on a 6 monthly basis until the milestones have been reached. 2. If at the indicated monitoring period the restoration area does not include mulch at 10cm deep, more will be applied.
HPU natural regrowth attributes: • crown cover (FPC); • plant density; • species diversity.	1. No retained trees will be damaged or removed during rehabilitation activities. 2. Maintain or increase the density and diversity of species within the HPU appropriate to the regional ecosystem	1. If retained trees are damaged during rehabilitation works they will be assessed by a qualified arborist for safety before the tree is allocated to be retained, retained and pruned or removed. If a tree has to be removed 5 trees will be planted in its place; 2. Reduction in plant numbers or diversity will be corrected by additional planting of species appropriate to the regional ecosystem recommended by suitably qualified

		rehabilitation expert.
Weed species and extent;	At the end of the first year monitoring period the rehabilitation area will include: 1. All State declared weeds controlled; 2. The understorey free of large swathes of groundcover weeds and exotic grasses; 3. The shrub layer free of understorey weeds; and 4. The upper canopy free of woody weeds.	If at the end of the first year monitoring period the restoration area has not met the performance criteria then an intensive weed clearance program will be developed to remove all remaining weeds. If at the end of the minimum five (5) year monitoring period the restoration area has not met the performance criteria then the monitoring period will continue until the milestones have been reached.
Site maintenance: • site damage and vandalism; • fencing; • sediment control.	1. Protection fencing will be erected prior to any rehabilitation work. 2. Sediment control must be implemented as per council requirements and the appropriate management plan 3. Any site damage or vandalism will be rectified.	Any deviation from the performance indicators will be rectified as soon as practicable.
Activities in and around the restoration areas	1. All contractors are to be fully aware of responsibilities under the RIPs and other relevant management plans. 2. No unauthorised activities have been undertaken within the restoration area.	Contractors failing to adhere to the restoration plan will be re-educated

6.5 Reporting

A short report will be prepared annually compiling the results of the monitoring inspections and the overall status of the works undertaken in the HPUs and HRUs. The report will include:

- Works undertaken;
- Progress of HPU regeneration or HRU revegetated areas (rehabilitation criteria **TABLES 6 and 7**);
- Significant problems encountered (death of native plants during weed removal, broken fences, vandalism, unsafe retained trees etc.) and the effect of these on the aims of the regeneration strategy;
- Success or failures of measures implemented to rectify previously identified problems;
- Measures to be taken to rectify new problems; and
- Address the success of the RIP using the Performance Indicators (listed in **TABLE 8**).

A final report will be produced at the end of five (5) years. This report will determine if the stated objectives have been reached, or alternatively if further monitoring is required.

REFERENCES

Cardno (2014) Raff Creek Restoration Concept Plan. NEBP – Residential West Area. Prepared for North East Business Park Pty Ltd.

Chenoweth EPLA and Bushland Restoration Services (2012) South East Queensland Ecological Restoration Framework: Guideline and Manual. Prepared on behalf of SEQ Catchments and South East Queensland Local Governments, Brisbane.

APPENDIX 1 – KEY ATTRIBUTES OF RESTORATION MANAGEMENT UNITS

Habitat Protection Units

A total of five (5) HPUs have been defined primarily based on the nature of the existing habitats that occupy the subject land and type of habitat that will be preserved or which will establish if the subject area if protected and managed to facilitate natural ecological processes. Details concerning some of the key characteristics of each of the identified HPUs, which are often comprised of a number of discrete areas, are provided in **TABLE 1** to **TABLE 5**.

TABLE 1
HPU2/2

Attribute	Information Provided
Extent (ha):	16.7
Existing Surface Elevations (m AHD):	1.6 – 2.6
Modified Surface Elevations (m AHD):	1.6 – 2.6
Existing Habitat Type:	Coastal and sub-coastal floodplain tree swamps - melaleuca and eucalypt
Existing Threated Species Habitat Values:	Koala (*Phascolarctos cinereus*)
Natural Regeneration:	High natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal floodplain tree swamps - melaleuca and eucalypt
Regional Ecosystem Equivalents:	RE12.3.5
Restoration Approach:	Natural regeneration / Assisted natural regeneration.
Future Threated Species Habitat Values:	Tusked Frog (*Adelotus brevis*) Lewin's Rails (*Rallus pectoralis*) Australian Painted Snipe (*Rostratula australis*) Koala (*Phascolarctos cinereus*)

TABLE 2
HPU3/3

Attribute	Information Provided
Extent (ha):	0.6
Existing Surface Elevations (m AHD):	1.1 – 1.7
Modified Surface Elevations (m AHD):	< 1.3
Existing Habitat Type:	Coastal and sub-coastal saline swamps
Existing Threated Species Habitat Values:	-
Natural Regeneration:	High natural regeneration potential.
Prescribed Habitat	Coastal and sub-coastal saline swamps

Attribute	Information Provided
Type (s):	
Regional Ecosystem Equivalents:	RE12.1.2
Restoration Approach:	Natural regeneration / Assisted natural regeneration.
Future Threated Species Habitat Values:	Water Mouse (*Xeromys myoides*)

TABLE 3
HPU4/4

Attribute	Information Provided
Extent (ha):	7.5
Existing Surface Elevations (m AHD):	< 1.3
Modified Surface Elevations (m AHD):	< 1.3
Existing Habitat Type:	Mangrove wetlands
Existing Threated Species Habitat Values:	-
Natural Regeneration:	High natural regeneration potential.
Prescribed Habitat Type (s):	Mangrove wetlands
Regional Ecosystem Equivalents:	RE12.1.3 / RE12.1.1
Restoration Approach:	Natural regeneration
Future Threated Species Habitat Values:	Water Mouse (*Xeromys myoides*)

TABLE 4
HPU5/5

Attribute	Information Provided
Extent (ha):	0.1
Existing Surface Elevations (m AHD):	1.5 – 3.2
Modified Surface Elevations (m AHD):	1.5 – 3.2
Existing Habitat Type:	Disturbed Wet-Terrestrial Grassland Mosaic
Existing Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*) Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Low-Moderate natural regeneration potential.
Prescribed Habitat Type (s):	Disturbed Wet-Terrestrial Grassland Mosaic

Attribute	Information Provided
Regional Ecosystem Equivalents:	N/A
Restoration Approach:	N/A - Area to be maintained in current condition to accommodate future regional roadway.
Future Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*) Koala (*Phascolarctos cinereus*)

TABLE 5
HPU6/6

Attribute	Information Provided
Extent (ha):	2.3
Existing Surface Elevations (m AHD):	1.5 – 3.2
Modified Surface Elevations (m AHD):	1.5 – 3.2
Existing Habitat Type:	Disturbed Terrestrial Grassland/Woodland
Existing Threated Species Habitat Values:	Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Low-Moderate natural regeneration potential.
Prescribed Habitat Type (s):	Disturbed Terrestrial Grassland/Woodland
Regional Ecosystem Equivalents:	N/A
Restoration Approach:	N/A - Area to be maintained in current condition to accommodate future regional roadway.
Future Threated Species Habitat Values:	Koala (*Phascolarctos cinereus*)

Habitat Restoration Units

A total of nine (9) HRUs have been defined primarily based on the nature of the existing habitats that occupy the subject land and type of habitat that will restored within the subject area following the completion of Raff Creek flood plain re-profiling works. Details concerning some of the key characteristics of each of the identified HRUs, which are often comprised of a number of discrete areas, are provided in **TABLE 6** to **TABLE 15**.

TABLE 6
HRU1/2

Attribute	Information Provided
Extent (ha):	7.5
Existing Surface Elevations (m AHD):	1.9 - 3.5
Modified Surface Elevations (m AHD):	1.6 - 1.9
Existing Habitat Type:	Coastal and sub-coastal floodplain, grass, sedge herb, swamps.

Attribute	Information Provided
Existing Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*)
Natural Regeneration:	Moderate to High natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal floodplain tree swamps - melaleuca and eucalypt
Regional Ecosystem Equivalents:	RE12.3.5
Restoration Approach:	Fabrication
Future Threated Species Habitat Values:	Tusked Frog (*Adelotus brevis*) Lewin's Rails (*Rallus pectoralis*) Australian Painted Snipe (*Rostratula australis*) Koala (*Phascolarctos cinereus*)

TABLE 7
HRU2/2

Attribute	Information Provided
Extent (ha):	1.2
Existing Surface Elevations (m AHD):	1.6 – 2.3
Modified Surface Elevations (m AHD):	1.4 – 1.6
Existing Habitat Type:	Coastal and sub-coastal floodplain, grass, sedge herb, swamps.
Existing Threated Species Habitat Values:	Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Moderate to High natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal floodplain tree swamps - Melaleuca and Eucalypt
Regional Ecosystem Equivalents:	RE12.3.5
Restoration Approach:	Fabrication
Future Threated Species Habitat Values:	Tusked Frog (*Adelotus brevis*) Lewin's Rails (*Rallus pectoralis*) Australian Painted Snipe (*Rostratula australis*) Koala (*Phascolarctos cinereus*)

TABLE 8
HRU2/3

Attribute	Information Provided
Extent (ha):	0.7
Existing Surface Elevations (m AHD):	1.7 – 2.5
Modified Surface Elevations (m AHD):	1.4 – 1.5

Attribute	Information Provided
Existing Habitat Type:	Coastal and sub-coastal floodplain, grass, sedge herb, swamps.
Existing Threated Species Habitat Values:	Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Moderate to High natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal saline swamps
Regional Ecosystem Equivalents:	RE12.1.2
Restoration Approach:	Fabrication
Future Threated Species Habitat Values:	Water Mouse (*Xeromys myoides*)

TABLE 9
HRU4/4

Attribute	Information Provided
Extent (ha):	0.5
Existing Surface Elevations (m AHD):	1.1 – 1.7
Modified Surface Elevations (m AHD):	< 1.3
Existing Habitat Type:	Mangrove wetlands
Existing Threated Species Habitat Values:	-
Natural Regeneration:	High natural regeneration potential.
Prescribed Habitat Type (s):	Mangrove wetlands
Regional Ecosystem Equivalents:	RE12.1.3 / RE12.1.1
Restoration Approach:	Fabrication / Natural regeneration
Future Threated Species Habitat Values:	Water Mouse (*Xeromys myoides*)

TABLE 10
HRU5/2

Attribute	Information Provided
Extent (ha):	8.9
Existing Surface Elevations (m AHD):	1.7 – 3.8
Modified Surface Elevations (m AHD):	1.6 – 2.6

Attribute	Information Provided
Existing Habitat Type:	Disturbed Wet-Terrestrial Grassland Mosaic
Existing Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*) Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Moderate - High natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal floodplain tree swamps - melaleuca and eucalypt
Regional Ecosystem Equivalents:	RE12.3.5
Restoration Approach:	Fabrication
Future Threated Species Habitat Values:	Tusked Frog (*Adelotus brevis*) Lewin's Rails (*Rallus pectoralis*) Australian Painted Snipe (*Rostratula australis*) Koala (*Phascolarctos cinereus*)

TABLE 11
HRU5/3

Attribute	Information Provided
Extent (ha):	0.5
Existing Surface Elevations (m AHD):	1.7 – 1.8
Modified Surface Elevations (m AHD):	1.4 - 1.5
Existing Habitat Type:	Disturbed Wet-Terrestrial Grassland Mosaic
Existing Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*) Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Low-Moderate natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal saline swamps
Regional Ecosystem Equivalents:	RE12.1.2
Restoration Approach:	Fabrication / Natural regeneration
Future Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*) Water Mouse (*Xeromys myoides*)

TABLE 12
HRU5/4

Attribute	Information Provided
Extent (ha):	0.2
Existing Surface Elevations (m AHD):	1.5 - 1.7
Modified Surface Elevations (m AHD):	< 1.4

Attribute	Information Provided
Existing Habitat Type:	Disturbed Wet-Terrestrial Grassland Mosaic
Existing Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*) Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Low-Moderate natural regeneration potential.
Prescribed Habitat Type (s):	Mangrove wetland
Regional Ecosystem Equivalents:	RE12.1.3
Restoration Approach:	Fabrication / Natural regeneration
Future Threated Species Habitat Values:	Water Mouse (*Xeromys myoides*)

TABLE 13
HRU6/2

Attribute	Information Provided
Extent (ha):	21.0
Existing Surface Elevations (m AHD):	3.5 – 6.4
Modified Surface Elevations (m AHD):	1.1 – 3.2
Existing Habitat Type:	Disturbed Terrestrial Grassland - Woodland
Existing Threated Species Habitat Values:	Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Low natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal floodplain tree swamps - Melaleuca and Eucalypt
Regional Ecosystem Equivalents:	RE12.3.5
Restoration Approach:	Fabrication
Future Threated Species Habitat Values:	Tusked Frog (*Adelotus brevis*) Lewin's Rails (*Rallus pectoralis*) Australian Painted Snipe (*Rostratula australis*) Koala (*Phascolarctos cinereus*)

TABLE 14
HRU6/3

Attribute	Information Provided
Extent (ha):	0.8
Existing Surface Elevations (m AHD):	1.4 – 2.1
Modified Surface Elevations (m AHD):	1.1 – 1.5

Attribute	Information Provided
Existing Habitat Type:	Disturbed Terrestrial Grassland - Woodland
Existing Threated Species Habitat Values:	Koala (*Phascolarctos cinereus*)
Natural Regeneration:	Low natural regeneration potential.
Prescribed Habitat Type (s):	Coastal and sub-coastal saline swamps
Regional Ecosystem Equivalents:	RE12.1.2
Restoration Approach:	Fabrication / Natural regeneration
Future Threated Species Habitat Values:	Black-necked Stork (*Ephippiorhynchus asiaticus*) Water Mouse (*Xeromys myoides*)

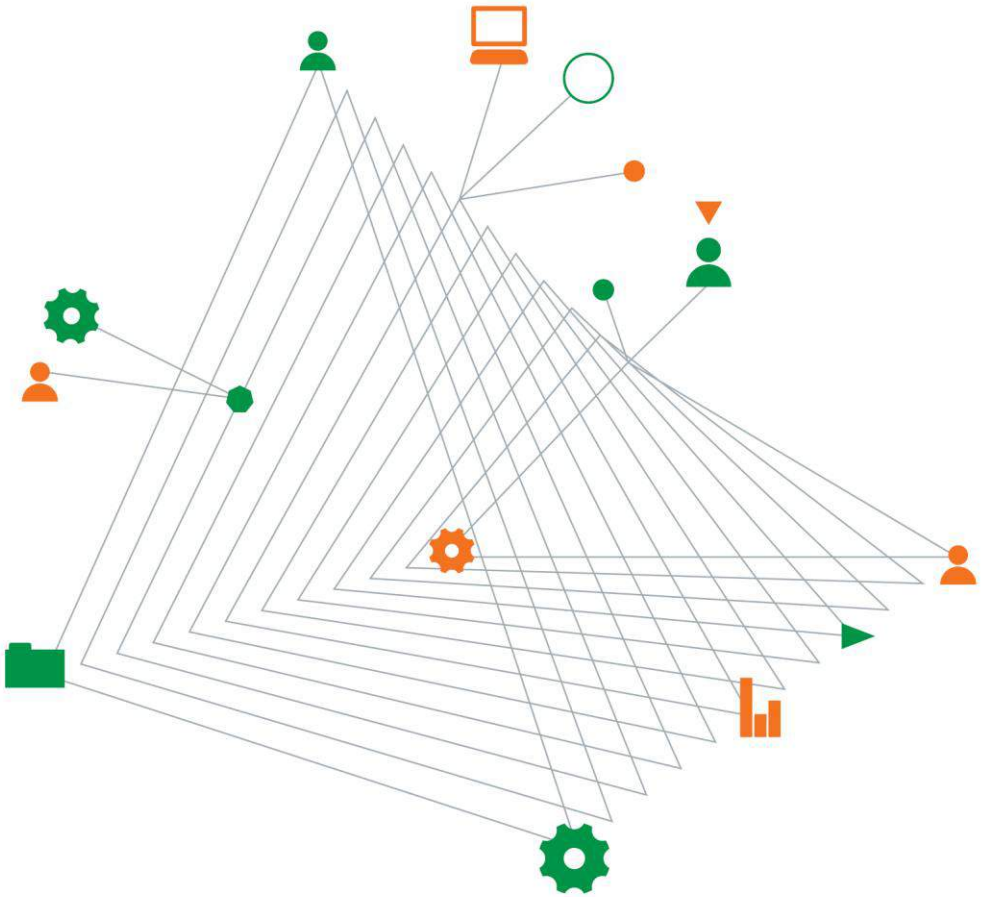
APPENDIX F – ADDENDUM TO ACID SULPHATE SOILS MANAGEMENT PLAN (ASSMP) FOR NEBP PHASE 1 AND PHASE 2A

Northeast Business Park Pty Ltd

North Harbour Residential Development

Addendum to Acid Sulfate Soil Management Plan
Northeast Business Park Phase 1 and Phase 2A

11 May 2015



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North Harbour Residential Development

Prepared for
Northeast Business Park Pty Ltd
Unit 2/6 Nepean Avenue
Arana Hills, QLD 4054

Prepared by
Coffey Geotechnics Pty Ltd
Unit 1, 36 Kerryl Street
Kunda Park QLD 4556 Australia
t: +61 7 5445 4952 f: +61 7 5445 3764
ABN: 93 056 929 483

11 May 2015

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For and on behalf of Coffey

Ron McMahon
Principal Engineer

Quality information

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Drawings

Appendices

1. Introduction

Coffey Geotechnics Pty Ltd (Coffey) have been commissioned by Northeast Business Park Pty Ltd to prepare an addendum to approved acid sulfate soil (ASS) management plan (ASSMP) prepared for the development of North East Business Park (NEBP) located off Buckley Road, Burpengary. The addendum is to adopt the same management practices as the ASSMP with updated location specific liming rates.

The NEBP works are currently being conducted in accordance with the ASSMP dated 10 December 2014 developed by Future Plus Environmental (FPE) for works in the Phase 1 area and part of the Phase 2 area. The areas covered by the FPE are shown on the attached plan Figure 1.

It is now proposed that some works be undertaken outside of the areas delineated in the FPE ASSMP. The additional works include:

- Placing and compacting of some soils, excavated from Stages 5 and 6 of Phase 1 (above RL5m AHD), to within the Phase 2A area. These soils have already been tested for ASS in accordance with the ASSMP.
- Excavation of soils predominantly above RL5m AHD in a section of the Phase 2A area outside of the area covered by the FPE ASSMP and placing the soils in the Phase 2A area. Most of the fill will be in areas already covered by the existing ASSMP. KN Drawing No 13-154-MCU10 attached shows the cut and fill areas.
- Excavation of some 46,000 cubic metres of soil from the compensation basin (shown as Area A in KN Drawing 13-154-MCU17 attached) and placing and compacting those soils in the Phase 2A area inside and outside of the area covered by the FPE ASSMP.
- Excavations for a sewer main. These works are covered by the FPE ASSMP.

The revised extent of the proposed works is shown in the attached plan Figure 1.

2. ASS Investigations

ASS investigations have been undertaken in or adjacent to the areas of ASS disturbance proposed in this Addendum.

2.1. Cut within Residential Areas

The area of proposed cut is shown in KN Drawing No 13-154-MCU10. The total area of cut is some 2.8 hectares. Most of the area of cut is above RL 5 m AHD and does not require an ASS investigation. An area of some 0.4 hectares of cut lies between RL 4 m and RL 5 m AHD. No ASS investigations have been undertaken within the area of proposed cut but the cut area is surrounded by six boreholes which have been undertaken as part of the ASS investigation. Boreholes BH 6, 7, 8, 10, 20 and 21 have all been sampled and tested for ASS. The borehole locations are shown in the copy of KN Drawing No 13-154-MCU10. The borehole logs are attached in Appendix A. Acid sulfate soil test data are contained in Appendix B.

Analyses of the data indicated that no ASS were encountered on the site. The chromium reducible sulfur measurements were below the limit of registration for the test in all samples. Significant actual acidity was present in most samples varying from 0 to 138 moles per tonne (compared to the QASSIT indicator level of 18 moles per tonne defining ASS). However, the level of pre-oxidation sulfur was near zero for all samples. The soils are thus acidic but not ASS. These findings are compatible with the 200 plus ASS classification tests undertaken as part of the ASS management regime undertaken by Coffey to date for the approved ASSMP for the Phase 1 area.

The approved ASSMP sets out a strategy for dealing with such acidic non ASS soils.

2.2. Compensatory Cut Area A

The area of proposed compensatory cut is shown in KN Drawing No 13-154-MCU17. The total area of cut is some 2.4 hectares. All of the cut area is below RL 5 m AHD. ASS investigations have been undertaken within the area of proposed cut with three boreholes which have been undertaken as part of the previous ASS investigation. Boreholes BH 3 and BH 4 from the FPE ASSMP and test pit TP20 from the Douglas Partners investigations in 2003 have all been sampled and tested for ASS. The borehole locations are shown in the copy of KN Drawing No 13-154-MCU17. The borehole logs are attached in Appendix C. Acid sulfate soil test data are contained in Appendix D.

The chromium reducible sulfur measurements were below the limit of registration for the test in all samples. The soils thus have no potential acid generating capacity. Significant actual acidity was present in most samples varying from 0 to 244 moles per tonne (compared to the QASSIT indicator level of 18 moles per tonne defining ASS). However, the level of pre-oxidation sulfur was near zero for the four samples tested for this parameter under the approved ASSMP. Those soils are thus acidic but not ASS. The approved ASSMP sets out a strategy for dealing with such soils.

In addition to the above, five boreholes (TPK102, 103, 105, 107 and 108) were undertaken by Coffey in the same soil unit as the proposed excavation. Screen testing was undertaken on samples from all test pits with laboratory testing of the worst case samples from the screen testing. The laboratory testing included samples from TPK 105 and 107. Results are set out in Table 1. The laboratory test certificates are attached in Appendix D. As demonstrated by all other testing of these soils on the site, the soils are thus indicated by these results to be acidic but not ASS. The approved ASSMP sets out a strategy for dealing with such soils.

Table 1: Test Results from Same Soil Unit

Sample Site	Screen Test Conclusion	Actual Acidity (TAA and S_{KCl})	Potential Acidity (TSA)	Assessment
TPK102	Some TAA, low TSA	-	-	Acidic, nonASS
TPK103	Some TAA, low TSA	-	-	Acidic, nonASS
TPK105	Some TAA, low TSA	TAA=91m/t; 0.01% S_{KCl}	TSA<0.01%	Acidic, nonASS
TPK107	Some TAA, low TSA	TAA=114m/t; 0.01% S_{KCl}	TSA<0.01%	Acidic, nonASS
TPK108	Some TAA, low TSA	-	-	Acidic, nonASS

Samples from the earlier investigations by Douglas Partners were not analysed for pre-oxidation sulfur so there is no means to assess the nature of the actual acidity present. The Coffey TPK testing included pre-oxidation sulfur which was zero for all samples. Also, as there was no oxidisable sulfur present in any of the samples tested, it is unlikely that the measured acidity is sulfuric. However, as there is some possibility that sulfuric acidity is present in some areas, then the strategies set out for managing both the ASS risk in the approved ASSMP shall be adopted.

3. ASS Management

The ASS management strategy shall be as adopted in the approved ASSMP. This shall involve the following key steps:

- All soils to be excavated shall be analysed for ASS prior to excavation at the rate of 1 test per 500 cubic metres excavated. This testing is to allow the soils to be characterized as ASS or acidic nonASS. Details of the testing required are set out in Section 5.0 of the ASSMP.
- Soils indicated to be ASS must be managed in accordance with the approved ASSMP. ASS shall thus be thoroughly mixed with fine agricultural lime at the appropriate rate and the effectiveness of the treatment confirmed by validation testing. The details of the management requirements are set out in Section 6.4 of the ASSMP.
- Soils indicated to be acidic but not ASS must be managed in accordance with the approved ASSMP. The acidic nonASS soils shall thus be placed with lime layers at 600 mm depth intervals. The treatment is to be validated by reference to a lime register showing appropriate lime placement. The details of the management requirements are set out in Section 6.5 of the ASSMP.
- All monitoring and reporting requirements shall be as per the ASSMP.

A summary of these requirements is set out in this Addendum.

3.1. Characterization Testing

The characterization testing is designed to allow the soils to be categorized as ASS or nonASS acidic soils. Details of the testing required are set out in Section 5 of the ASSMP. A summary of the ASSMP requirements is set out below.

Testing

- The testing is by laboratory analyses for pH, total actual acidity (TAA), pre-oxidation sulfur (S_{KCl}), oxidisable sulfur by the chromium reducible sulfur method (S_{CR}) and residual acidity (S_{RAS}). The test frequency is one test per 500 cubic metres.

A soil shall be considered ASS when:

- pH < 4.5; or
- S_{CR} > 0.03%; or
- TAA > 18 moles per tonne and S_{KCl} > 0.03%.

A soil shall be considered acidic nonASS when:

- pH > 4.5; and
- S_{CR} < 0.03%; and
- TAA > 18 moles per tonne but S_{KCl} < 0.03%.

3.2. ASS Treatment Strategy

Where the characterization testing indicates the soils to be ASS, then the soils must be treated as set out in Section 6.4 of the ASSMP. The management strategies include:

- Liming of the base of treatment areas, basal lime layers in reclamation areas where ASS is to be placed and cut batters in ASS should be undertaken at the rate of 5 kilograms fine agricultural lime per square metre.
- Thoroughly mixing fine agricultural lime with the ASS. The rate should be calculated based on the total acidity calculated from results of characterization testing with a factor of safety of 1.5. The minimum liming rates are set out for the two areas of soil excavation in Table 2. The liming rates in Table 2 are site specific and different to (and higher) than those in Table 8 of the ASSMP. These minimum liming rates are based on the maximum total acidity encountered by testing in those areas.
- Validation testing as specified in the approved ASSMP must be undertaken at the frequency of 1 test per 250 cubic metres.

Table 2: Minimum Liming Rate - ASS

Source of Fill	Maximum Acidity(moles/tonne)	Bulk Density (tonnes/m^3)	Factor of Safety	Minimum Liming Rate (kilograms/m^3)
Stage 2B	138	1.7	1.5	18
Compensatory Cut Area A	244	1.7	1.5	31

3.3. Acidic NonASS Treatment Strategy

Where the characterization testing indicates the soils to be acidic but nonASS, then the soils must be treated as set out in Section 6.6 of the ASSMP. The management strategies include:

- Liming of the base of treatment areas, basal lime layers in reclamation areas where ASS is to be placed and cut batters in ASS should be undertaken at the rate of 5 kilograms fine agricultural lime per square metre.
- Placement of fine agricultural lime as a basal layer and then layers interspersed with the acidic fill at not more than 600 mm depth intervals. The rate should be calculated based on the 90 percentile value of total acidity calculated from results of characterization testing with a factor of safety of 1.2. The minimum liming rates are set out for the two areas of soil excavation in Table 3. The liming rates in Table 3 are site specific and different to (and

higher) than those in Table 9 of the ASSMP. These minimum liming rates are based on the 90 percentile total acidity encountered by testing in those areas.

- Validation testing is not required. As specified in the approved ASSMP, the verification of appropriate lime treatment must be undertaken by the maintenance of a lime register by the earthworks Contractor.

Table 3: Minimum Liming Rate – Acidic NonASS

Source of Fill	Maximum Acidity(moles/tonne)	Bulk Density (tonnes/m^3)	Factor of Safety	Minimum Liming Rate (kilograms/m^3)
Stage 2B	128	1.7	1.2	13
Compensatory Cut Area A	150	1.7	1.2	15

4. Other ASSMP Requirements

All other requirements of the approved ASSMP shall apply to the additional works covered by this Addendum. These include erosion and sediment control measures, all surface water and groundwater monitoring, record keeping, the recording of non-compliance and reporting.

Important information about your **Coffey** Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Important information about your **Coffey** Report

Data should not be separated from the report*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

Rely on Coffey for additional assistance

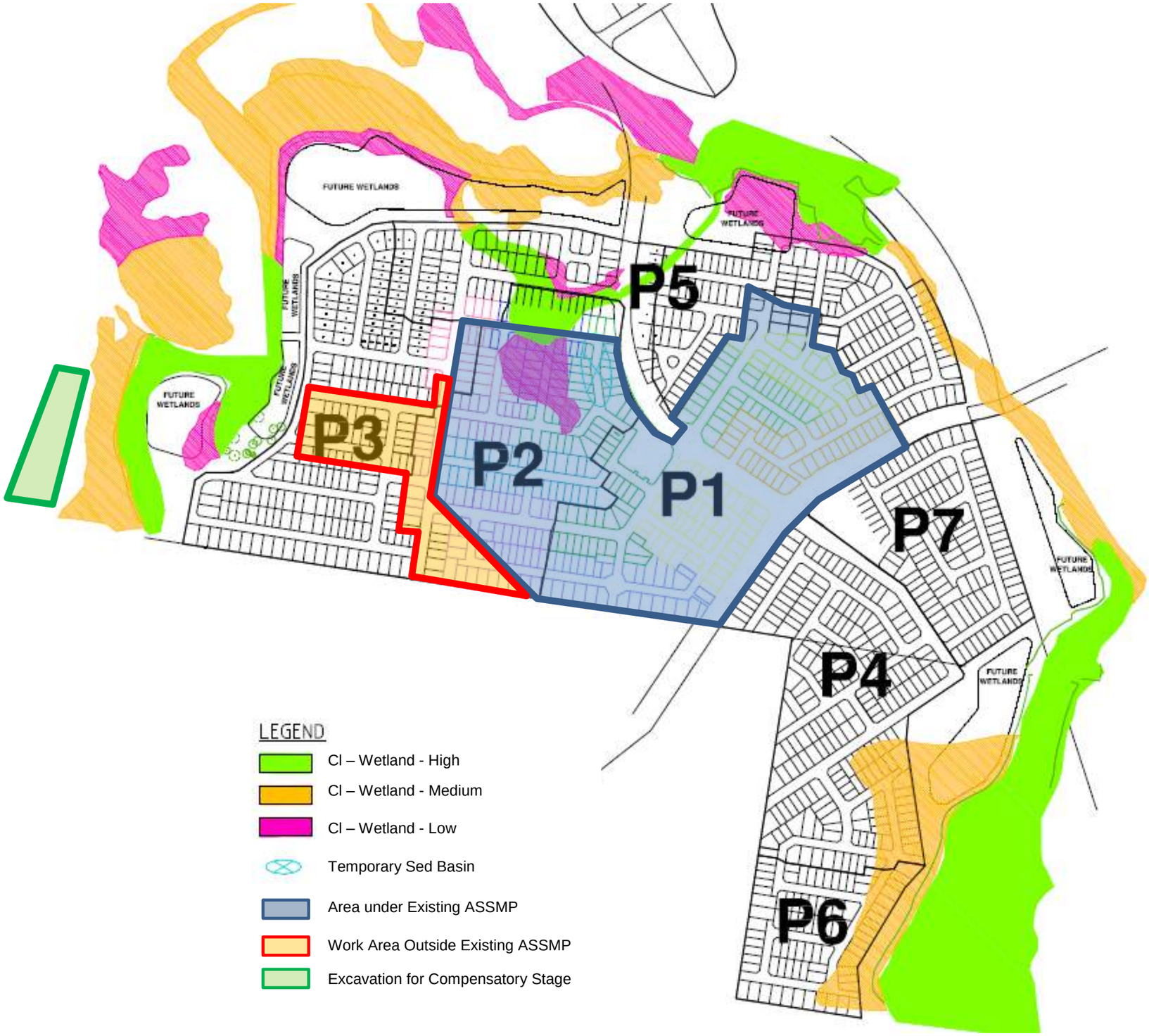
Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction,
speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Figures



revision	description	drawn	approved	date

drawn	**MC**
approved	**RM**
date	**07/05/2015**
scale	**NTS**
original size	**A3**

coffey

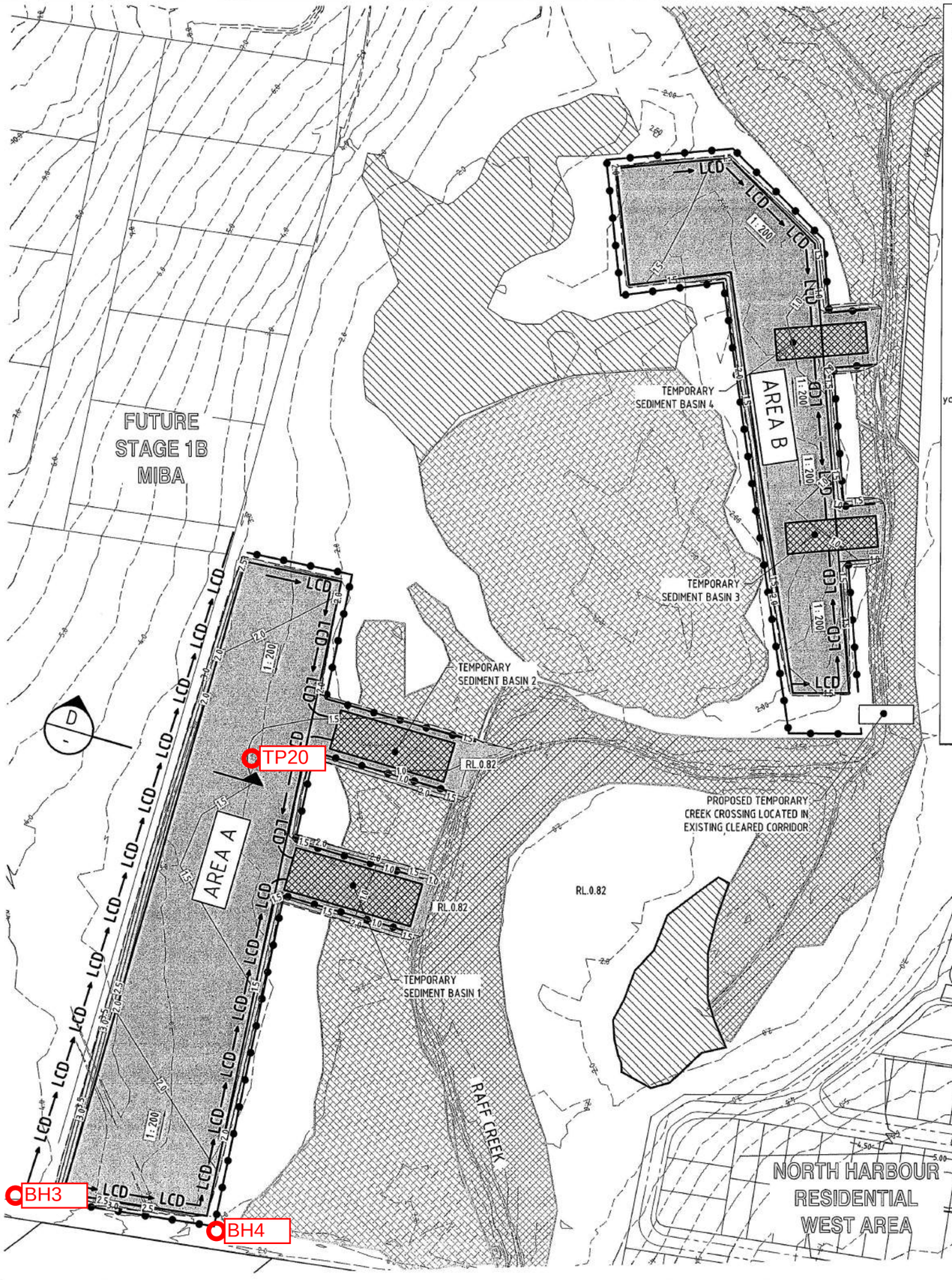
client: **Northeast Business Park Pty Ltd**

project: **Addendum to Acid Sulfate Soil Management Plan Northeast Business Park Phase 1 and Phase 2A**

title: **Site Plan Delineating Areas Covered by ASSMP**

project no: GEOTKPAR01976AC

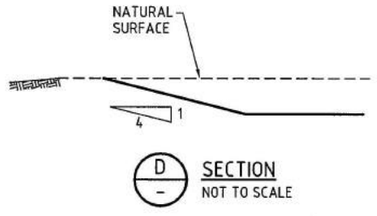
figure no: **FIGURE 1**



Job No. 13-154
Client: Port Binnli
Project: North Harbour - North East Business Park

Basin	**1**	**2**	**2**		
Basin Design	Type D	Type D	Type D		
Contributing Stages	**1**	**2**	**3,4**		
	Basin	Basin	Basin		
R(y%5day)	63	63	63	mm	Table B5 (90th%-sensitive receiving water)
Soil Type	Clay	Clay	Clay		
Cv	0.67	0.67	0.67		Table B7 (interpolated)
Effective catchment area (A)	2.50	2.00	1.20	Ha	
Vs (volume of settling zone)	1055.3	844.2	506.5	m3	Vs = 10.R(y%5day).Cv.A
settling depth	0.6	0.6	0.6	m	
Area of basin	1758.8	1407.0	844.2	m2	
Base width	24.2	21.7	16.8	m	
Base length	72.6	65.0	50.3	m	
settling zone Volume check	1055.3	844.2	506.5	m3	= required volume therefore ok
Spillway Design					
Less than 3month operation	Q10	Q10	Q10		
3-12month operation	Q20	Q20	Q20		Life of basin Chosen
greater than 12 months	Q100	Q100	Q100		
Intensity for a 20 year, 6 min event	227.0	227.0	227.0	mm/hr	(MBRC - Caboolture)
C10 value	0.88	0.88	0.88		Factor by 1.05 for C20
Effective catchment area (a)	2.5	2.0	1.2	Ha	
Q (flow rate)	**1.46**	**1.17**	**0.70**	m3/s	flow to design for weir and spillway
(n)	0.025	0.025	0.025		Mannings value for rock rip rap
width of spillway	18.0	30.0	30.0	m	
yc = 2/3H depth of flow over spillway	0.13	0.16	0.16	m	(Maximum 0.45m, IECA 2008, Page B.35)
gradient of spill way "wings"	2.0	2.0	2.0	:1	
area spillway (using gradient 2:1)	2.44	4.89	4.89		area (cross section) of spillway
perimeter	18.6	30.7	30.7	m	wetted perimeter
Slipway outlet slope (S)	0.100	0.100	0.100		
(R)	0.13	0.16	0.16	m	(area/wetted perimeter)
Velocity (V)	3.3	3.7	3.7	m/s	V=R^(2/3) * S^(1/2) / n
Check against design flow (Q)	**7.9**	**18.2**	**18.2**	m3/s	OK
Bottom velocity (V)	2.3	2.6	2.6	m/s	
Weir Flow Calculation (H)	0.2	0.242	0.242	m	Maximum Depth above weir
Check on against design flow rate (Q)	**2.78**	**6.14**	**6.14**	m3/s	OK refer Table A21 IECA

Summary	Basin	Basin	Basin	
Basin to be constructed in Cut/Fill	Cut	Cut	Cut	
Minimum required depth of weir	0.35	0.45	0.45	m
settling depth	0.60	0.60	0.60	m
storage depth	0.60	0.60	0.60	m
Total depth	1.55	1.65	1.65	m
Base width	24.2	21.7	16.8	m
Base Length	72.6	65.0	50.3	m
Spillway width	18.0	30.0	30.0	m
Spillway Slope	10	10	10	1 in
Weir Rock Diameter Size	200	200	200	mm Sized using QUDM figure 8.13



D — SECTION
NOT TO SCALE

LEGEND

- NATURAL SURFACE CONTOURS
- DESIGN SURFACE CONTOURS
- SEDIMENT AND DIVERSION FENCE (TEMPORARY)
- STAGE BOUNDARY
- LCD — LINED CATCH DRAIN CHECK DAMS @ 50m CENTRES
- Test Location
- WETLAND-HIGH
- WETLAND-MED
- WETLAND-LOW
- EXTENT OF CUT

SCALE
10 0 10 20 30 40 50 60 70 80 90 100m
1 : 1250 (A1 UNREDUCED)

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW

NORTH

Client

NorthEast
BUSINESS PARK

Project

North Harbour
feel right at home

Project

BULK EARTHWORKS
MCU
PHASE 2A

KN GROUP PTY LTD
CONSULTING ENGINEERS
LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au
ABN 35 112 053 611

Approved Delegate - RPEQ 1988 23.3.15

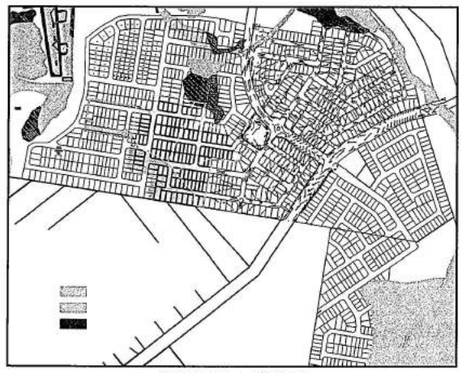
Drawing Title
EARTHWORKS CONTOUR PLAN
RAFF CREEK

Drawn	Designed	Checked	Date
RW	JB	GBG	MAR 15
Scale: AS SHOWN			Sheet: 8 of 8
A1	Drawing No: 13-154-MCU17		Revision: A

DO NOT SCALE THIS DRAWING
IF IN DOUBT - ASK!

REVISIONS

No	Description	Date	By
A	COUNCIL APPROVAL	16/03/15	RW



OVERALL LAYOUT
SCALE 1:10,000

STAGE No.	COMPENSATORY FLOOD VOLUME OFFSET REQUIRED	OFFSET VOLUME AVAILABLE (REFER KN DWG 13-154-MCU17)	
STAGE 7	700m³	AREA A	31,000m³
STAGE 8	14,800m³ (1,300m³ IN TEMPORARY BATTERS)	AREA B	14,000m³
STAGE 12	13,700m³ (4,000m³ IN TEMPORARY BATTERS)		
TOTAL	29,200m³		45,000m³

LEGEND

- NATURAL SURFACE CONTOURS
- FINAL SURFACE CONTOURS
- 2 STRAND WIRE FENCING TO PERIMETER WITH BUNTING TO DELTINIATE EXTENTS
- BULK EARTHWORKS CONTRACT STAGE BOUNDARY
- EXTENT OF CUT
- EXTENT OF FILL
- Borehole Location

SCALE 100 50 0 100 200 300 400 500 600 700 800 900 1000m
1 : 10000 (A1 UNREDUCED)

SCALE 10 0 10 20 30 40 50 60 70 80 90 100m
1 : 1250 (A1 UNREDUCED)

NORTH

Client
NorthEast BUSINESS PARK

Project
North Harbour
feel right at home

Project
BULK EARTHWORKS
MCU
PHASE 2A

KN GROUP PTY LTD CONSULTING ENGINEERS
LEVEL 2 - 71 GREY STREET
SOUTH BRISBANE
QUEENSLAND 4101
PHONE 07 3017 1900
FAX 07 3017 1911
EMAIL kng@knpl.com.au
ABN 35 112 053 611

Approved Delegator - RPEQ 1985 23.3.15

Drawing Title
EARTHWORKS CONTOUR PLAN

Drawn	Designed	Checked	Date
RW	JB	GBG	MAR 15

Scale	Sheet
AS SHOWN	1 of 8

	Drawing No	Revision
A1	13-154-MCU10	A

Appendix A – Borehole Logs Residential Areas

APOD Soil Testing Pty Ltd

Domestic & Commercial Site Investigations
ABN: 47 106 610 977 ACN: 106 610 977

53 Drapers Road
Eatons Hill Qld 4037
Telephone: (07) 3261 6995
Fax: (07) 3261 6991
Email: apodsoil@bigpond.com

Address: Buckley Road, Burpengary | Job No: 14-09-24353 | Date: 17/09/2014

TEST HOLE NO. 5

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SAND (SW) (br-lt.br)			
200	- fine to medium grain			
300	dry			
400	SILTY CLAY (CH) (gy.mott.or-br)			
500	- minor sand			
600	- minor small gravels			
700	moist			
800				
900	- XW rock layers			
1000	slightly moist			
1100				
1200	XW ROCK (br)			
1300	- trace clay lenses			
1400				
1500				
1600				
1700				
1800	dry			
1900				
2000				
2100				
2200				
2300	SILTY CLAY (CH/CI)			
2400	(lt.gy.mott.yell-br)			
2500	- XW rock lenses			
2600				
2700	slightly moist/moist			
2800				
2900				
3000				
3100	END P/A			
3200				
3300				
3400				
3500				
3600				
3700				
3800				
3900				
4000				

TEST HOLE NO. 6

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SANDY SILT (SM) (dk-br)			
200	- trace clay moist			
300	SAND (SW) (lt.gy)			
400	- trace silt			
500	very moist/wet			
600				
700	SILTY CLAY (CH) (lt.gy.mott.or-br)			
800	- with sand			
900	- medium to coarse grain			
1000				
1100				
1200				
1300				
1400				
1500				
1600				
1700				
1800	moist			
1900				
2000				
2100				
2200				
2300				
2400				
2500				
2600				
2700	moist/slightly moist			
2800				
2900				
3000				
3100	END P/A			
3200				
3300				
3400				
3500				
3600				
3700				
3800				
3900				
4000				

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Eatons Hill Qld 4037
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Address: Buckley Road, Burpengary | Job No: 14-09-24353 | Date: 17/09/2014

TEST HOLE NO. 7

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SILTY SAND (SM) (dk.gy)			
200	- fine to medium grain			
300	slightly moist			
400				
500	moist (gy)			
600	SILTY CLAY (CH)			
700	(lt.gy.mott.or-yell-br)			
800	- minor sand			
900	- trace gravels			
1000				
1100				
1200	moist			
1300				
1400				
1500				
1600				
1700	- XW rock layers			
1800				
1900	slightly moist			
2000				
2100				
2200				
2300				
2400				
2500				
2600	- trace XW rock lenses			
2700				
2800				
2900				
3000				
3100				
3200				
3300	slightly moist/moist			
3400				
3500				
3600				
3700				
3800				
3900				
4000				
4100	END P/A			

TEST HOLE NO. 8

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SILTY CLAY (CH) (dk.br.mott.yell-or)			
200	- trace sand			
300	moist			
400	(lt.gy-gy.mott.yell-br)			
500	moist			
600				
700	- minor sand			
800	- very moist lenses			
900				
1000	very moist/moist			
1100				
1200				
1300	XW ROCK (lt.gy)			
1400	dry			
1500	UTP P/A			
1600	(ROCK)			
1700				
1800				
1900				
2000				
2100				
2200				
2300				
2400				
2500				
2600				
2700				
2800				
2900				
3000				
3100				
3200				
3300				
3400				
3500				
3600				
3700				
3800				
3900				
4000				
4100				

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Telephone: (07) 3261 6995
Fax: (07) 3261 6991
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Address: Buckley Road, Burpengary | Job No: 14-09-24353 | Date: 17/09/2014

TEST HOLE NO. 9

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SILTY SAND (SM) (dk.gy-dk.br)			
200	- trace small gravels			
300	- fine to medium grain			
400	moist			
500	SAND (SW) (lt.gy)			
600	- fine to medium grain			
700	wet			
800	- perched water table			
900	SILTY CLAY (CH) (gy.mott.or-yell-br)			
1000	- with sand			
1100				
1200				
1300				
1400	very moist/moist			
1500				
1600				
1700				
1800	- trace sand			
1900	- trace gravels			
2000	moist			
2100				
2200	- with sand			
2300				
2400				
2500	moist			
2600				
2700				
2800				
2900				
3000				
3100	END P/A			
3200				
3300				
3400				
3500				
3600				
3700				
3800				
3900				
4000				

TEST HOLE NO. 10

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SAND (SW) (lt.gy-br)			
200	- fine to medium grain			
300				
400				
500	moist			
600				
700	SILTY CLAY (CH/CI) (gy.mott.or-br)			
800	- with sand			
900				
1000				
1100	very moist/moist			
1200				
1300				
1400	XW ROCK (gy)			
1500	- trace clay			
1600	slightly moist			
1700	(lt.gy)			
1800	dry			
1900	UTP P/A			
2000				
2100				
2200				
2300				
2400				
2500				
2600				
2700				
2800				
2900				
3000				
3100				
3200				
3300				
3400				
3500				
3600				
3700				
3800				
3900				
4000				

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Address: Buckley Road, Burpengary | Job No: 14-09-24353 | Date: 17/09/2014

TEST HOLE NO. 20

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SILTY CLAY (CH) (gy-br.mott.or)			
200	- trace small gravels			
300	slightly moist/moist			
400				
500	CLAYEY SAND (SC) (br-gy)			
600	- medium grain very moist			
700	SILTY CLAY (CH) (lt.gy.mott.or-br)			
800	- trace sand & small gravels			
900				
1000				
1100	moist/slightly moist			
1200				
1300				
1400				
1500				
1600				
1700				
1800				
1900				
2000				
2100	slightly moist			
2200				
2300				
2400				
2500				
2600				
2700				
2800				
2900				
3000				
3100				
3200				
3300				
3400				
3500				
3600	moist			
3700				
3800				
3900				
4000				
4100				
4200	- very silty			
4300				
4400				
4500				
4600				
4800				
4900				

TEST HOLE NO. 20

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
5000				
5100				
5200				
5300	(or-br.mott.gy)			
5400				
5500	very moist/moist			
5600				
5700				
5800				
5900				
6000	very moist/moist			
6100				
6200				
6300				
6400				
6500				
6600				
6700				
6800				
6900				
7000				
7100				
7200	CLAYEY SAND (SC) (or-br)			
7300	- medium to coarse grain			
7400				
7500				
7600				
7700	moist			
7800				
7900				
8000				
8100				
8200				
8300				
8400				
8500				
8600				
8700				
8800				
8900				
9000				
9100	END P/A			
9200				
9300				
9400				
9500				
9600				
9800				

APOD Soil Testing Pty Ltd

Domestic & Commercial Site Investigations
ABN: 47 106 610 977 ACN: 106 610 977

53 Drapers Road
Eatons Hill Qld 4037
Telephone: (07) 3261 6995
Fax: (07) 3261 6991
Email: apodsoil@bigpond.com

Address: Buckley Road, Burpengary | Job No: 14-09-24353 | Date: 17/09/2014

TEST HOLE NO. 21					TEST HOLE NO.				
DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u	DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SILTY SAND (SM) (dk.gy)				100				
200	(br-gy)				200				
300					300				
400					400				
500	moist				500				
600					600				
700					700				
800	SANDY CLAY (CH) (gy.mott.or-br)				800				
900	- trace sand & small gravels				900				
1000					1000				
1100					1100				
1200					1200				
1300					1300				
1400	moist/slightly moist				1400				
1500					1500				
1600					1600				
1700	- weathered rock layers				1700				
1800					1800				
1900					1900				
2000					2000				
2100					2100				
2200					2200				
2300					2300				
2400	slightly moist/dry				2400				
2500					2500				
2600					2600				
2700					2700				
2800					2800				
2900					2900				
3000					3000				
3100	END P/A				3100				

Appendix B - ASS Test Results Residential Areas

Cardno
Shaping the Future

Cardno Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
Kunda Park Qld 4556

Telephone:
(07) 5452 0100
Facsimile:
(07) 5452 0133

Email: cardnobowlerkp@cardno.com.au
Website: www.cardno.com.au

pH_F and pH_{Fox}

Client:	Future Plus Environmental		
Client Address:	PO Box 1250, Buddina, Qld 4575		
Project:	4543		
Project Number:	3740/P/648		
Date Started:	19/09/2014	**Date Finished:**	19/09/2014
Test Procedure:	ASSLMG V2.1 H1-1		

Sample No.	Location	pH_F	pH_{FOX}	pH Change	Reaction
3740/S/35568	BH6 0.25	5.50	3.78	1.72	x
3740/S/35569	BH6 0.50	5.67	5.20	0.47	x
3740/S/35570	BH6 0.75	5.35	4.61	0.74	x
3740/S/35571	BH6 1.00	5.36	5.05	0.31	-
3740/S/35572	BH6 1.25	5.40	4.24	1.16	x
3740/S/35573	BH6 1.50	5.35	4.54	0.81	x
3740/S/35574	BH6 1.75	5.40	4.73	0.67	x
3740/S/35575	BH6 2.00	5.50	4.70	0.80	x
3740/S/35576	BH6 2.25	5.36	4.70	0.66	x
3740/S/35577	BH6 2.50	5.55	4.84	0.71	x
3740/S/35578	BH6 2.75	5.66	4.60	1.06	x
3740/S/35579	BH6 3.00	5.77	4.78	0.99	x

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80°C

Form Number:
REP pH

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pH_F and pH_{Fox}

Client:	Future Plus Environmental
Client Address:	PO Box 1250, Buddina, Qld 4575
Project:	4543
Project Number:	3740/P/648
Date Started:	19/09/2014
Date Finished:	19/09/2014
Test Procedure:	ASSLMG V2.1 H1-1

Sample No.	Location	pH_F	pH_{FOX}	pH Change	Reaction
3740/S/35580	BH7 0.25	5.44	2.28	3.16	x
3740/S/35581	BH7 0.50	5.58	3.57	2.01	x
3740/S/35582	BH7 0.75	5.48	4.27	1.21	x
3740/S/35583	BH7 1.00	5.50	4.35	1.15	x
3740/S/35584	BH7 1.25	5.59	4.39	1.20	x
3740/S/35585	BH7 1.50	5.61	4.79	0.82	x
3740/S/35586	BH7 1.75	5.76	4.45	1.31	x
3740/S/35587	BH7 2.00	5.77	4.53	1.24	x
3740/S/35588	BH7 2.25	5.66	4.83	0.83	x
3740/S/35589	BH7 2.50	5.72	4.50	1.22	x
3740/S/35590	BH7 2.75	5.81	4.74	1.07	-
3740/S/35591	BH7 3.00	6.00	4.85	1.15	x
3740/S/35592	BH7 3.25	5.72	4.90	0.82	x
3740/S/35593	BH7 3.50	5.79	4.96	0.83	x
3740/S/35594	BH7 3.75	5.68	4.96	0.72	x
3740/S/35595	BH7 4.00	5.59	4.90	0.69	x

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80°C

Form Number:
REP pH

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pH_F and pH_{Fox}

Client:	Future Plus Environmental		
Client Address:	PO Box 1250, Buddina, Qld 4575		
Project:	4543		
Project Number:	3740/P/648		
Date Started:	18/09/2014	**Date Finished:**	18/09/2014
Test Procedure:	ASSLMG V2.1 H1-1		

Sample No.	Location	pH_F	pH_{FOX}	pH Change	Reaction
3740/S/35596	BH8 0.25	4.71	3.22	1.49	x
3740/S/35597	BH8 0.50	4.89	3.28	1.61	-
3740/S/35598	BH8 0.75	4.73	3.77	0.96	-
3740/S/35599	BH8 1.00	4.95	3.88	1.07	-
3740/S/35600	BH8 1.25	4.95	3.86	1.09	-
3740/S/35601	BH8 1.50	5.01	3.88	1.13	-

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80°C

Form Number:
REP pH

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pH_F and pH_{Fox}

Client:	Future Plus Environmental		
Client Address:	PO Box 1250, Buddina, Qld 4575		
Project:	4543		
Project Number:	3740/P/648		
Date Started:	18/09/2014	**Date Finished:**	18/09/2014
Test Procedure:	ASSLMG V2.1 H1-1		

Sample No.	Location	pH_F	pH_{FOX}	pH Change	Reaction
3740/S/35614	BH10 0.25	5.57	2.72	2.85	x
3740/S/35615	BH10 0.50	5.69	4.86	0.83	x
3740/S/35616	BH10 0.75	5.51	3.92	1.59	xx
3740/S/35617	BH10 1.00	5.68	4.46	1.22	x
3740/S/35618	BH10 1.25	6.12	5.18	0.94	x
3740/S/35619	BH10 1.50	5.97	5.06	0.91	-
3740/S/35620	BH10 1.75	5.99	5.07	0.92	-
3740/S/35621	BH10 1.90	6.18	5.41	0.77	-

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80°C

Form Number:
REP pH

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pH_F and pH_{Fox}

Client:	Future Plus Environmental
Client Address:	PO Box 1250, Buddina, Qld 4575
Project:	4543
Project Number:	3740/P/648
Date Started:	19/09/2014
Date Finished:	19/09/2014
Test Procedure:	ASSLMG V2.1 H1-1

Sample No.	Location	pH_F	pH_{Fox}	pH Change	Reaction
3740/S/35884	BH20 0.25	4.75	3.32	1.43	x
3740/S/35885	BH20 0.50	4.90	3.57	1.33	-
3740/S/35886	BH20 0.75	4.95	3.70	1.25	x
3740/S/35887	BH20 1.00	5.22	3.99	1.23	x
3740/S/35888	BH20 1.25	5.05	3.80	1.25	-
3740/S/35889	BH20 1.50	5.15	3.93	1.22	-
3740/S/35890	BH20 1.75	5.36	3.90	1.46	-
3740/S/35891	BH20 2.00	5.45	4.30	1.15	-
3740/S/35892	BH20 2.25	5.70	4.74	0.96	-
3740/S/35893	BH20 2.50	5.83	4.92	0.91	-
3740/S/35894	BH20 2.75	6.00	4.83	1.17	-
3740/S/35895	BH20 3.00	5.53	4.48	1.05	-
3740/S/35896	BH20 3.25	5.48	4.51	0.97	-
3740/S/35897	BH20 3.50	5.66	4.68	0.98	-
3740/S/35898	BH20 3.75	5.73	4.91	0.82	-
3740/S/35899	BH20 4.00	5.61	5.08	0.53	-
3740/S/35900	BH20 4.25	5.88	5.10	0.78	-
3740/S/35901	BH20 4.50	6.31	5.29	1.02	-
3740/S/35902	BH20 4.75	6.68	5.93	0.75	-
3740/S/35903	BH20 5.00	6.64	5.36	1.28	-
3740/S/35904	BH20 5.25	6.60	5.52	1.08	x
3740/S/35905	BH20 5.50	6.80	5.63	1.17	-
3740/S/35906	BH20 5.75	6.71	5.48	1.23	-
3740/S/35907	BH20 6.00	5.53	4.74	0.79	-
3740/S/35908	BH20 6.25	6.60	5.44	1.16	-
3740/S/35909	BH20 6.50	6.88	5.63	1.25	-
3740/S/35910	BH20 6.75	7.46	5.84	1.62	-
3740/S/35911	BH20 7.00	7.42	5.87	1.55	-
3740/S/35912	BH20 7.25	7.28	5.77	1.51	-
3740/S/35913	BH20 7.50	7.00	5.70	1.30	-
3740/S/35914	BH20 7.75	6.58	5.62	0.96	-
3740/S/35915	BH20 8.00	6.86	5.69	1.17	-
3740/S/35916	BH20 8.25	7.02	5.82	1.20	-
3740/S/35917	BH20 8.50	7.48	5.88	1.60	-
3740/S/35918	BH20 8.75	7.52	5.93	1.59	-
3740/S/35919	BH20 9.00	7.46	5.76	1.70	x

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80 °C

Form Number:

REP pH

Cardno
Shaping the Future

Cardno Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
Kunda Park Qld 4556

Telephone:
(07) 5452 0100
Facsimile:
(07) 5452 0133

Email: cardnobowlerkp@cardno.com.au
Website: www.cardno.com.au

pH_F and pH_{Fox}

Client:	Future Plus Environmental
Client Address:	PO Box 1250, Buddina, Qld 4575
Project:	4543
Project Number:	3740/P/648
Date Started:	19/09/2014
Date Finished:	19/09/2014
Test Procedure:	ASSLMG V2.1 H1-1

Sample No.	Location	pH_F	pH_{FOX}	pH Change	Reaction
3740/S/35923	BH21 0.25	6.02	4.87	1.15	x
3740/S/35924	BH21 0.50	6.17	5.53	0.64	-
3740/S/35925	BH21 0.75	5.48	4.43	1.05	-
3740/S/35926	BH21 1.00	5.38	4.29	1.09	x
3740/S/35927	BH21 1.25	5.57	4.07	1.50	x
3740/S/35928	BH21 1.50	5.45	4.29	1.16	x
3740/S/35929	BH21 1.75	5.32	4.44	0.88	x
3740/S/35930	BH21 2.00	5.62	5.03	0.59	x
3740/S/35931	BH21 2.25	5.51	4.78	0.73	x
3740/S/35932	BH21 2.50	5.58	5.09	0.49	x
3740/S/35933	BH21 2.75	5.88	4.94	0.94	x
3740/S/35934	BH21 3.00	5.59	4.72	0.87	x

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80°C

Form Number:

REP pH

Cardno Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
Kunda Park Qld 4556

Telephone:
(07) 5452 0100

Email:
cardnobowlerkp@cardno.com.au

Facsimile:
(07) 5452 0133

Website:
www.cardno.com.au

Shaping the Future

CHROMIUM SUITE TEST REPORT

Report Number:	3740/S/35509CRS		
Client:	Future Plus Environmental		
Client Address:	PO Box 1250, Buddina Qld 4575	**Date Sampled:**	18/08/2014
Project:	4543	**Date Received:**	17/09/2014
Project no.	3740/P/648	**Date Tested:**	24/09/2014
Sampled by:	Client	**Date Reported:**	24/09/2014
Methods:	AS 4969.0, .1, .2, .4, .7, .8, .11, .13, .14		

Laboratory Number	Sample Location	pH_{KCl}	TAA	TAA	S_{KCl}	S_{Cr}	S_{NAS}	ANC_{BT}	ANC_{BT}	Net Acidity	Net Acidity	Recommended Liming Rate
	units:	-	(H^+mol/t)	(% S)	(% S) [a]	(% S)	(% S)	(%$CaCO_3$) [#]	(%S) [#]	(H^+mol/t)	(% S)	(kg of lime per cubic metre)
	LOR:	0.1	1	0.001	0.007	0.02	0.001	0.01	0.01	1	0.001	0.1
3740/S/35509	BH1 0.50	6.3	15	0.024	0.015	<0.02	nr	nr	nr	15	0.024	No Liming Required
3740/S/35522	BH2 0.75	6.3	9	0.015	<0.007	<0.02	nr	nr	nr	9	0.015	No Liming Required
3740/S/35544	BH3 0.25	6.2	34	0.054	<0.007	<0.02	nr	nr	nr	34	0.054	4.8
3740/S/35551	BH3 2.00	5.0	41	0.065	0.019	<0.02	nr	nr	nr	41	0.065	5.8
3740/S/35535	BH4 1.00	4.1	244	0.390	0.027	<0.02	<0.02	nr	nr	244	0.390	34.5
3740/S/35538	BH4 1.75	6.3	16	0.025	<0.007	<0.02	nr	nr	nr	16	0.025	No Liming Required
3740/S/35559	BH5 1.00	4.5	92	0.147	<0.007	<0.02	nr	nr	nr	92	0.147	13.0
3740/S/35568	BH6 0.25	6.3	15	0.024	<0.007	<0.02	nr	nr	nr	15	0.024	No Liming Required
3740/S/35580	BH7 0.25	6.4	19	0.031	<0.007	<0.02	nr	nr	nr	19	0.031	2.7
3740/S/35589	BH7 2.50	4.9	54	0.086	<0.007	<0.02	nr	nr	nr	54	0.086	7.6
3740/S/35596	BH8 0.25	4.6	122	0.196	<0.007	<0.02	nr	nr	nr	122	0.196	17.3
3740/S/35601	BH8 1.50	5.0	56	0.089	<0.007	<0.02	nr	nr	nr	56	0.089	7.9
3740/S/35602	BH9 0.25	6.3	9	0.015	<0.007	<0.02	nr	nr	nr	9	0.015	No Liming Required
3740/S/35606	BH9 1.25	4.8	74	0.119	<0.007	<0.02	nr	nr	nr	74	0.119	10.5
Blank		6.1	2.0	0.003								

Notes:

nr: not required, pH trigger not met.

LOR: Limit of Reporting

[#] If pH_{KCl} <6.5 it must be assumed that effective ANC is zero.

Effective ANC is ANC_{BT}/Fineness Factor of 1.5.

[a] S_{KCl} determined as sulfate by turbidimetric method.

Where liming is specified, lime should be fine grained agricultural lime of at least 90% purity.

Any liming rate provided is a recommended rate only, and is based on the total of TAA Equivalent % Oxidisable Sulphur plus Potential Acidity (S_{Cr}) plus Retained Acidity (S_{NAS}) minus effective ANC; with a factor of safety of 1.5.

Any recommended liming rate is based on the 0.03%S action criteria.

A placed dry density of 1.7 tonnes/cubic metre has been used in calculating liming rate/s.

The recommended liming rate is derived from a mathematical equation and will need to be field validated.

Cardno accepts no responsibility for any loss associated with use of the calculated liming rate/s.

The test results contained within this report relate only to the samples as they were received.

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025

Accreditation No.: 1986

Corporate Site Number: 3740

APPROVED SIGNATORY: Paul Mayes

Form Number: REP CRS 1/09/2014 Revision 7

Cardno Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
Kunda Park Qld 4556

Telephone:
(07) 5452 0100

Email:
cardnobowlerkp@cardno.com.au

Facsimile:
(07) 5452 0133

Website:
www.cardno.com.au

Cardno
Shaping the Future

CHROMIUM SUITE TEST REPORT

Report Number:	3740/S/35614CRS		
Client:	Future Plus Environmental		
Client Address:	PO Box 1250, Buddina Qld 4575	**Date Sampled:**	17/09/2014
Project:	4543	**Date Received:**	17/09/2014
Project no.	3740/P/648	**Date Tested:**	24/09/2014
Sampled by:	Client	**Date Reported:**	24/09/2014
Methods:	AS 4969.0, .1, .2, .4, .7, .8, .11, .13, .14		

Laboratory Number	Sample Location	pH_{KCl}	TAA	TAA	S_{KCl}	S_{Cr}	S_{NAS}	ANC_{BT}	ANC_{BT}	Net Acidity	Net Acidity	Recommended Liming Rate
	units:	-	(H^+mol/t)	(% S)	(% S) [a]	(% S)	(% S)	(%$CaCO_3$) [#]	(%S) [#]	(H^+mol/t)	(% S)	(kg of lime per cubic metre)
	LOR:	0.1	1	0.001	0.007	0.02	0.001	0.01	0.01	1	0.001	0.1
3740/S/35614	BH10 0.25	6.4	<1	<0.002	<0.007	<0.02	nr	nr	nr	0	0.000	No Liming Required
3740/S/35616	BH10 0.75	6.1	10	0.015	0.018	<0.02	nr	nr	nr	10	0.015	No Liming Required
3740/S/35625	BH11 1.00	6.3	22	0.035	0.007	<0.02	nr	nr	nr	22	0.035	3.1
3740/S/35634	BH12 0.25	6.3	7	0.012	0.007	<0.02	nr	nr	nr	7	0.012	No Liming Required
3740/S/35641	BH12 2.00	4.9	56	0.090	<0.007	<0.02	nr	nr	nr	56	0.090	8.0
3740/S/35654	BH13 0.25	6.3	32	0.051	<0.007	<0.02	nr	nr	nr	32	0.051	4.5
3740/S/35660	BH13 1.75	4.9	73	0.117	<0.007	<0.02	nr	nr	nr	73	0.117	10.3
3740/S/35667	BH14 0.50	6.1	22	0.035	<0.007	<0.02	nr	nr	nr	22	0.035	3.1
3740/S/35674	BH14 2.25	5.8	25	0.039	0.019	<0.02	nr	nr	nr	25	0.039	3.5
3740/S/35691	BH15 1.50	5.8	41	0.066	0.008	<0.02	nr	nr	nr	41	0.066	5.8
3740/S/35706	BH15 5.25	5.0	46	0.074	0.018	<0.02	nr	nr	nr	46	0.074	6.5
Blank		6.1	2.0	0.003								

Notes:
nr: not required, pH trigger not met.
LOR: Limit of Reporting
[#] if pH_{KCl} <6.5 it must be assumed that effective ANC is zero.
Effective ANC is ANC_{BT}/Fineness Factor of 1.5.
[a] S_{KCl} determined as sulfate by turbidimetric method.
Where liming is specified, lime should be fine grained agricultural lime of at least 90% purity.
Any liming rate provided is a recommended rate only, and is based on the total of TAA Equivalent % Oxidisable Sulphur plus Potential Acidity (S_{Cr}) plus Retained Acidity (S_{NAS}) minus effective ANC; with a factor of safety of 1.5.
Any recommended liming rate is based on the 0.03%S action criteria.
A placed dry density of 1.7 tonnes/cubic metre has been used in calculating liming rate/s.
The recommended liming rate is derived from a mathematical equation and will need to be field validated.
Cardno accepts no responsibility for any loss associated with use of the calculated liming rate/s.
The test results contained within this report relate only to the samples as they were received.

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025

Accreditation No.: 1986

Corporate Site Number: 3740

APPROVED SIGNATORY: Paul Mayes

Form Number: REP CRS 1/09/2014 Revision 7

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ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
Kunda Park Qld 4556

Telephone:
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cardnobowlarkp@cardno.com.au

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Website:
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CHROMIUM SUITE TEST REPORT

Report Number:	3740/S/35800CRS		
Client:	Future Plus Environmental		
Client Address:	PO Box 1250, Buddina Qld 4575	**Date Sampled:**	18/09/2014
Project:	4543	**Date Received:**	18/09/2014
Project no.	3740/P/648	**Date Tested:**	24/09/2014
Sampled by:	Client	**Date Reported:**	24/09/2014
Methods:	AS 4969.0, .1, .2, .4, .7, .8, .11, .13, .14		

Laboratory Number	Sample Location	pH_{KCl}	TAA	TAA	S_{KCl}	S_{Cr}	S_{NAS}	ANC_{BT}	ANC_{BT}	Net Acidity	Net Acidity	Recommended Liming Rate
units:		-	(H+mol/t)	(% S)	(% S) [a]	(% S)	(% S)	(%$CaCO_3$) [#]	(%S) [#]	(H+mol/t)	(% S)	(kg of lime per cubic metre)
LOR:		0.1	1	0.001	0.007	0.02	0.001	0.01	0.01	1	0.001	0.1
3740/S/35800	BH16 0.25	4.8	176	0.282	0.015	<0.02	nr	nr	nr	176	0.282	25.0
3740/S/35805	BH16 1.50	5.5	41	0.066	0.022	<0.02	nr	nr	nr	41	0.066	5.9
3740/S/35827	BH17 1.00	5.4	31	0.050	0.011	<0.02	nr	nr	nr	31	0.050	4.4
3740/S/35841	BH17 4.50	4.9	50	0.080	0.015	<0.02	nr	nr	nr	50	0.080	7.1
3740/S/35858	BH18 2.75	5.8	42	0.068	0.022	<0.02	nr	nr	nr	42	0.068	6.0
3740/S/35867	BH18 5.00	5.8	28	0.045	0.018	<0.02	nr	nr	nr	28	0.045	4.0
3740/S/35875	BH19 1.00	4.8	98	0.157	0.007	<0.02	nr	nr	nr	98	0.157	13.9
3740/S/35884	BH20 0.25	4.5	138	0.222	<0.007	<0.02	nr	nr	nr	138	0.222	19.6
3740/S/35890	BH20 1.75	4.4	128	0.205	0.007	<0.02	<0.02	nr	nr	128	0.205	18.1
3740/S/35904	BH20 5.25	5.3	37	0.060	<0.007	<0.02	nr	nr	nr	37	0.060	5.3
3740/S/35915	BH20 8.00	6.2	27	0.044	0.015	<0.02	nr	nr	nr	27	0.044	3.9
3740/S/35926	BH21 1.00	5.8	36	0.058	0.011	<0.02	nr	nr	nr	36	0.058	5.1
Blank		6.1	2.0	0.003								

Notes:
nr: not required, pH trigger not met.
LOR: Limit of Reporting
[#] If pH_{KCl} <6.5 it must be assumed that effective ANC is zero.
Effective ANC is ANC_{BT}/Fineness Factor of 1.5.
[a] S_{KCl} determined as sulfate by turbidimetric method.
Where liming is specified, lime should be fine grained agricultural lime of at least 90% purity.
Any liming rate provided is a recommended rate only, and is based on the total of TAA Equivalent % Oxidisable Sulphur plus Potential Acidity (S_{Cr}) plus Retained Acidity (S_{NAS}) minus effective ANC; with a factor of safety of 1.5.
Any recommended liming rate is based on the 0.03%S action criteria.
A placed dry density of 1.7 tonnes/cubic metre has been used in calculating liming rate/s.
The recommended liming rate is derived from a mathematical equation and will need to be field validated.
Cardno accepts no responsibility for any loss associated with use of the calculated liming rate/s.
The test results contained within this report relate only to the samples as they were received.

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025

Accreditation No.: 1986

Corporate Site Number: 3740

APPROVED SIGNATORY: Paul Mayes

Form Number: REP CRS 1/09/2014 Revision 7

Cardno Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
Kunda Park Qld 4556

Telephone:
(07) 5452 0100

Email:
cardnobowlerkp@cardno.com.au

Facsimile:
(07) 5452 0133

Website:
www.cardno.com.au

Cardno
Shaping the Future

CHROMIUM SUITE TEST REPORT

Report Number:	3740/S/36094CRS
Client:	Future Plus Environmental
Client Address:	PO Box 1250, Buddina Qld 4575
Project:	4543
Project no.	3740/P/648
Sampled by:	Client
Methods:	AS 4969.0, .1, .2, .4, .7, .8, .11, .13, .14

Date Sampled:	24/09/2014
Date Received:	24/09/2014
Date Tested:	29/09/2014
Date Reported:	30/09/2014

Laboratory Number	Sample Location	pH_{KCl}	TAA	TAA	S_{KCl}	S_{Cr}	S_{NAS}	ANC_{BT}	ANC_{BT}	Net Acidity	Net Acidity	Recommended Liming Rate
	units:	-	(H^+mol/t)	(% S)	(% S) [a]	(% S)	(% S)	(%$CaCO_3$) [#]	(%S) [#]	(H^+mol/t)	(% S)	(kg of lime per cubic metre)
	LOR:	0.1	1	0.001	0.007	0.02	0.001	0.01	0.01	1	0.001	0.1
3740/S/36094	BH23 0.25	6.8	0	0.000	0.011	<0.02	nr	0.10	0.03	-13	-0.021	No Liming Required
3740/S/36108	BH24 0.75	6.8	0	0.000	0.018	<0.02	nr	0.08	0.02	-10	-0.016	No Liming Required
3740/S/36115	BH24 2.50	6.8	0	0.000	<0.007	<0.02	nr	0.19	0.06	-25	-0.040	No Liming Required
Blank		6.0	4.0	0.006								

Notes:
nr: not required, pH trigger not met.
LOR: Limit of Reporting
[#] If pH_{KCl} <6.5 it must be assumed that effective ANC is zero.
Effective ANC is ANC_{BT}/Fineness Factor of 1.5.
[a] S_{KCl} determined as sulfate by turbidimetric method.
Where liming is specified, lime should be fine grained agricultural lime of at least 90% purity.
Any liming rate provided is a recommended rate only, and is based on the total of TAA Equivalent % Oxidisable Sulphur plus Potential Acidity (S_{Cr}) plus Retained Acidity (S_{NAS}) minus effective ANC; with a factor of safety of 1.5.
Any recommended liming rate is based on the 0.03%S action criteria.
A placed dry density of 1.7 tonnes/cubic metre has been used in calculating liming rate/s.
The recommended liming rate is derived from a mathematical equation and will need to be field validated.
Cardno accepts no responsibility for any loss associated with use of the calculated liming rate/s.
The test results contained within this report relate only to the samples as they were received.

NATA

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Accredited for compliance with ISO/IEC 17025

Accreditation No.: 1966

Corporate Site Number: 3740

APPROVED SIGNATORY: Paul Mayes
Form Number: REP CRS 1/09/2014 Revision 7

Appendix C - Borehole Logs Compensatory Cut Area A

APOD Soil Testing Pty Ltd

Domestic & Commercial Site Investigations
ABN: 47 106 610 977 ACN: 106 610 977

53 Drapers Road
Eatons Hill Qld 4037
Telephone: (07) 3261 6995
Fax: (07) 3261 6991
Email: apodsoil@bigpond.com

Address: Buckley Road, Burpengary | Job No: 14-09-24353 | Date: 17/09/2014

TEST HOLE NO. 3

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SILTY SAND (SM) (mott.dk.gy)			
200	- trace small gravels			
300				
400	dry/slightly moist			
500				
600	SAND (SW) (lt.br)			
700	- fine to medium grain			
800	- with minor small gravels			
900				
1000	slightly moist			
1100				
1200				
1300				
1400	SILTY CLAY (CH)			
1500	(br.mott.or-yell-lt.gy-rd)			
1600	- minor sand			
1700	- minor small gravels			
1800				
1900	moist			
2000				
2100				
2200				
2300	- with sand (gy.mott.rd-or-br)			
2400	- with minor gravels			
2500				
2600				
2700	moist			
2800				
2900				
3000				
3100	END P/A			
3200				
3300				
3400				
3500				
3600				
3700				
3800				
3900				
4000				

TEST HOLE NO. 4

DEPTH mm	DESCRIPTION Soil type-colour-consistency	FILL	DCP	PP kPa Q_u
100	SANDY SILT (SM) sl. moist (dk.br)			
200	SILTY CLAY (CH) (gy.mott.yell-br)			
300	- trace sand			
400	- trace small gravels			
500				
600				
700	moist/very moist			
800				
900				
1000				
1100				
1200				
1300				
1400	- minor sand			
1500				
1600	very moist			
1700				
1800	SAND (SW) (gy-lt.gy)			
1900	- minor silt slightly moist			
2000	- fine to medium grain			
2100	- water table encountered			
2200	- trace clay lenses			
2300				
2400				
2500				
2600	wet			
2700				
2800				
2900				
3000				
3100	END P/A			
3200				
3300				
3400				
3500				
3600				
3700				
3800				
3900				
4000				

TEST PIT REPORT

CLIENT: LENSWORTH GROUP LTD
PROJECT: ASS & PRELIMINARY GEOTECHNICAL INVEST.
LOCATION: 2-32 & 34 NOLAN DRIVE, MORAYFIELD

DATE: 2 July 2003
PROJECT No.: 33454A
SURFACE LEVEL:

TEST PIT No. 20
SHEET 1 OF 1

Depth m	Description of Strata (Soil Type, Strength, Moisture, Colour, [Origin])	Sampling & Testing: Type	Depth (m)	Results
0	SILTY CLAY - dark brown/black silty clay	D	0.5	
0.5	- orange/brown mottled grey silty clay		0.7	
	- grey silty clay	D	1.0	
1			1.3	
1.5		D	1.5	
			1.7	
2	- grey mottled orange and red silty clay	D	2.0	
2.0	PIT DISCONTINUED AT 2.0m DEPTH			
2.5				
3				
3.5				
4				
4.5				
5				

RIG: Backhoe

LOGGED: CD

GROUND WATER OBSERVATIONS: No groundwater observed

REMARKS: No hydrocarbon odours observed.

SAMPLING & TESTING

A Auger sample	pp Pocket Penetrometer (kPa)
B Bulk sample	PID Photo Ionisation Detector
D Disturbed sample	Ux x mm dia. tube
M Moisture content (%)	Wp Plastic limit

CHECKED:
Initials: CD
Date: 30/7

Douglas Partners
Geotechnics · Environment · Groundwater

Appendix D – ASS Test Results Compensatory Cut Area A

Cardno
Shaping the Future

Cardno Construction Sciences Pty Ltd
ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
Kunda Park Qld 4556

Telephone:
(07) 5452 0100
Facsimile:
(07) 5452 0133

Email: cardnobowlerkp@cardno.com.au
Website: www.cardno.com.au

pH_F and pH_{Fox}

Client:	Future Plus Environmental
Client Address:	PO Box 1250, Buddina, Qld 4575
Project:	4543
Project Number:	3740/P/648
Date Started:	18/09/2014
Date Finished:	18/09/2014
Test Procedure:	ASSLMG V2.1 H1-1

Sample No.	Location	pH_F	pH_{FOX}	pH Change	Reaction
3740/S/35544	BH3 0.25	5.26	2.79	2.47	xx
3740/S/35545	BH3 0.50	5.25	4.13	1.12	x
3740/S/35546	BH3 0.75	5.89	4.82	1.07	x
3740/S/35547	BH3 1.00	6.24	5.46	0.78	x
3740/S/35548	BH3 1.25	6.27	5.36	0.91	x
3740/S/35549	BH3 1.50	5.88	4.46	1.42	x
3740/S/35550	BH3 1.75	5.86	4.88	0.98	x
3740/S/35551	BH3 2.00	5.68	3.99	1.69	x
3740/S/35552	BH3 2.25	5.49	4.54	0.95	-
3740/S/35553	BH3 2.50	5.55	4.73	0.82	x
3740/S/35554	BH3 2.75	5.54	4.57	0.97	x
3740/S/35555	BH3 3.00	5.42	4.72	0.70	x

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80°C

Form Number:
REP pH

Cardno
Shaping the Future

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ABN: 74 128 806 735

Address:
32 Hi-Tech Drive
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Email: cardnobowlerkp@cardno.com.au
Website: www.cardno.com.au

pH_F and pH_{Fox}

Client:	Future Plus Environmental
Client Address:	PO Box 1250, Buddina, Qld 4575
Project:	4543
Project Number:	3740/P/648
Date Started:	18/09/2014
Date Finished:	18/09/2014
Test Procedure:	ASSLMG V2.1 H1-1

Sample No.	Location	pH_F	pH_{FOX}	pH Change	Reaction
3740/S/35532	BH4 0.25	4.31	2.90	1.41	-
3740/S/35533	BH4 0.50	3.87	2.57	1.30	-
3740/S/35534	BH4 0.75	4.16	2.60	1.56	-
3740/S/35535	BH4 1.00	4.32	2.56	1.76	-
3740/S/35536	BH4 1.25	4.54	3.28	1.26	xxxx
3740/S/35537	BH4 1.50	4.90	3.28	1.62	xxxx
3740/S/35538	BH4 1.75	4.94	3.04	1.90	xxxx
3740/S/35539	BH4 2.00	4.99	2.62	2.37	-
3740/S/35540	BH4 2.25	4.80	3.38	1.42	-
3740/S/35541	BH4 2.50	4.56	3.60	0.96	x
3740/S/35542	BH4 2.75	4.67	3.72	0.95	x
3740/S/35543	BH4 3.00	4.61	3.94	0.67	x

Notes:

-	No Reaction
x	Slight Reaction
xx	Moderate Reaction
xxx	High Reaction
xxxx	Very vigorous reaction, gas produced and heat generated commonly >80°C

Form Number:
REP pH

Cardno Shaping the Future

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Email:
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Facsimile:
(07) 5452 0133

Website:
www.cardno.com.au

CHROMIUM SUITE TEST REPORT

Report Number:	3740/S/35509CRS		
Client:	Future Plus Environmental		
Client Address:	PO Box 1250, Buddina Qld 4575	Date Sampled:	18/08/2014
Project:	4543	Date Received:	17/09/2014
Project no.	3740/P/648	Date Tested:	24/09/2014
Sampled by:	Client	Date Reported:	24/09/2014
Methods:	AS 4969.0, .1, .2, .4, .7, .8, .11, .13, .14		

Laboratory Number	Sample Location	pH_{KCl}	TAA	TAA	S_{KCl}	S_{Cr}	S_{NAS}	ANC_{BT}	ANC_{BT}	Net Acidity	Net Acidity	Recommended Liming Rate
	units:	-	(H^+mol/t)	(% S)	(% S) [a]	(% S)	(% S)	($\%CaCO_3$) [#]	(%S) [#]	(H^+mol/t)	(% S)	(kg of lime per cubic metre)
	LOR:	0.1	1	0.001	0.007	0.02	0.001	0.01	0.01	1	0.001	0.1
3740/S/35509	BH1 0.50	6.3	15	0.024	0.015	<0.02	nr	nr	nr	15	0.024	No Liming Required
3740/S/35522	BH2 0.75	6.3	9	0.015	<0.007	<0.02	nr	nr	nr	9	0.015	No Liming Required
3740/S/35544	BH3 0.25	6.2	34	0.054	<0.007	<0.02	nr	nr	nr	34	0.054	4.8
3740/S/35551	BH3 2.00	5.0	41	0.065	0.019	<0.02	nr	nr	nr	41	0.065	5.8
3740/S/35535	BH4 1.00	4.1	244	0.390	0.027	<0.02	<0.02	nr	nr	244	0.390	34.5
3740/S/35538	BH4 1.75	6.3	16	0.025	<0.007	<0.02	nr	nr	nr	16	0.025	No Liming Required
3740/S/35559	BH5 1.00	4.5	92	0.147	<0.007	<0.02	nr	nr	nr	92	0.147	13.0
3740/S/35568	BH6 0.25	6.3	15	0.024	<0.007	<0.02	nr	nr	nr	15	0.024	No Liming Required
3740/S/35580	BH7 0.25	6.4	19	0.031	<0.007	<0.02	nr	nr	nr	19	0.031	2.7
3740/S/35589	BH7 2.50	4.9	54	0.086	<0.007	<0.02	nr	nr	nr	54	0.086	7.6
3740/S/35596	BH8 0.25	4.6	122	0.196	<0.007	<0.02	nr	nr	nr	122	0.196	17.3
3740/S/35601	BH8 1.50	5.0	56	0.089	<0.007	<0.02	nr	nr	nr	56	0.089	7.9
3740/S/35602	BH9 0.25	6.3	9	0.015	<0.007	<0.02	nr	nr	nr	9	0.015	No Liming Required
3740/S/35606	BH9 1.25	4.8	74	0.119	<0.007	<0.02	nr	nr	nr	74	0.119	10.5
Blank		6.1	2.0	0.003								

Notes:
nr: not required, pH trigger not met.
LOR: Limit of Reporting
[#] if pH_{KCl} <6.5 it must be assumed that effective ANC is zero.
Effective ANC is ANC_{BT}/Fineness Factor of 1.5.
[a] S_{KCl} determined as sulfate by turbidimetric method.
Where liming is specified, lime should be fine grained agricultural lime of at least 90% purity.
Any liming rate provided is a recommended rate only, and is based on the total of TAA Equivalent % Oxidisable Sulphur plus Potential Acidity (S_{Cr}) plus Retained Acidity (S_{NAS}) minus effective ANC; with a factor of safety of 1.5.
Any recommended liming rate is based on the 0.03%S action criteria.
A placed dry density of 1.7 tonnes/cubic metre has been used in calculating liming rate/s.
The recommended liming rate is derived from a mathematical equation and will need to be field validated.
Cardno accepts no responsibility for any loss associated with use of the calculated liming rate/s.
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Accreditation No.: 1986

Corporate Site Number: 3740

APPROVED SIGNATORY: Paul Mayes

Form Number: REP CRS 1/09/2014 Revision 7

Batch: AEB56753
Sub Batch: 0
Date of Issue: 23/07/2003
Client: DOUGLAS PARTNERS PTY LTD
Client Reference: 33454A

CERTIFICATE OF ANALYSIS

				SAMPLE IDENTIFICATION									
		Laboratory I.D.		1	2	3	4	5	6	7	8	9	10
		Date Sampled											
METHOD	ANALYSIS DESCRIPTION	UNIT	LOR	TP18-1.5m	TP19-0.5m	TP19-1.5m	TP20-1.5m	TP21-0.5m	TP22-1.0m	TP23-0.5m	YP23-1.0m	TP24-1.0m	TP25-1.0m
EA-002	pH after Oxidation		0.1	4.7	—	3.1	3.0	3.6	3.4	—	3.0	2.9	2.9
EA-022	Ca (Acid Reacted)	%	0.02	<0.02	—	<0.02	<0.02	<0.02	<0.02	—	<0.02	<0.02	<0.02
EA-022	Ca (KCl)	%	0.02	<0.02	—	<0.02	<0.02	<0.02	<0.02	—	<0.02	0.02	0.02
EA-022	Ca (Peroxide)	%	0.02	<0.02	—	<0.02	<0.02	<0.02	<0.02	—	<0.02	<0.02	<0.02
EA-022	Mg (Acid Reacted)	%	0.02	<0.02	—	<0.02	<0.02	<0.02	<0.02	—	<0.02	<0.02	<0.02
EA-022	Mg (KCl)	%	0.02	<0.02	—	0.06	0.03	<0.02	<0.02	—	0.08	0.06	0.04
EA-022	Mg (Peroxide)	%	0.02	<0.02	—	0.04	0.03	<0.02	<0.02	—	0.05	0.04	0.03
EA-022	Na (Acid Reacted)	%	0.02	<0.02	—	<0.02	<0.02	<0.02	<0.02	—	<0.02	<0.02	<0.02
EA-022	Na (KCl)	%	0.02	<0.02	—	0.12	0.05	<0.02	<0.02	—	0.17	0.11	0.10
EA-022	Na (Peroxide)	%	0.02	<0.02	—	0.08	0.04	<0.02	<0.02	—	0.12	0.07	0.08
EA-022	S (KCl)	%	0.02	<0.02	—	0.06	0.02	<0.02	<0.02	—	0.05	0.04	0.03
EA-022	S (Peroxide)	%	0.02	<0.02	—	0.04	0.02	<0.02	<0.02	—	0.03	0.03	0.04
EA-022	S (Pos)	%	0.02	<0.02	—	<0.02	<0.02	<0.02	<0.02	—	<0.02	<0.02	<0.02
EA-022	TAA	mole/tonne	2	<2	—	21	74	13	4	—	44	80	103
EA-022	TPA	mole/tonne	2	<2	—	42	74	17	25	—	59	97	122
EA-022	TSA	mole/tonne	2	<2	—	21	<2	4	21	—	15	17	19
EA-022	pH (KCl)		0.1	5.2	—	3.7	3.6	4.5	4.8	—	3.6	3.5	3.5
EA-026	Chromium Reducible Sulphur	%	0.02	—	0.04	—	—	—	—	<0.02	—	—	—

FIELD SCREENING TEST RESULTS FOR ACID SULFATE SOILS
Ref: Qld ASS Sampling and Testing Guidelines, 1998

PROJECT: ASS & Preliminary Geotechnical Investigation	PROJECT NO: 33464A
CLIENT: LENSWORTH GROUP LTD	STORAGE: Frozen
SAMPLING METHOD:	DATE TESTED: 07-07-03
DATE SAMPLED: 03-07-03	TESTED BY: ACL

SAMPLE IDENTIFICATION		pH_F	pH_{FOX}	ΔpH	REACTION *
TP18	0.5 m	5.3	1.6	3.7	2 – organic
	1.0 m	5.7	4.0	1.7	2
	1.5 m	5.9	4.0	1.9	2
	2.0 m	5.0	3.2	1.8	2
TP19	0.5 m	5.8	1.4	4.4	2 – organic
	1.0 m	4.1	2.1	2.0	2
	1.5 m	3.8	2.5	1.3	2
	2.0 m	4.0	2.8	1.2	2
TP20	0.5 m	5.1	2.0	3.1	2 – organic
	1.0 m	4.7	2.6	2.1	2
	1.5 m	5.1	2.7	2.4	2
	2.0 m	4.6	2.6	2.0	2
TP21	0.5 m	5.6	1.8	3.8	2
	1.0 m	4.7	4.4	0.3	2
	1.5 m	5.4	3.0	2.4	2
TP22	0.5 m	5.1	1.9	3.2	2 – organic
	1.0 m	5.2	2.4	2.8	2
	1.5 m	5.4	2.6	2.8	2 – organic
TP23	0.5 m	6.3	1.9	4.4	2 - organic
	1.0 m	4.2	2.5	1.7	2
	1.5 m	4.2	2.6	1.6	2
	2.0 m	4.3	2.9	1.4	2
TP24	0.5 m	5.3	1.6	3.7	2 – organic
	1.0 m	3.7	1.9	1.8	2
	1.5 m	3.4	1.6	1.8	2
	2.0 m	3.8	2.0	1.8	2

Notes:
* **Reaction Intensity:**
(1) No Reaction (2) Mild Reaction (3) Vigorous Reaction (4) Violent Reaction
pH_F: Field pH; pH_{FOX}: Field pH after hydrogen peroxide oxidation; ΔpH: pH_F - pH_{FOX}

CALIBRATION DETAILS			
Standard Buffer pH 4	☑	Use by Date: 12/03	pH Meter No: MC-81
Standard Buffer pH 6.88	☑	Use by Date: 12/03	pH of Hydrogen Peroxide: 4.9

CHECKED: 24-7-03	NAME: ADAM LUPTON	SIGNED: A. Lupton

Douglas Partners
Geotechnics · Environment · Groundwater

A.S.S. SOIL TEST SCREEN REPORT

Refer to attached notes for analytical methods.

Analysis By: Bio-Track Pty Ltd

ABN 91 056 237 275
Mt. Glorious Road
Highvale, Brisbane, Australia, 4520
Ph. 07 3289 7179 Fx. 07 3289 7155

DATE OF REPORT 18 DECEMBER 2006
CLIENT NAME MR KARL MUNIZ
CLIENT FIRM COFFEY GEOTECHNICSS PTY LTD YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC
CLIENT ADDRESS PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GEONATH 18367 AC SAMPLING DATE 11/12/6
NUMBER OF SAMPLES 11 SAMPLE TYPE SOIL SAMPLE FOR ACID SULFATE STUDY
PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING
SAMPLES DISPOSED ON 1/4/2007
LOG-IN DATE 13 DECEMBER 2006 LAB REF. LR13126.530

TEST METHODOLOGY FOR pH_f AND pH_fox AS PER QASSIT 2004 Laboratory Methods. Indications based on pH data only.
RATE: 0=none 1=slight 2=moderate 3=high 4=very high (steam evolved) visual observation at 0-5 minutes.
TEMP: Surface temperature rise ('C) oxidised sample at 5 minutes.

SAMPLE ID	Upper	Lower (m)	pH_f	pH_fox	change	RATE	TEMP	INDICATION
TP 101	1.2		6.6	5.7	-0.9	0	6	no TAA & low TPA & low sulphide
TP 102	1.3		4.8	3.9	-0.9	1	0	low TAA & low sulphide
TP 103	1.2		4.2	3.3	-0.9	1	2	moderate TPA & low sulphide
TP 104	1.0		4.0	2.6	-1.4	2	6	moderate TPA
TP 105	1.2		3.9	2.6	-1.3	2	3	moderate TPA
TP 106	1.2		5.8	2.8	-3.0	3	13	low TAA & moderate TPA & sulphide possible
TP 107	1.1		4.2	3.3	-0.9	4	31	moderate TPA & low sulphide
TP 108	1.0		4.3	3.1	-1.2	1	1	moderate TPA
TP 109	0.6		4.3	2.6	-1.7	1	3	moderate TPA
TP 110	0.9		4.6	3.4	-1.2	2	5	low TAA & moderate TPA
TP 111	0.9		4.6	3.4	-1.2	0	6	low TAA & moderate TPA

Signatory P. Johnston For and behalf of Bio-Track Pty Ltd

DETERMINATION OF ACID SULFATE SOIL PROPERTIES

CERTIFICATE OF ANALYSIS

Analysis By: Bio-Track Pty Ltd ABN 91 056 237 275

781 Mt. Glorious Road Highvale, Brisbane, Australia, 4520 Ph. 07 3289 7179 Fx. 07 3289 7155

LAB REFERENCE LR19126.528 DATE OF REPORT 05 FEBRUARY 2007 @09:38:13
CLIENT NAME MR KARL MUNIZ c/o COFFEY GEOTECHNICSS PTY LTD PO BOX 108 SALISBURY QLD 4107
PROJECT NAME GEONATH 18367 AC YOUR PROJECT/JOB REFERENCE GEONATH 18367 AC
SAMPLING DATE 11/12/6 NUMBER OF SAMPLES 6 Samples supplied by client SAMPLE TYPE:SOIL SAMPLE FOR ACID SULFATE STUDY
DATE RECEIVED 19 DECEMBER 2006 PACKAGING SAMPLES LABELLED - INTACT - BAGGED - CHILLED IN INSULATED PACKAGING Ground Oven Dry Samples DISPOSED ON 1/9/2007

Sample ID as received. METHODOLOGY: As per (DNR QASSIT May 2004), oven dried (85°C), >1000 um shell removed, fine grind. All reported values gravimetric, dry mass.
LIME1 rates calculated to neutralise TPA (or TAA if >TPA)+ aS_RAS -ANC_E/1.5 LIME2 rates calculated to neutralise TAA + aS_POS or S_Cr + aS_RAS -ANC_E/1.5
NB. Lime rates assume 97% lime neutralisation but DO NOT include any safety factors. Suggested factor=1.5-2. Rates are kg/ton. Multiply by bulk density to convert to kg/m3.
Fineness Factor=1.5 CBN POS= moles carbonate alkalinity released by oxidation assuming (Ca POS - Ca KCl) + (Mg POS - Mg KCl) is due to carbonate solution.
Blanks represent unmeasured values, zeros & <0.x represent measured values. If pH KCl>4.5 then s-RAS (calculated from acid extract) may be zero for undisturbed soil. Ca/ar is the acid reactive calcium calculated as the difference between 1 M KCl and 4 M HCl soluble Ca.

ID.	DEPTH	pH	pH	TAA	TPA	TSA	S KCl	S P	S POS	S Cr	s-RAS	s EQ	Ca KCl	Ca P	Mg KCl	Mg P	CBN POS	LIME1	LIME2	sANC_E	Ca/ar
	m	KCL	ox	m/t	m/t	m/t	%	%	%	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	m/t	kg/t	kg/t	%	mg/kg
Analytical Method Codes		23A	23B	23F	23G	23H	23Ce	23De	23Ee	22B	s23Re	s	23Vh	23Wh	23Sm	23Tm	a23U&X			s19A2	
TP 104	1.0	3.69	4.45	132	64	0	0.02	0.04	0.01		<0.01	0.222	610	652	645	659	3	6.8	7.0		50
TP 105	1.2	3.77	4.91	91	32	0	0.01	0.02	<0.01		<0.01	0.155	321	337	406	401	1	4.8	4.9		46
TP 106	1.2	6.14	5.04	1	40	39	0.05	0.14	0.10		<0.01	0.105	602	672	1271	1290	5	2.3	3.2		145
TP 107	1.1	3.75	4.52	114	72	0	0.01	0.04	0.02		<0.01	0.212	244	287	247	235	2	6.0	6.7		52
TP 109	0.6	4.61	5.93	9	5	0	<0.01	<0.01	<0.01		<0.01	0.018	18	84	11	13	4	0.5	0.5		57
TP 110	0.9	3.80	5.11	96	45	0	0.02	0.05	0.03		<0.01	0.183	428	465	436	436	2	5.0	5.8		72

Signatory P. Robertson

For and on behalf of Bio-Track Pty Ltd

APPENDIX G – EXAMPLE OF CORRECTIVE ACTION REPORT FORM

CORRECTIVE ACTION REPORT			
Report No.			
Prepared By:		**Position:**	
Date		**Time:**	
Details Of Non-Conformance:			
Date:		**Time:**	
Location:			
Inspected By:		**Position:**	
Description of Event:			
Likely Causes:			
Details of Corrective Action/s:			
Proposed Corrective Action/s:			
Dated Submitted to Developer:		**Reply Required By:**	
Dated Submitted to Regulator:		**Reply Required By:**	
Consultant/Expert/Regulator Advice (if required):			
Date Corrective Action Required By:			
Person Responsible for Corrective Action:			
Corrective Action Authorised By:		**Date/Signed:**	
Date Corrective Action/s Implemented:			
Corrective Action Follow-up Required/Completed:			
Circulation:		**Developer**	
		Department of Environment	
		Moreton Bay Regional Council	
		Other	