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WALLUM SEDGE FROG MANAGEMENT PLAN

Kings Forest

A Report Prepared for
Project 28 Pty Ltd

JUNE 2020

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1 INTRODUCTION

1.1 Background

JWA Pty Ltd (JWA) has been engaged by Project 28 Pty Ltd to prepare a Wallum Sedge Frog Management Plan (WSFMP) for the Kings Forest project site, located in the Tweed Shire between Bogangar (in the south) and Kingscliff (in the north).

The Wallum sedge frog (WSF) (*Litoria olongburensis*) is a small frog species found in wallum swamps and surrounding vegetation types in coastal south-east Queensland and north-east New South Wales (NSW). The WSF is listed as Vulnerable within schedules of the NSW *Biodiversity Conservation Act (2016)* (BC Act) and the Commonwealth *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act).

The Kings Forest site is 846 hectares in area and is located in the coastal zone of the Tweed Shire Local Government Area (LGA). The site was zoned for residential and commercial development in the early 1990's and has been subject to a lengthy Commonwealth, State and Council approval process. Numerous ecological studies have been completed on the site over the last 30 years including detailed flora, fauna and hydrological surveys.

The Kings Forest project received NSW planning approval in 2010 (Concept Plan). A "Threatened Species Management Plan" was prepared in accordance with the Concept Plan approval conditions. A Revised Threatened Species Management Plan was approved as part of the Major Project Approval in 2013. At this time Project 28 commenced discussions with the (now) Commonwealth Department of Agriculture, Water and Environment (DAWE). A subsequent approval under the EPBC Act was granted in May 2015. This approval required the completion of a Wallum Sedge Frog Management Plan (WSFMP). This WSFMP plan will replace the Threatened Species Management Plan (in so far as it refers to the Wallum sedge frog) approved by NSW Planning in 2013.

This WSFMP has been prepared to address relevant Commonwealth and State approval conditions.

1.2 Plan Preparation

The preparation of this WSFMP has been based on detailed ecological and hydrological assessments, a comprehensive review of the latest literature relating to the protection of WSF and their habitat, and recommendations from Tweed Shire Council (TSC), NSW Department of Planning, Industry and Environment (DPI&E), Biodiversity and Conservation Division (BCD) of NSW DPI&E and DAWE.

Dr Arthur White (Biosphere Environmental Consultants), a frog specialist, completed extensive field surveys over the Kings Forest site and produced a number of reports relevant to the WSF populations on the site, and has been consulted on a range of issues during the preparation of this management plan.

1.3 Rationale

The philosophy of WSF management within an urban environment must be based on the need to:

a) Provide for the persistence of WSF in the urban context; and

b) Protect them from the associated threats (i.e. habitat loss, habitat degradation, and motor vehicle related mortalities).

This WSFMP has been prepared in the knowledge that:

- The habitat utilised by the WSF, particularly that on the mainland of Australia, has been extensively cleared and/or drained for agriculture, sand-mining, resort/residential development and the establishment of pine plantations (Ehmann 1997; Ingram & McDonald 1993; Lewis & Goldingay 2005);
- The Kings Forest site supports an estimated population of up to two-hundred (200) WSF (BEC 2014); and
- The development of Kings Forest provides an opportunity to generate a significant addition to the available habitat for the WSF population within the adjoining Cudgen Nature Reserve.

With consideration of the above, development outcomes for the Kings Forest site need to:

- Conserve as much of the existing WSF breeding and foraging habitat as possible and protect these areas from potentially degrading processes;
- Provide additional areas of potential breeding and foraging habitat;
- Provide ongoing access to areas of habitat supporting resident populations and potential habitat in such a way as to protect the population from impacts associated with the development;
- Allow for co-operation with the managers of Cudgen Nature Reserve in relation to bushfire management and other conservation matters;
- Buffer WSF habitat areas from development areas;
- Prevent WSF from entering the development zone; and
- Implement an environmental awareness and extension program for new residents.

1.4 Aim and Objectives

The aim of this WSFMP is to protect and conserve the WSF population in the Kings Forest area to ensure the ongoing survival of the population through appropriate management of project impacts.

The objectives are:

- To ensure that the proposed development does not remove areas of habitat outside of approved clearing areas;

- To ensure that movement corridors for the local WSF population are maintained and/or improved;
- To protect WSF from injury or other adverse impacts during the development phases through the implementation of appropriate management actions;
- To improve the habitat values of the site, including the creation of WSF habitat as part of a comprehensive and staged offset strategy;
- To ensure that WSF continue to utilise habitat at Kings Forest;
- To raise awareness and promote community ownership of environmental management (including the conservation of the local WSF population);
- Compliance with relevant conditions; and
- Revision of the WSFMP as appropriate.

1.5 Relevant Statutory Regulations and Documents

Several key statutory documents and plans prepared by the Commonwealth and State government agencies related to WSF were considered during the preparation of this WSFMP. These statutory documents and plans include:

- NSW *Threatened Species Conservation Act (1995)* (TSC Act) (repealed, however applicable at the time of relevant approvals);
- NSW *Environmental Planning and Assessment Act (1979)* (EP&A Act);
- *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act);
- The National Recovery Plan for the Wallum Sedge Frog and other wallum-dependant frog species (Meyer *et al*. 2006);
- The Action Plan for Australian Frogs (Tyler 1997);
- Threat Abatement Plan for infection of amphibians with chytrid fungus resulting in chytridiomycosis (DEH 2006);
- Threat abatement plan for predation, habitat degradation, competition and disease transmitted by feral pigs (DEH 2005);
- Survey guidelines for Australia's threatened frogs (DEWHA 2010);
- Predation by *Gambusia holbrooki* - The Plague Minnow (NSW NPWS 2003); and
- Threatened Species Management Information Circular No. 6 - Hygiene protocol for the control of disease in frogs (NSW DECC 2008).

1.6 Public Authority Consultations

Development of this WSFMP has been an iterative and consultative process. It has included input from relevant experts and agencies as well as data from scientific studies with respect to WSF populations and habitat within the Kings Forest area.

Public authorities consulted have included:

- Tweed Shire Council (TSC) - Councillors and officers;
- Commonwealth Department of Environment (DoE) now Department of Agriculture, Water and Environment (DAWE);
- NSW Department of Environment and Climate Change then NSW Office of Environment and Heritage (OEH) now Biodiversity and Conservation Division (BCD) – Northern Region;
- NSW Roads and Traffic Authority (now NSW Roads and Maritime Services);
- NSW Department of Planning and Infrastructure then Department of Planning and Environment (DoPE) now NSW Department of Planning, Industry and Environment (DPI&E);
- NSW National Parks and Wildlife Service;
- NSW Environmental Protection Agency;
- NSW Department of Primary Industries;
- NSW Rural Fire Service; and
- NSW Office of Water.

A summary of the public authority consultations during the approval process is contained in **APPENDIX 1**.

1.7 Compliance with Relevant Approval Conditions

The Kings Forest project received NSW planning approval in 2010 (Concept Plan) and 2013 (Project Approval). Commonwealth approval under the EPBC Act was received in May 2015.

APPENDIX 2 contains the details of the following relevant Consolidated Approval Conditions and also note where they are addressed in this WSFMP:

- Concept Plan 06_0318 Consolidated Approval Conditions incorporating the following:
    - Modification No. 1, approved on 22 December 2010;
    - Modification No. 2, approved on 11 August 2013;
    - Modification No. 3, approved on 16 May 2014;
    - Modification No. 4, approved on 20 November 2014;
    - Modification No. 5, approved on 10 November 2015;
    - Modification No. 8, approved on 24 May 2018;
- Project Approval 08_0194 Consolidated Approval Conditions incorporating the following:
    - Modification No. 1, approved on 16 May 2014;
    - Modification No. 2, approved on 20 November 2014;
    - Modification No. 3, approved on 20 February 2017;
    - Modification No. 6, approved on 21 December 2017;

  - Modification No. 7, approved 24 May 2018; and
- the EPBC Act Approval Conditions (2012/6328) incorporating the Approved Variations to Conditions (June 2017 and June 2020).

1.8 Requirements for Management Plan Updates

This WSFMP is considered a 'live' document, incorporating an adaptive management approach and will be updated as and when necessary (in accordance with relevant approval conditions) during the life of the project.

Conditions B1 and C2 of the Concept Plan Approval (06_0318, MOD 8) require that the Threatened Species Management Plan (including the WSFMP) be updated at each stage of development so that proposed measures remain relevant and effective, and based on contemporary scientific data throughout the development of the Project (discussed further in **APPENDIX 2**).

Updates may also be required in the event that the proposed development of the subject site is amended. Project 28 will submit, to DAWE a revised version of the WSFMP if they wish to carry out any activity which is not in accordance with the approved WSFMP.

Furthermore, in accordance with EPBC Approval Condition 24, if the Minister believes that it is necessary or convenient for the better protection of the Wallum sedge frog, the Minister may request that Project 28 revise the WSFMP. Project 28 must revise the WSFMP as directed by the Minister.

1.9 Related Environmental Management Plans

Concept Plan Condition C2 requires that related environmental management plans work together and do not negatively impact on each other. This WSFMP should be read in conjunction with the following documents prepared for the Kings Forest development:

- Kings Forest Vegetation Management Plans (VMPs) (JWA 2020a, b, c);
- Kings Forest Threatened Species Management Plans (TSMPs) (JWA 2020d, e, f);
- Kings Forest Buffer Management Plans (BMPs) (JWA 2020g, h);
- Kings Forest Feral Animal Management Plan (FAMP) (JWA 2020i);
- Kings Forest Flora and Fauna Monitoring Report (JWA 2020j);
- Kings Forest Weed Management Plans (WMPs) (JWA 2020k, l, m);
- Kings Forest Koala Plan of Management Plan (JWA 2020n);
- Kings Forest Stage 1 Bushfire Management Plan (BushfireSafe 2020);
- Site Based Management Plan Incorporating Golf Course Management Plan (G&S 2011a);
- Construction Environmental Management Plan (MUS 2020);
- Kings Forest Summary of Management Plans (SOMP) (G&S 2020a); and
- Kings Forest Overall Water Management Plan (G&S 2020b).

APPENDIX 3 provides further details of these management plans and details of their relationship to the WSFMP.

1.10 Adaptive Management Approach

This management plan adopts an adaptive management approach and includes specific goals for management and procedures for implementation of management actions, followed by monitoring of the performance of these measures against specific goals and identified thresholds. A monitoring program has been developed to evaluate the effectiveness of the management measures and corrective actions identified to improve mitigation where required.

To ensure the success of this approach the management goals presented in the plan are based on the following SMART principles:

- **S**pecific;
- **M**easurable;
- **A**chievable;
- **R**esults-based; and
- **T**ime-based.

2 SITE DESCRIPTION AND EXISTING VALUES

2.1 Location

Kings Forest is located on the far north coast of NSW in the Tweed local government area (LGA) approximately 20 km south of the Queensland/NSW border, 5 km north-west of the village of Bogangar and 4 km south-west of Kingscliff (**FIGURE 1**).

2.2 Site Description

The Kings Forest site is comprised of fourteen (14) land parcels with a total area of 846 hectares:

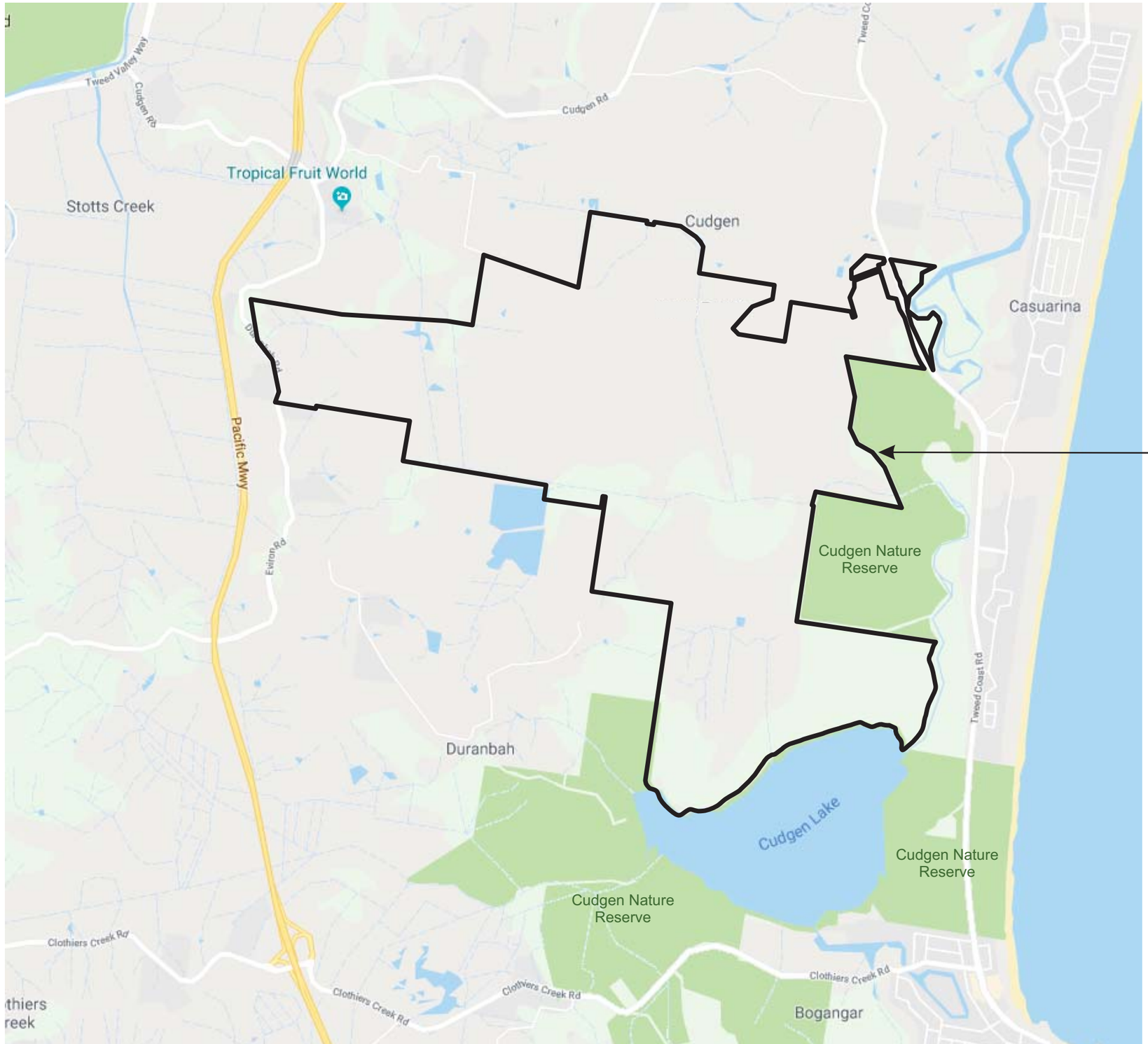
- Lot 76, 272, 323 and 326 in DP 755701;
- Lot 6 in DP 875446;
- Lot 2 in DP 819015;
- Lot 1 in DP 706497;
- Lot 40 in DP 7482;
- Lot 37A in DP 13727;
- Lot 38A in DP 13727;
- Lot 38B in DP 13727;
- Lot 1 in DP 129737;
- Lot 1 in DP 781633; and
- Lot 7 in DP 875447.

Project 28 owns and manages the site which is currently used for cattle grazing and silviculture. The site consists of a mosaic of natural, partially natural, modified and regenerating plant communities including Heathland, Swamp sclerophyll (Paperbark) forest, Woodland, Pine plantation, Freshwater wetland and Pasture. The majority of the site is maintained as pasture for cattle grazing.

The Kings Forest site abuts agricultural and rural lands to the north, west and south west. Cudgen Nature Reserve (including Cudgen Lake and Cudgen Creek) abuts the site boundaries to the south and east. There are a small number of residential properties along Tweed Coast Road to the north of the site.

2.3 Conservation Reserves/Ecologically Significant Areas in the Locality

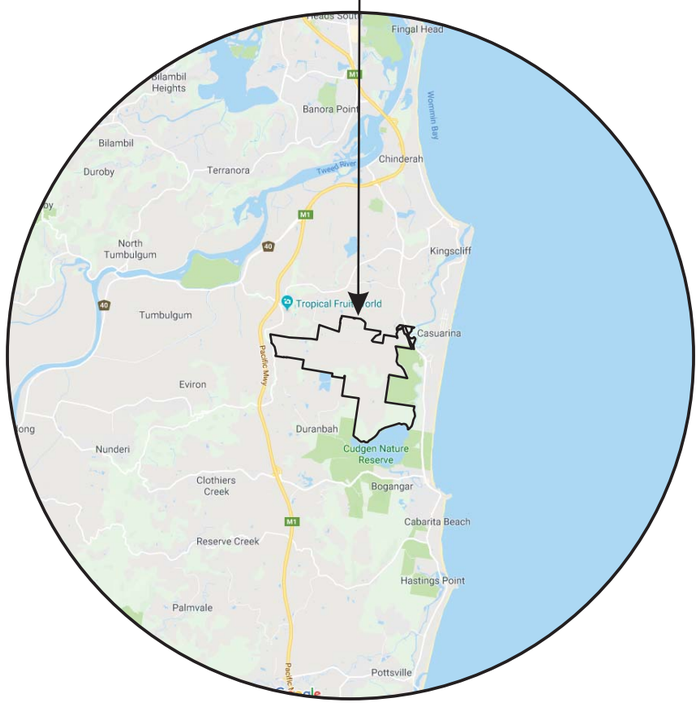
The Cudgen Nature Reserve adjoins the southern and (in part) eastern boundaries of the subject site (**FIGURE 2**). Stotts Island Nature Reserve is situated approximately 2 km to the north-west of the site.



N

LEGEND
Kings Forest Boundary

SUBJECT SITE



0 750m
1 : 30 000

SOURCE: Google Maps SCALE: 1 : 30 000 @ A3 *JWA PTY LTD* *Ecological Consultants*	CLIENT Project 28 Pty Ltd PROJECT Wallum Sedge Frog Management Plan Kings Forest Melaleuca Drive, Duranbah, NSW Shire of Tweed	**FIGURE 1** PREPARED: BW DATE: 07 April 2020 FILE: N97017_Locality.cdr	TITLE **LOCALITY PLAN**



N

LEGEND
Cudgen Nature Reserve
Kings Forest Boundary

0 750m
1 : 30 000

SOURCE: NSW DPI Cadastre
Google Earth Apr 2017 Aerial

SCALE: 1 : 30 000 @ A3

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Ecological Consultants

CLIENT
Project 28 Pty Ltd

PROJECT
Wallum Sedge Frog Management Plan
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 2

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Cudgen NR.cdr

TITLE
CUDGEN NATURE RESERVE

Several Freshwater wetland and Littoral Rainforest areas protected under the (superseded) State Environmental Planning Policy (SEPP) 14 (Coastal Wetlands) and SEPP26 (Littoral Rainforests) exist within and near the site (**FIGURE 3**). These SEPP's have been superseded by State Environmental Planning Policy (SEPP) Coastal Management (2018). Whilst there are areas of discrepancy between the superseded and current SEPP wetland mapping on site, the wetlands generally occur in areas zoned for Environmental Protection on the NSW Planning SEPP Major Development 2005 – Kings Forest land zoning map (**FIGURE 4**). As all relevant approvals were granted prior to the gazettal of the Coastal Management SEPP reference to this mapping has not been shown to avoid confusion.

2.4 Land Use Zones

Land use zones over the Kings Forest development site are identified on the NSW Planning SEPP Major Development 2005 – Kings Forest land zoning map (**FIGURE 4**). SEPP 14 wetland areas, as well as a number of smaller wetland and Littoral rainforest parcels have been designated Environmental Protection (Wetlands and Littoral Rainforests) (7a) zones. Substantial buffer zones occur wherever the 2(c) lands abut neighbouring agricultural land (150 metres) and Environmental Protection zones (50 metre). Lands in the far south of the property are subject to clause 50b of the Tweed LEP, committing them to conservation. Apart from other smaller areas of Environmental Protection (Habitat) (7l), the remainder of the property is zoned Urban Expansion (2c).

2.5 Soils and Geology

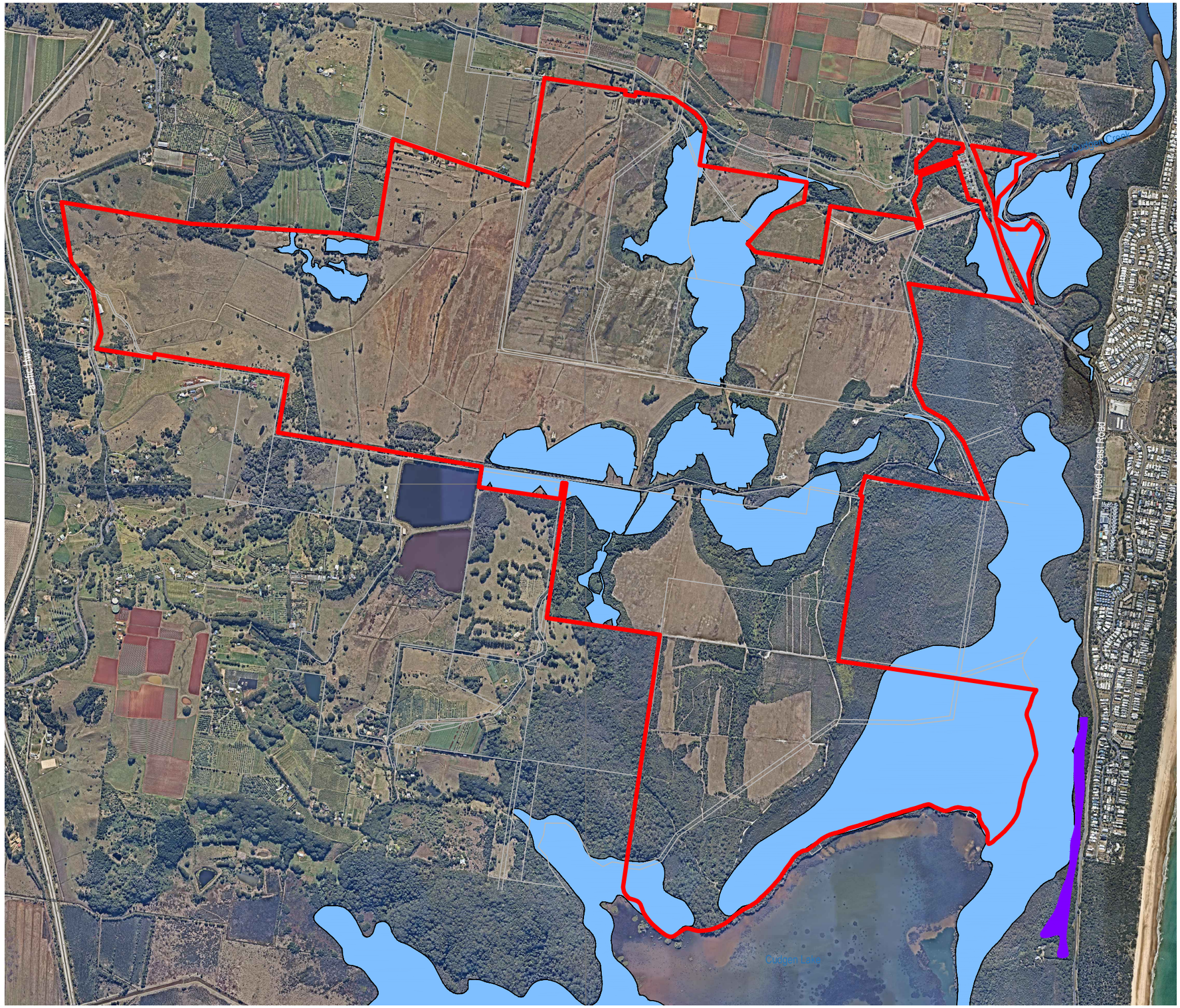
Soil landscapes within the Murwillumbah area have been mapped and described by Morand (1996). Kings Forest is situated within the Murwillumbah map sheet area (Department of Land and Water Conservation (DWLC)). The low-lying areas are predominantly Aeolian and marine formed beach ridge plains of Pleistocene origin (DWLC classification: *Kingscliff soil landscape*).

An ancient stream channel cuts through the inner barrier sediments, creating low-lying swampy areas of Holocene origin dominated by Organosols (G&S 2011b). Low hills of Neranleigh-Fernvale derived material bound the site in part on the western, south-western and southern fringes, with a low hill of basalt derived material present on the north-western boundary.

The beach ridge plain is comprised essentially of Pleistocene sands and extends from Cudgen Lake north to Old Bogangar Road and west to the low hills bordering Duranbah Road. The south of the site, including Cudgen Paddock, consists of a poorly drained depression within Pleistocene sand sheets and dunes. Elevation is less than 3 m in these areas of the site and water ponding is common with the water table generally within 100 cm of the surface (Morand 1996). Artificial drains run north and south through the Cudgen Paddock.

An area of wetland bisects the beach ridge plain at the centre of the site and extends to the northern boundary and along a relict stream channel flowing east towards Cudgen Creek.

Six (6) main soil orders have been identified at the site, according to the Australian Soil Classification (Isbell 2002). These are Podosols, Organosols, Dermosols, Kandosols, Ferrosols



LEGEND

- SEPP 14 Coastal Wetlands
- SEPP 26 Littoral Rainforest
- Kings Forest Boundary

Note:
These SEPP's have been superseded by State Environmental Planning Policy (SEPP) Coastal Management (2018). As all relevant approvals were granted prior to the gazettal of the Coastal Management SEPP, reference to the revised mapping has not been shown to avoid confusion.

0 500m
1 : 20 000

SOURCE: Landpartners - SEPP14 Wetlands (Amendment 15) & SEPP26 Littoral Rainforest; Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

JWA PTY LTD
Ecological Consultants

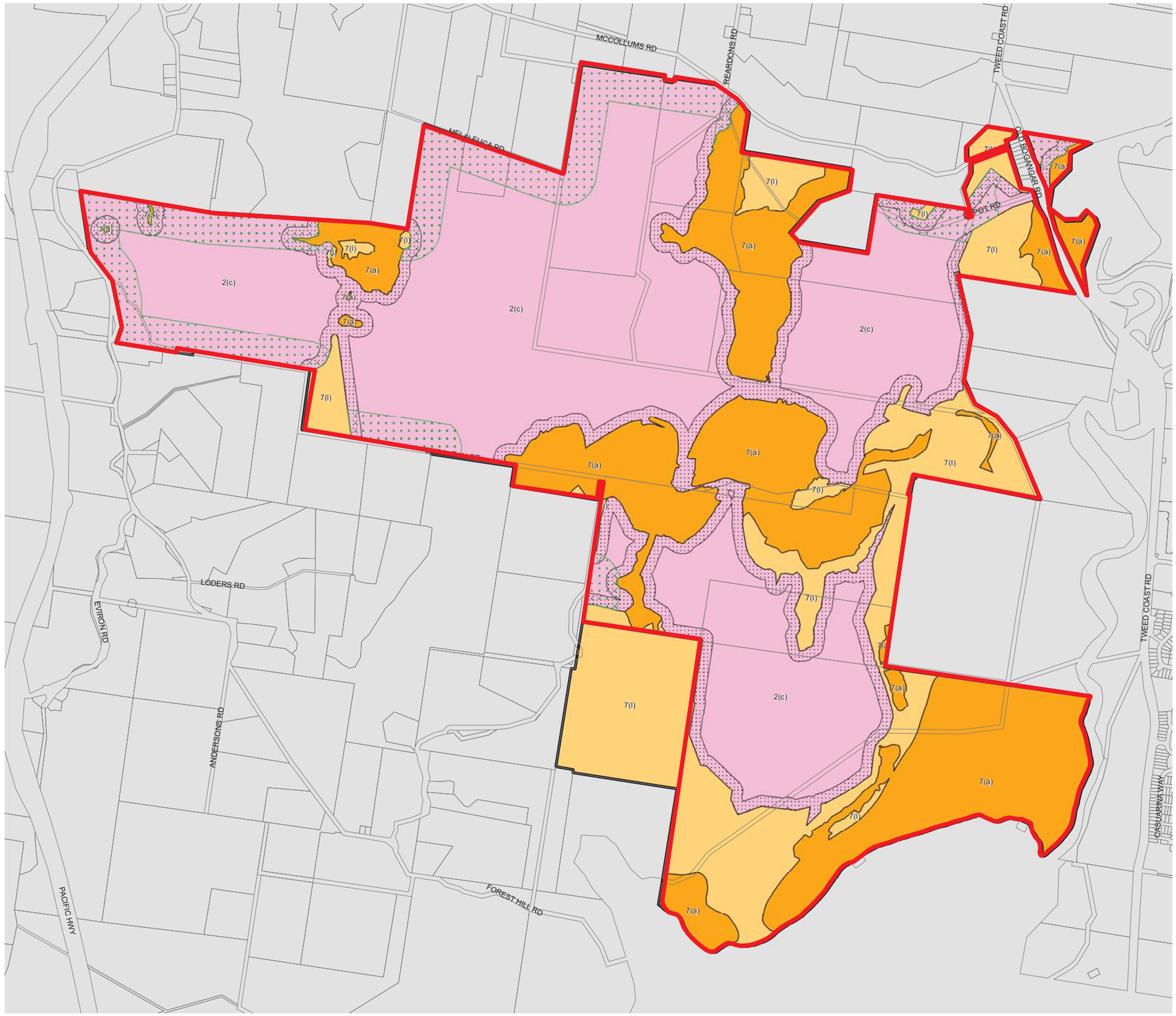
CLIENT
Project 28 Pty Ltd

PROJECT
Wallum Sedge Frog Management Plan
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 3

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP.dwg

TITLE
SEPP No. 14
COASTAL WETLANDS
& SEPP No. 26
LITTORAL RAINFOREST



N

LEGEND

Kings Forest Boundary

ZONING

- 2(c) Urban Expansion
- 7(a) Environmental Protection (Wetlands & Littoral Rainforests)
- 7(l) Environmental Protection (Habitat)
- Agricultural Buffer (150m)
- Ecological Buffer (50m)

0 500m

1 : 20 000

SOURCE: NSW Planning SEPP (Major Development) 2005 - Kings Forest Land Zoning Map (Ref: SEPP_MD_KIF_LZN_001_20100201)
SCALE: 1 : 20 000 @ A3

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Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 4

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Zoning.cdr

TITLE

ZONING PLAN

and Hydrosols. In general, the soils on the site can be classified into three (3) main areas. Those soils occurring on the Pleistocene beach ridge plain, the more recently deposited Holocene peats and sediments of the wetland areas, and the soils associated with the higher slopes on the western boundaries of the site (G&S 2011b) (**FIGURE 5**).

2.6 Topography and Drainage

The site is on a gently undulating coastal floodplain with the Duranbah Ridge bordering the western boundary. The majority of the site (and surrounding lands) is generally low lying and of low relief, with a large proportion comprising a beach ridge plain. Approximately 94% of the land is below 10 m AHD and the remainder generally less than 20 m AHD with the exception of two (2) areas in the western portion of the site and an area within the Environmental Protection Zone in the south, which have slopes exceeding 20%. Approximately 25% of the coastal plain within the site is permanent wetland.

The site is dominated by two (2) major and a number of minor drainage lines (**FIGURE 6**). The two (2) major drainage features are:

- Blacks Creek, which has a small catchment to the south of the western portion of the Kings Forest site in "Turners Land". Blacks Creek enters the site and then drains immediately east through a maintained large drain, traverses the SEPP 14 landscape feature and exits to the Cudgen Nature Reserve at the eastern boundary to the site; and
- The SEPP 14 wetland habitats in the northern central and middle eastern portions of the site and associated constructed drains. The northern central portion of the SEPP 14 drains to the south (via a constructed drain) and into the middle eastern portion of the SEPP 14. All this water then continues via constructed drains into Blacks Creek.

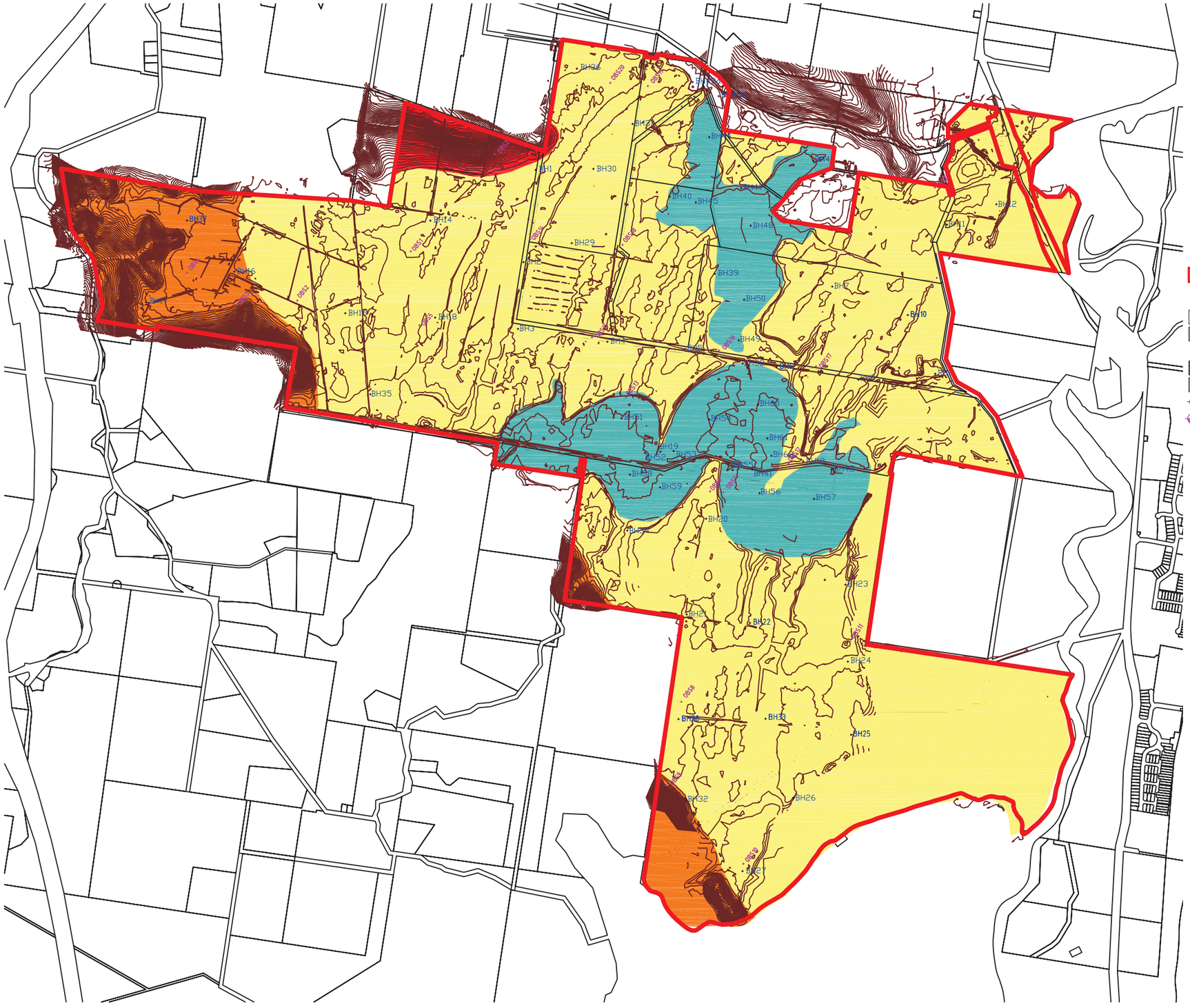
It should be noted that although these drainage features are labelled as intermittent on the topographical mapping (**FIGURE 6**) site observations over the last twenty-five (25) years would indicate that these are permanent streams.

The majority of the land in the southern portion of the Kings Forest site (Cudgen Paddock) drains to the north into the SEPP 14 (middle eastern portion) and thence into the Blacks Creek system.

A creek and smaller SEPP 14 wetland drainage system occurs in the western portion of the site. This creek system drains to the south of the Kings Forest site.

2.7 Vegetation

The Kings Forest site has a decades-long history of various land uses and land management practices, including pine plantation, sand mining, pasture improvement and turf production, dairy farming, small cropping and sugar cane production. It is presently used generally for cattle grazing. Over many years the land has been extensively cleared for these activities. There remain, however, large areas of undisturbed vegetation in the eastern and south-eastern portions of the property and within wetland areas throughout. These areas of the site are generally zoned for Environment Protection.



SOURCE: Gilbert & Sutherland (Ref: soils.pdf)

SCALE: 1 : 20 000 @ A3

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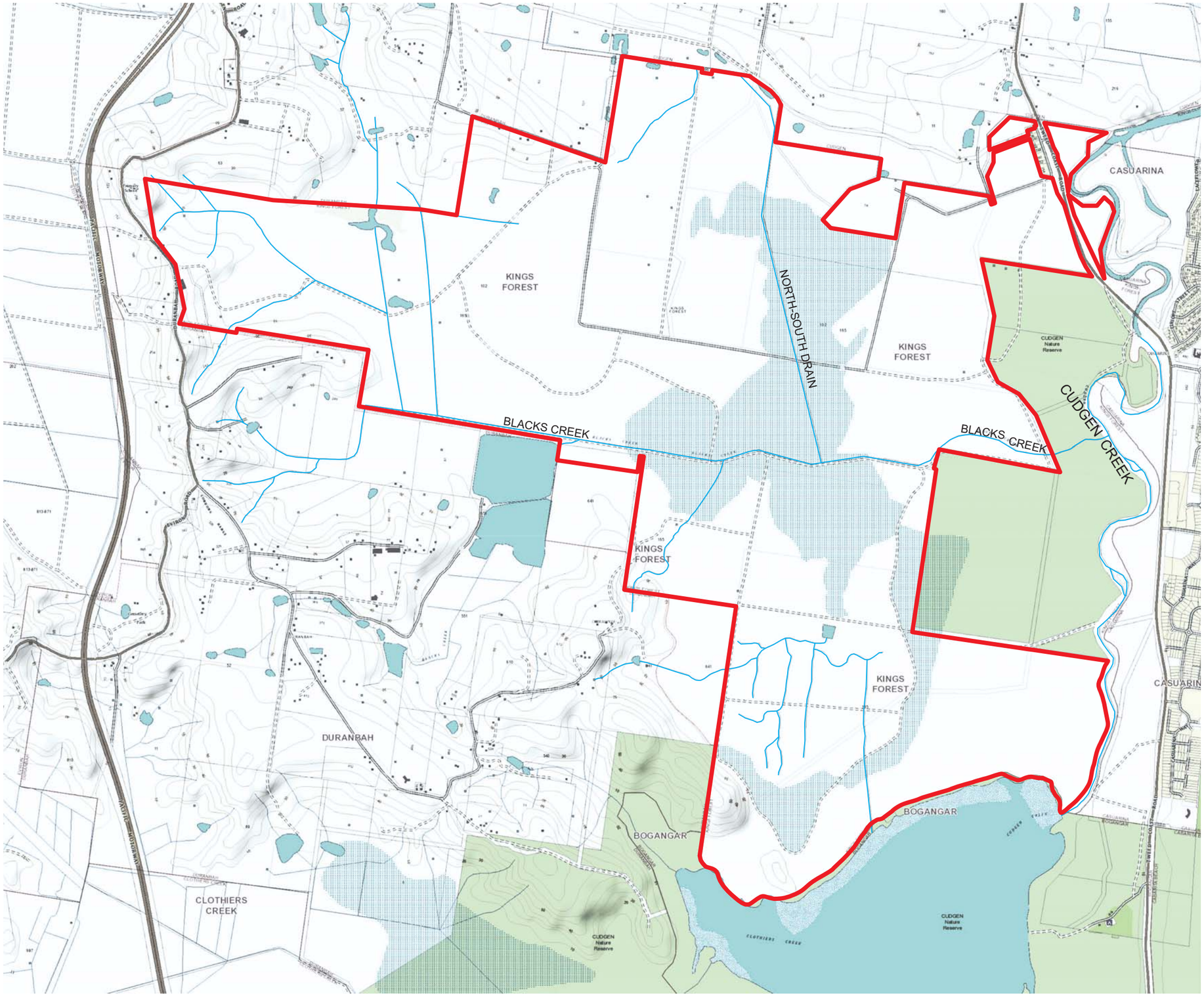
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FIGURE 5

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_G&S Soils.cdr

TITLE

SOILS PLAN



LEGEND

Kings Forest Boundary

DRAINAGE FEATURES

- Intermittent Stream
- Perennial Lake
- Land Subject to Inundation
- Sand

N

0 500m

1 : 20 000

SOURCE: NSW Department of Finance & Services 2012 Topographic map of NSW

SCALE: 1 : 20 000 @ A3

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FIGURE 6

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Topo Drainage.cdr

TITLE

DRAINAGE PLAN

Vegetation at the subject site has been described in varying degrees of detail (Warren 2000, Kingston *et al*. 2004, Callaghan *et al*. 2005). The most comprehensive vegetation mapping over the Kings Forest site was completed by the Australian Koala Foundation (Callaghan *et al*. 2005). However, harvesting of areas of pine plantation, continued infestation of native vegetation with Slash pine (*Pinus elliottii*) wildings and areas of natural heath regeneration has occurred since the preparation of this map.

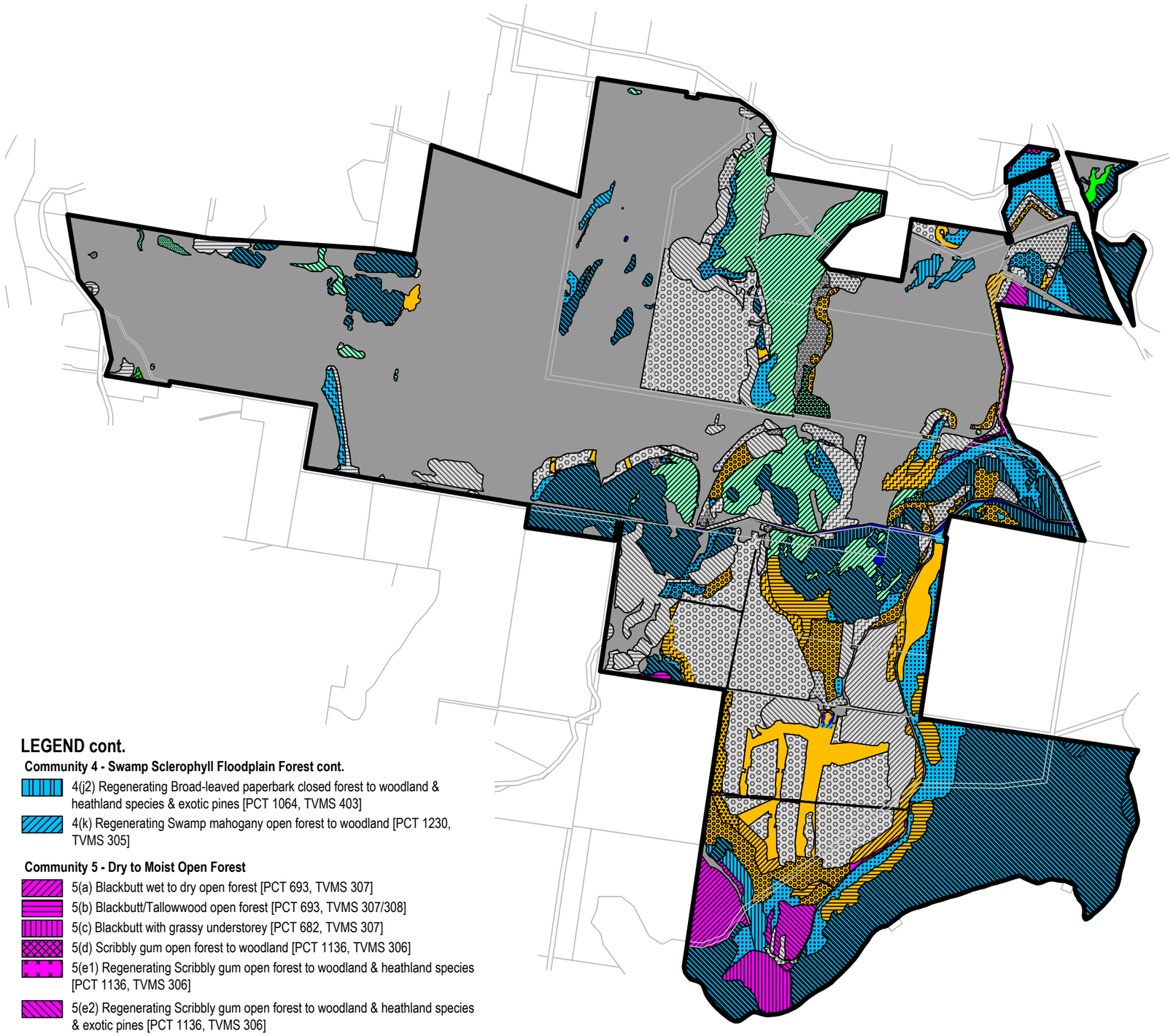
FIGURE 7 shows the vegetation communities occurring over the site (as at July 2019) and has been adapted from the Callaghan *et al*. (2005) mapping combined with detailed re-mapping/ground-truthing surveys completed by JWA between 2010 – 2019.

In total, six (6) broad vegetation types comprising forty-two (42) discrete vegetation communities have been identified over the Kings Forest site (**FIGURE 7**). The six (6) vegetation types mapped over the site include:

- Highly modified vegetation communities;
- Freshwater wetlands;
- Heathland and shrublands;
- Swamp sclerophyll floodplain forests;
- Dry to moist open forests; and
- Rainforest.

Vegetation community descriptions in this WSFMP, including proposed offset/compensatory habitat areas, are discussed in relation to their closest Plant Community Type (PCT) descriptions which were accessed via the NSW Office of Environment and Heritage (OEH) database (i.e. the BioNet Vegetation Classification System). PCTs are classified based on vegetation types occurring within the Interim Biogeographic Regionalisation for Australia (IBRA) subregions, as developed by the Commonwealth government. The IBRA framework divides Australia landscapes into bioregions and subsequently subregions based on common features such as climate, geology, landform, and vegetation.

It is noted however that PCT descriptions are still undergoing revision and many remain undescribed for the SEQ03 – Burringbar-Conondale Ranges IBRA subregion. Therefore, corresponding Tweed Vegetation Management Strategy 2004 (TVMS) codes have also been provided.



LEGEND

Kings Forest Boundary

Community 1 - Highly Modified

- 1(a) Substantially cleared of native vegetation
- 1(b) Camphor laurel dominant closed forest (with rainforest species)
- 1(c) Native plantation/plantings
- 1(d) *Leptospermum petersonii* plantation (with heathland species)
- 1(e1) Exotic pine plantation
- 1(e2) Exotic pine plantation (with heathland species)
- 1(f) Exotic grassland dominated (with heathland species)
- 1(g) Exotic grassland dominated (with regrowth Acacia & other native species)
- 1(h) Exotic pines with sedgeland/rushland/fernland
- 1(i) Exotic pines with swamp sclerophyll floodplain forest

Community 2 - Freshwater Wetland

- 2(a) Hillside seepage swamp (with *Eleocharis tetraquetra*) [PCT 1911, TVMS 701]
- 2(b) Ponds & fringing wetland [PCT 1911, TVMS 701]
- 2(c1) Sedgeland/rushland/fernland [PCT 1911, TVMS 701/702]
- 2(c2) Sedgeland/rushland/fernland (with exotic pines) [PCT 1911, TVMS 701/702]

Community 3 - Heathland & Shrubland

- 3(a1) Dry coastal heathland to shrubland [PCT 663, TVMS 501]
- 3(a2) Dry coastal heathland to shrubland (with exotic pines) [PCT 663, TVMS 501]
- 3(b1) Wet coastal heathland to shrubland [PCT 1297, TVMS 502]
- 3(b2) Wet coastal heathland to shrubland (with exotic pines) [PCT 1297, TVMS 502]
- 3(d) Regenerating wet/dry coastal heathland to shrubland [PCT 1297, TVMS 501/5022]
- 3(e) Regenerating wet/dry coastal heathland to shrubland (with exotic pines) [PCT 1297, TVMS 501/502]

Community 4 - Swamp Sclerophyll Floodplain Forest

- 4(a) Forest red gum open forest to woodland/Broad-leaved paperbark closed forest to woodland [PCT 1064, TVMS 403]
- 4(b) Swamp mahogany open forest to woodland & heathland species [PCT 1230, TVMS 305]
- 4(c) Scribbly gum/Swamp mahogany +/- Red mahogany, Swamp turpentine, Hard corkwood closed forest to woodland [PCT 1230, TVMS 305/306]
- 4(d) Swamp box open forest to woodland [PCT 1064, TVMS 309]
- 4(e) Broad-leaved paperbark closed forest to woodland [PCT 1064, TVMS 401]
- 4(f) Broad-leaved paperbark closed forest to woodland (with Scribbly gum) [PCT 1064, TVMS 401]
- 4(g1) Broad-leaved paperbark closed forest to woodland (with rainforest species) [PCT 1064, TVMS 401]
- 4(g2) Broad-leaved paperbark closed forest to woodland (with rainforest species & camphor laurel) [PCT 1064, TVMS 401]
- 4(h) Broad-leaved paperbark closed forest to woodland/Swamp mahogany open forest to woodland [PCT 1064, TVMS 403]
- 4(i) Swamp sclerophyll & heathland species (with exotic pines) [PCT 1064, TVMS 403]
- 4(j1) Regenerating Broad-leaved paperbark closed forest to woodland & heathland species [PCT 1064, TVMS 403]

LEGEND cont.

Community 4 - Swamp Sclerophyll Floodplain Forest cont.

- 4(j2) Regenerating Broad-leaved paperbark closed forest to woodland & heathland species & exotic pines [PCT 1064, TVMS 403]
- 4(k) Regenerating Swamp mahogany open forest to woodland [PCT 1230, TVMS 305]

Community 5 - Dry to Moist Open Forest

- 5(a) Blackbutt wet to dry open forest [PCT 693, TVMS 307]
- 5(b) Blackbutt/Tallowwood open forest [PCT 693, TVMS 307/308]
- 5(c) Blackbutt with grassy understorey [PCT 682, TVMS 307]
- 5(d) Scribbly gum open forest to woodland [PCT 1136, TVMS 306]
- 5(e1) Regenerating Scribbly gum open forest to woodland & heathland species [PCT 1136, TVMS 306]
- 5(e2) Regenerating Scribbly gum open forest to woodland & heathland species & exotic pines [PCT 1136, TVMS 306]

Community 6 - Rainforest

- 6(a) Littoral rainforest [PCT 751, TVMS 101]
- 6(b) Regenerating sub-tropical rainforest [PCT 1302, TVMS 102]
- Open water

NOTE: Vegetation mapping has been adapted from the Australian Koala Foundation (Callaghan *et al.* 2005) mapping combined with detailed re-mapping/ground-truthing surveys completed by JWA between 2010 - 2018.

0 500m
1 : 20 000

SOURCE: JWA March to August Site Investigations 2018

SCALE: 1 : 20 000 @ A3

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FIGURE 7

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP.dwg

TITLE

VEGETATION COMMUNITIES

3 THE PROPOSED DEVELOPMENT

On the 19th August 2010, Concept Plan Approval No. 06_0138 was issued for Kings Forest. The site is proposed to be developed into a master planned residential community. The areas proposed for residential development are shown on the Revised Concept Plan, Revision B dated the 5th December 2013 (**FIGURE 8**). The total area of the proposed development is 422.32 ha and will include the following in accordance with the Concept Plan Approval (as modified Mods 1 to 5):

- Residential development for approximately 4500 dwellings;
- Town centre and neighbourhood centre for future retail and commercial uses;
- Community and education facilities;
- Employment land;
- 18 hole Golf Course;
- Open space;
- Wildlife corridors;
- Protection and rehabilitation of environmentally sensitive land;
- Utility services infrastructure;
- Water management areas and lake; and
- Roads and pedestrian and bicycle paths.

The Kings Forest project will likely proceed over many years. The length of time will be dependent, to a certain degree, on the demand for land over time. The development of the site will be completed on a precinct-by-precinct basis in accordance with approved Precinct Plan (**FIGURE 9**). It is intended to developed Precincts 1, 2, 5 and majority of Precinct 4 as Stage 1. The staging of development of remaining precincts will be then proceed in accordance with the approved Precinct Plan, however this may be subject change. Indicative staging is shown in **TABLE 1.**

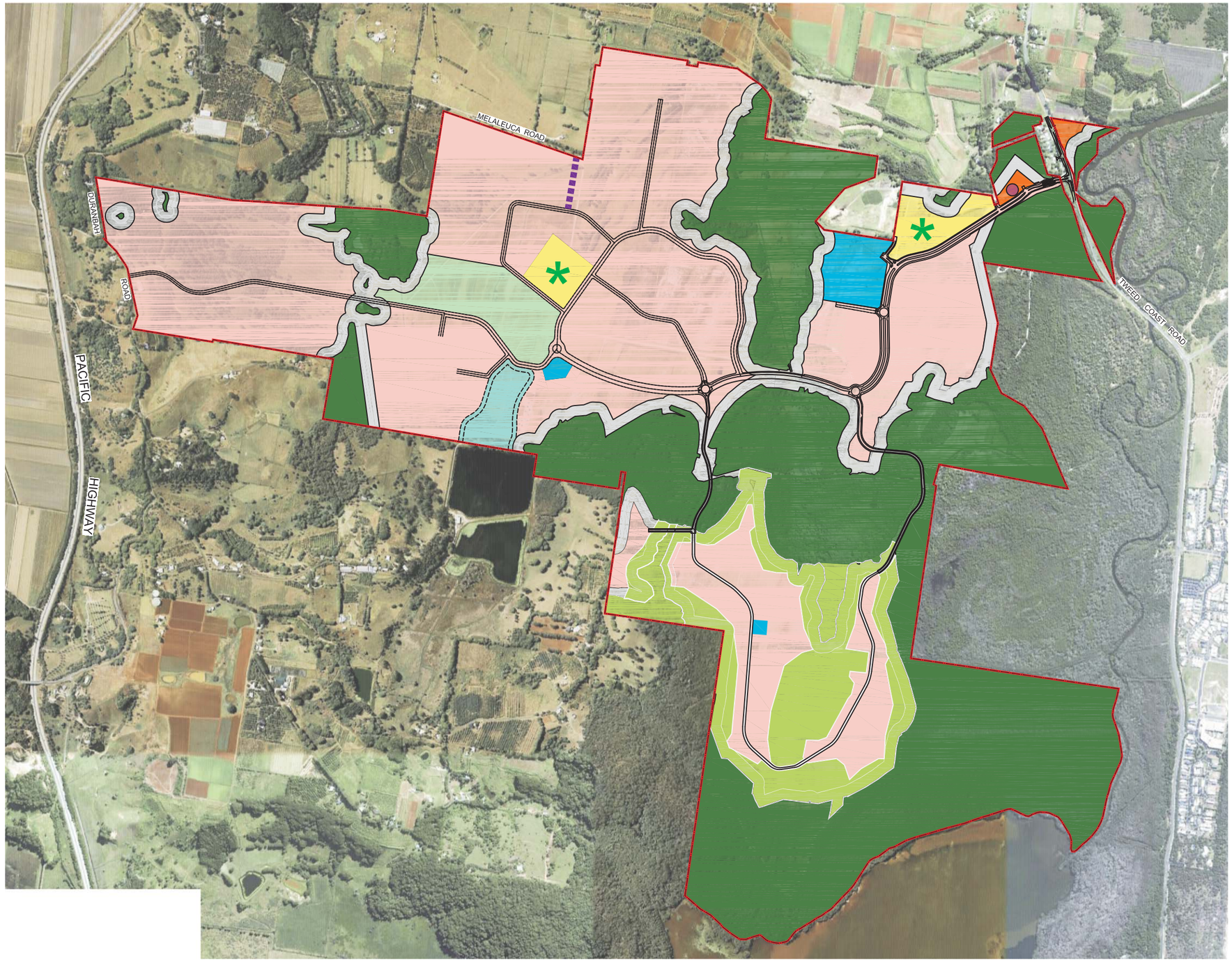
TABLE 1
INDICATIVE DEVELOPMENT STAGING

Development Stage	Precinct
Stage 1	Precinct 1
	Precinct 2
	Majority of Precinct 4
	Precinct 5
	Offsite Koala Offsets
	East-West Corridor
Stage 2	Precinct 3
	Remainder of Precinct 4
Stage 3	Precinct 6
Stage 4	Precinct 7
Stage 5	Precinct 8

Development Stage	Precinct
Stage 6	Precinct 9
Stage 7	Precinct 10
Stage 8	Precinct 11
Stage 9	Precincts 12-14

Retained vegetation and habitat areas across the site generally occur within Environmental Protection Zones (EPZs) and associated buffers. To assist in identifying the staging of rehabilitation and management actions, these EPZ and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs) throughout the WSFMP. Works within the EMAs will be completed in accordance with the staging detailed in **TABLE 1.**

As listed above, the approved Concept Plan included an eighteen (18) hole Golf Course. The Golf Course is proposed as Precinct 14 (**FIGURE 9**) and occurs in the southern portion of the site. During preparation of this WSFMP the design of the Golf Course was revised to allow for further retention/protection of ecological values and the provision of additional compensatory habitat areas. The revised Golf Course design is provided as **FIGURE 10.**



LEGEND

- Town Centre / Neighbourhood Centre
- Residential
- Community Facilities / Education
- Employment Land
- Structured Open Space (Active)
  (Passive open space to council standards, location subject to urban design)
- Environmental Protection Area
- 50m Ecological Buffer
  (includes APZ's & roads where approved)
- State School Site
- Proposed Zone Substation
  (subject to Country Energy final approval)
- Potential Road Connection to Melaleuca Road

Private Open Space

- Golf Course Area
  (encompassing ecological buffers where indicated)
- Private Open Space including Lake
- Kings Forest Boundary

IMPORTANT NOTE

This plan was prepared as a preliminary concept plan for planning purposes only. As such all particulars, including lot design, areas and densities, are subject to detailed survey, site investigations and to the requirements of council and any other authority which may have requirements under any relevant legislation.
This note is an integral part of this plan.

0 500m
1 : 20 000

SOURCE: RPS Revised Concept Plan Rev B dated 05/12/13 (Ref: 113691-PSP-4b(CONCEPT PLAN).dwg)
SCALE: 1 : 20 000 @ A3

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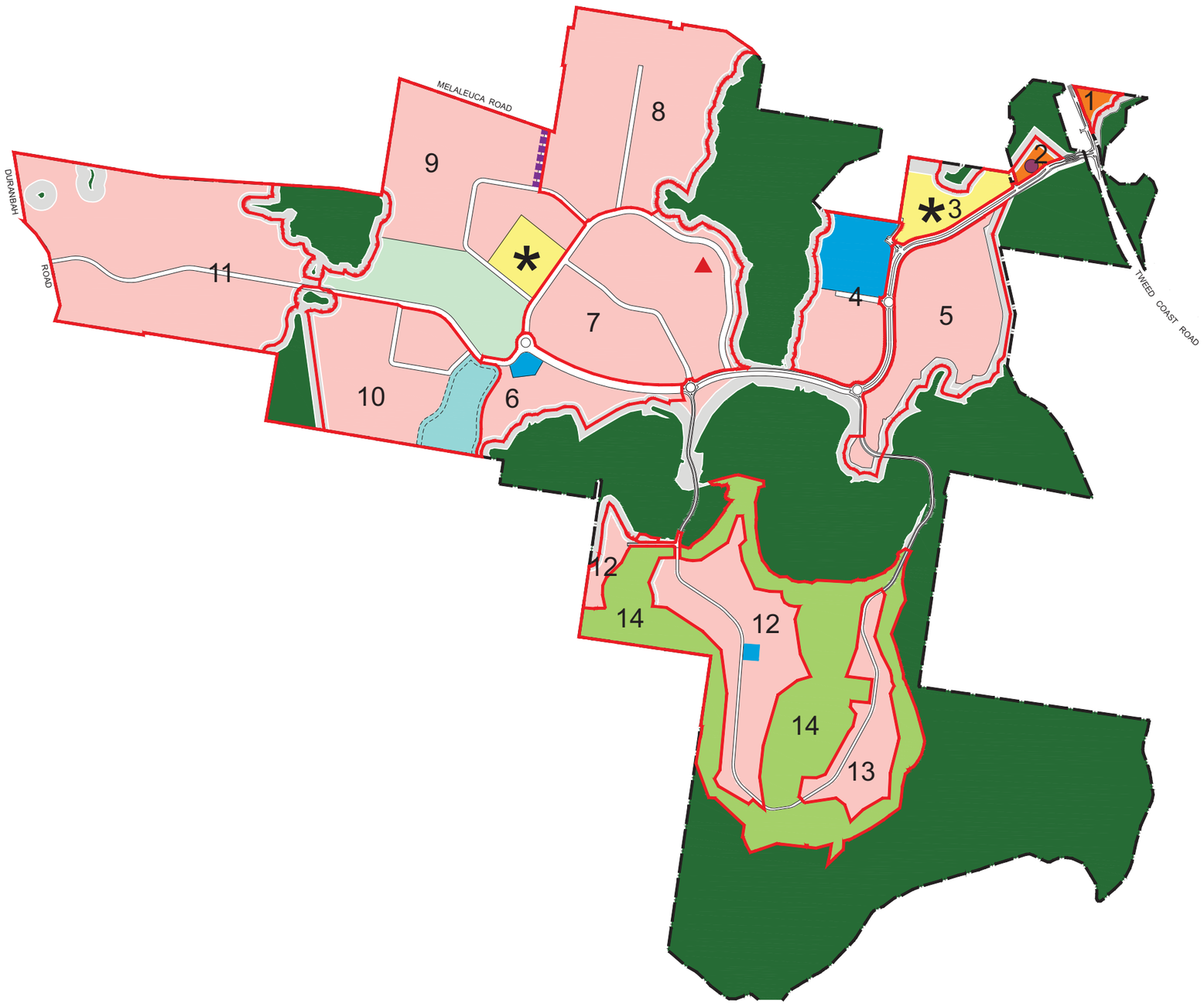
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FIGURE 8

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Concept Plan.cdr

TITLE
REVISED CONCEPT PLAN



N

TOWN CENTRE / NEIGHBOURHOOD CENTRE

RESIDENTIAL

COMMUNITY FACILITIES / EDUCATION

EMPLOYMENT LAND

STRUCTURED OPEN SPACE (ACTIVE)
(Passive open space to council standards, location subject to urban design).

ENVIRONMENTAL PROTECTION AREA

50m ECOLOGICAL BUFFER
(Includes APZs & Roads where approved)

STATE SCHOOL SITE

PROPOSED ZONE SUBSTATION
(Subject to County Energy final approval)

POTENTIAL AFFORDABLE HOUSING LOCATION

POTENTIAL ROAD CONNECTION TO MELALEUCA ROAD

PRIVATE OPEN SPACE

GOLF COURSE AREA
(Encompassing ecological buffers where indicated)

PRIVATE OPEN SPACE INCLUDING LAKE

IMPORTANT NOTE

This plan was prepared as a preliminary concept plan for planning purposes only. As such all particulars, including lot design, areas and densities, are subject to detailed survey, site investigations and to the requirements of council and any other authority which may have requirements under any relevant legislation.
This note is an integral part of this plan.

0 500m
1 : 20 000

SOURCE: RPS Precinct Plan Rev B dated 05/12/13 (Ref: 113691-PSP-4b(PRECINCT PLAN).dwg)
SCALE: 1 : 20 000 @ A3

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FIGURE 9

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Precinct Plan.cdr

TITLE

PRECINCT PLAN

RESIDENTIAL
30.2 Ha

RESIDENTIAL
15.1 Ha

K5 HERITAGE SITE
NO EXCAVATION

FUTURE DEVELOPMENT
INCLUDING CAR PARKING
GOLF OPERATIONS

PRACTICE
RANGE

COMPOUND

EARTHWORKS IN AND AROUND EXISTING POND IS SUBJECT TO DIRECTION ON SITE BY GOLF COURSE DESIGNER

REFAIN EXISTING VEGETATION

PRACTICE

GREENS

300m

SCORECARD

BLUE	METRES	PAR	METRES	RED
1	500	5	420	1
2	175	3	150	2
3	170	3	125	3
4	280	4	230	4
5	360	4	300	5
6	130	3	110	6
7	140	3	130	7
8	80	3	70	8
9	170	3	145	9
OUT	2015	31	1680	OUT
10	345	4	315	10
11	330	4	245	11
12	135	3	105	12
13	260	4	215	13
14	295	4	235	14
15	470	5	410	15
16	175	3	130	16
17	165	3	160	17
18	515	5	425	18
IN	2690	35	2240	IN
OUT	2015	31	1680	OUT
TOTAL	4705	66	3920	TOTAL

LEGEND

NOTE:
UNDISTURBED AREAS TO BE RETAINED AND / OR REGENERATED WITH APPROVED NATIVE VEGETATION

PUTTING GREEN

BIO-RETENTION/DETENTION/ AQUIFER RECHARGE/NATIVE VEGETATION & FAUNA HABITAT SWALES

BUNKER

⑤ ORDER OF PLAY

EDGE OF FAIRWAY

CREATED WETLAND, DETENTION AND NUTRIENT STRIPPING POND

MAXIMUM RESIDENTIAL BOUNDARY

PROPOSED CART PATHS

AREA SUITABLE FOR HEATH PLANTING

TEE AREAS

INCORPORATING POTENTIAL GOLF COURSE BUFFERS

Potential 50m Ecological Buffer within Golf Course (21.22ha)

Potential 30m Outer Protection Zone Buffer within Golf Course (12.07ha)

Note: Areas of existing and proposed compensatory Koala and Wallum sedge frog habitat have been excluded from potential buffer areas.

N

0 150m

1 : 5000

SOURCE: GNP Golf Design (Ref: KF Alternative Golf Layout G291.AGL.01 (WHITE).pdf) amended by JWA 10/12/16
SCALE: 1 : 5000 @ A3

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Koala Plan of Management
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 10

PREPARED: BW
DATE: 17 February 2020
FILE: N97017_Golf Course.cdr

TITLE

REVISED GOLF COURSE LAYOUT

4 WSF SPECIES PROFILE AND HABITAT ASSESSMENT

4.1 Introduction

This section provides a brief description of the WSF and a summary of their known distribution, habitat requirements, and life cycle, as well as resource availability on the Kings Forest site.

4.2 Description

The WSF is a small slender frog, approximately 25-31 mm in length. This species is a light brown to green colour with a dark stripe bordered below by a creamy streak running the length of the flank (Czechura 1995). The thighs have distinctive purple and orange colouration and the toes have rounded discs and are webbed at the base.

4.3 Population and Distribution

The WSF has a coastal distribution from Fraser Island in south-east Queensland to Woolgoolga in northern NSW. The area of occupancy of the species is approximately 9000 km^2 (Hero *et al*. 2008). There is little information on population size, structure or dynamics (Hines *et al*. 1999).

4.4 Breeding Biology

Limited information is available on the breeding biology of the species. Ehmann (1997) recorded males calling in spring, summer and early autumn at night and by day when swamps were rising, or ample water was available. WSF mainly breed following heavy rain in perched swamps, amidst sedges, grasses and/or Swamp water fern (*Blechnum indicum*) in still water 0.5-1.5 m deep. The wallum waters in which the species breeds are typically heavily tannin-stained, highly acidic and generally dilute. Eggs are attached to grasses and sedges and tadpoles are nektonic (live in the water column in still water) and dwell amongst reeds and grasses in water 0.5-1.5 m deep. Fish are largely absent from habitat occupied by the species (Ehmann 1997; Hopkins 2003).

4.5 Habitat Preferences

4.5.1 Vegetation

The WSF is found in sandy coastal lowlands (wallum) in heathlands, shrublands, woodlands or forests primarily occurring on sand dunes or flats at elevations above tidal influence.

4.5.2 Breeding Habitat

Suitable breeding habitats for the WSF occur in acidic, permanent to ephemeral, freshwater wetlands with emergent vegetation, most notably sedges, reeds or ferns, and occasionally *Melaleuca* (paperbark) woodlands. These wetlands (wallum swamps, bogs, lakes or creeks), which are considered habitats critical to the survival of the species, typically overlie deep, low-nutrient, sandy soils where groundwater levels are characteristically high (Wallum Sedge Frog Workshop 2010).

NSW vegetation types, within which suitable breeding habitats for the WSF (as described above) are likely to occur, are (NSW DECC 2005):

- Wallum sedgeland and rushland of near coastal lowlands of the North Coast;
- Wet heathland and shrubland of coastal lowlands of the North Coast; and
- Coastal freshwater meadows and forblands of lagoons and wetlands.

4.5.3 Non-Breeding Habitat

The extent to which wallum frog species, including the WSF, rely on vegetation away from breeding sites is largely unknown; however, it is likely to facilitate the dispersal of frogs and gene flows between potential metapopulations. Vegetation surrounding lakes and swamps may also play an important role in maintaining hydrology and water quality at breeding site. Vegetation within swamp and lake catchments may, therefore, be considered habitat critical to the survival of the species (Wallum Sedge Frog Workshop 2010; Meyer *et al*. 2006).

NSW vegetation types, within which suitable non-breeding habitats for the WSF (as described above) are likely to occur, are (NSW DECC 2005):

- *Banksia aemula* dry shrubland on coastal sands of the North Coast;
- Graminoid clay heaths of the coastal lowlands of the North Coast;
- Coastal floodplain sedgelands, rushlands and forblands; and
- *Melaleuca quinquenervia* swamp forest of the coastal lowlands of the North Coast.

Habitat suitable for breeding by the WSF may be found anywhere within the above-mentioned habitat types where permanent to ephemeral wetlands occur.

4.5.4 Movement Patterns

Under wet conditions (i.e. resulting from significant rainfall events) the WSF is known to utilise heathlands, grasslands, woodlands and forests, which adjoin breeding habitats, in wallum environments and on near-coastal alluvial (clay) plains for foraging (Byron Shire Council 2010). Hines *et al*. (1999) state, however, that "there is no published information on non-breeding habitat requirements." These non-breeding habitats provide landscape connectivity and may play an important role in maintaining landscape hydrology and the quality of water in suitable breeding habitats.

The movement patterns of WSF are not well known. While residing in wetland habitats year-round, the species may disperse into nearby heath and woodland during very wet periods (Hines and Meyer 2011). Recolonisation of habitat destroyed by fire (Lewis and Goldingay 2005), suggests the species may disperse over larger distances (up to 500 m and possibly more) provided suitable movement corridors are available (James 1996; Lewis and Goldingay 2005; Meyer *et al*. 2006).

4.6 Presence on the Kings Forest Site

WSF has been recorded on the Kings Forest site within regenerating heath and sedgeland communities to the north and north-east of Precinct 5, in constructed drains in Precinct 7, within Precincts 12 and 14 and within the adjacent Cudgen Nature Reserve (**FIGURE 11**). The majority of records were in low-lying areas with standing water, sedges and grass cover e.g. *Gahnia sieberiana*, *Lepironia articulata*, *Blechnum indicum*, *Baloskion tetraphyllum* and *Juncus usitatus, J. polyanthemus* and *J. articulatus*.

The distribution of WSF breeding and forage habitat (onsite and offsite) has been identified by JWA and verified by Dr Arthur White of Biosphere Environmental Consultants (BEC) and is shown in **FIGURE 12**. WSF breeding habitat is defined as areas within mapped foraging habitat, in which standing water was held for a period of at least four (4) to six (6) weeks after rainfall events.

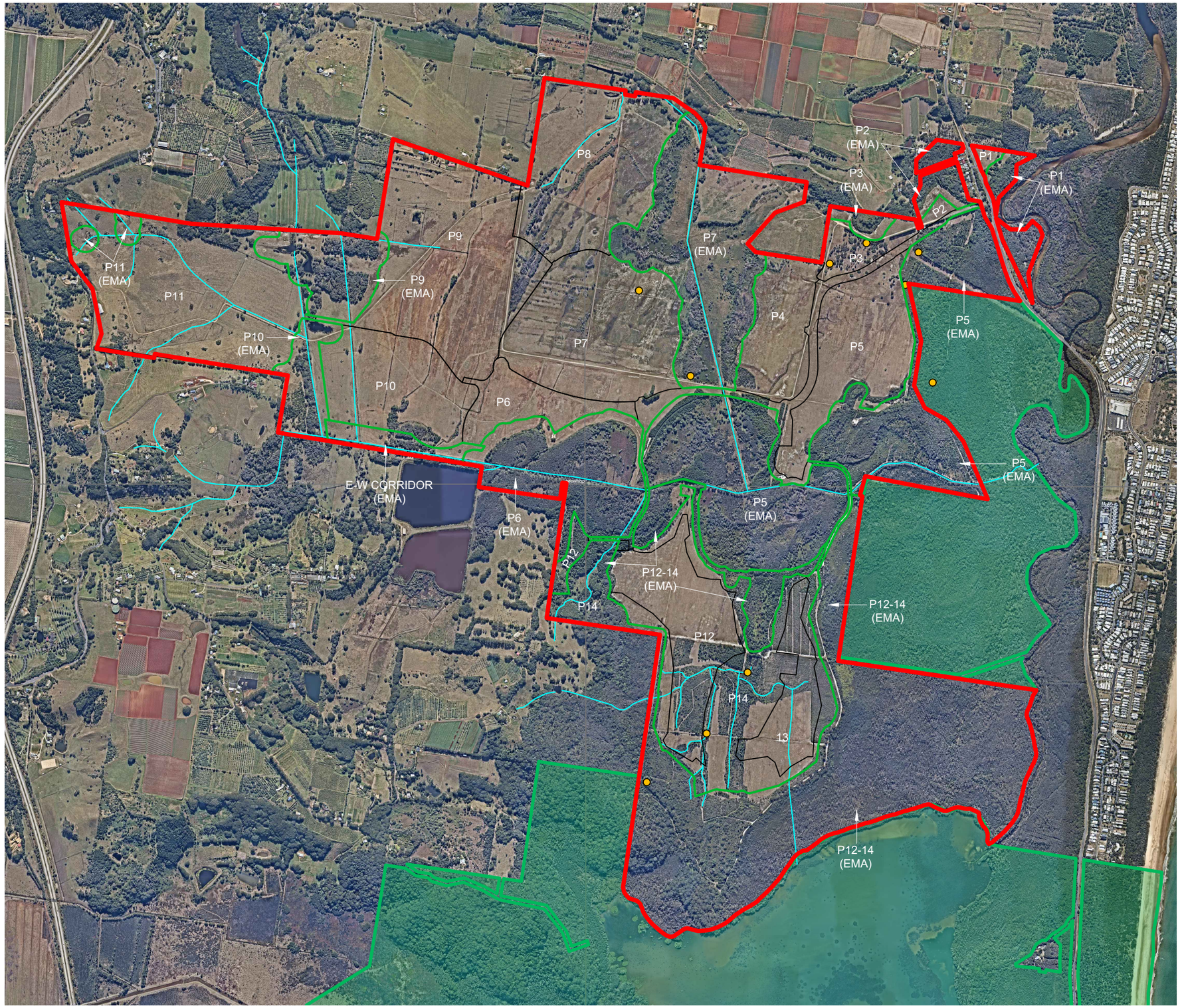
The Kings Forest site is predominately cleared land, with pockets of remnant wallum vegetation and fernland that provide WSF habitat. This habitat primarily occurs in areas that were not historically cleared when the site was being used principally for agriculture. Many of these remnant pockets of habitat are small and are located around small surface drainage lines constructed across the site.

A total of 82.39 ha of WSF habitat was mapped as occurring on the site. Mapped habitat is comprised of thirty-two (32) breeding sites covering 1.50 ha of breeding habitat and 80.89 ha of foraging habitat.

In addition, approximately 47.98 ha of WSF habitat was identified offsite within the neighbouring portions of the Cudgen Nature Reserve to the east and land to the south-west. This mapped offsite habitat is comprised of 0.28 ha of breeding habitat, 3.25 ha of forage habitat and 44.45 ha of potential habitat (i.e. breeding and foraging habitat has not been differentiated in these areas).

It should be noted that BEC (2014) states, "Overall, the amount of breeding habitat on the Kings Forest site is small and the better-quality habitat lies outside of the eastern [sic] and southern margins of the site."

Suitable connections exist between the majority of the onsite habitat areas and offsite habitat, although potential habitat to the north of the site is somewhat isolated by cleared land and Depot Road (**FIGURE 12**). Connectivity between potential habitat in Cudgen Nature Reserve to the east of Cudgen Paddock and onsite habitats would only be likely under suitable conditions (i.e. during prolonged wet weather events).



N

LEGEND

- Wallum sedge frog (*Litoria olongburensis*) - Vulnerable (BC Act 2016 & EPBC Act 1999)
- Drainage Lines
- Cudgen Nature Reserve
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: JWA Site Investigations; Landpartners Revised TSMP & VMP (July 2009); NSW DFS 2012 NSW Topographic Map; Near Map 08/08/18 Aerial

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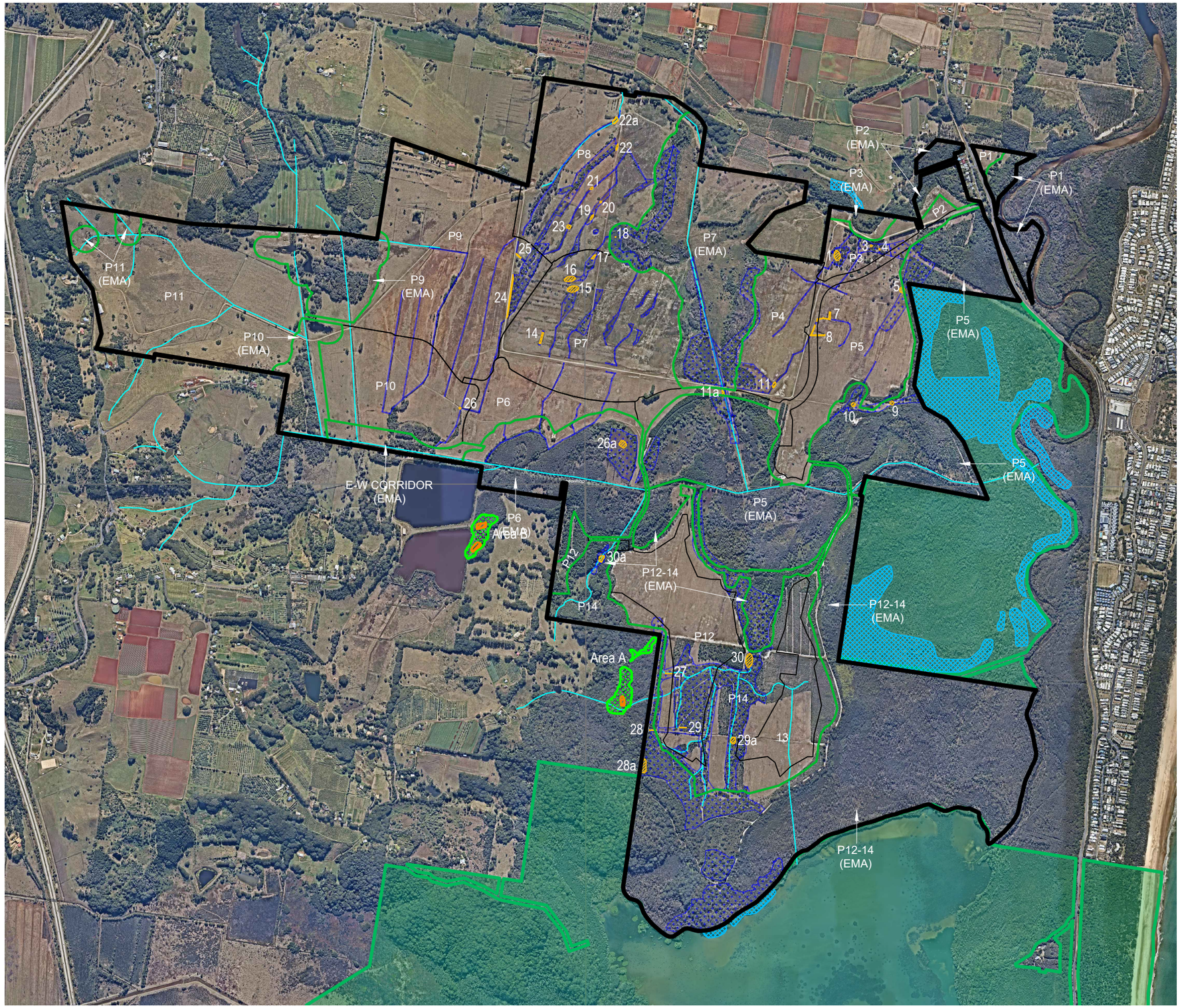
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Kings Forest
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Shire of Tweed

FIGURE 11

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP.dwg

TITLE

WALLUM SEDGE FROG RECORDS



LEGEND

- Drainage Lines
- Cudgen Nature Reserve
- Environmental Management Area (EMA) Boundary (#)
- Precinct Boundary
- Kings Forest Boundary

WSF HABITAT ONSITE (82.39ha)

- WSF breeding habitat (1.50ha)
- WSF forage habitat (80.89ha)

WSF HABITAT OFFSITE (47.98ha)

- WSF breeding habitat (0.28ha)
- WSF forage habitat (3.25ha)
- WSF potential habitat (44.45ha)

Note:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

0 500m
1 : 20 000

SOURCE: JWA Site Investigations; BEC 2014 Habitat Mapping; NSW DFS 2012 NSW Topographic Map; Near Map 08/08/18 Aerial

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FIGURE 12

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FILE: N97017_WSFMP.dwg

TITLE
EXISTING WALLUM SEDGE FROG HABITAT

5 THREATENING PROCESSES

5.1 Introduction

The loss of WSF habitat on freehold land on the mainland is of highest concern (Meyer *et al*. 2006). Populations in south-east Queensland and north-eastern NSW are under greatest threat. In these areas, habitat has become highly fragmented leaving many small isolated populations. These populations may be at greater risk of extinction because of limited gene flow, reduced likelihood of immigration and greater vulnerability to stochastic demographic and genetic processes (i.e. chance fluctuations in population structure and size and genetic drift).

The National recovery plan for the wallum sedge frog and other wallum-dependent frog species (Meyer *et al*. 2006) list the recognised known or potential threats to WSF as follows:

- Habitat loss;
- Habitat degradation;
- Habitat fragmentation as a result of land clearing;
- Inappropriate fire regimes;
- Predation by the introduced mosquito fish and cane toads;
- Use of biocides in weed and mosquito control;
- Pig damage;
- Exotic disease; and
- Vehicular traffic.

Each of the above threats to WSF are discussed in further detail in the following sections.

5.2 Habitat Loss

The habitat utilised by these frogs, particularly that on the mainland, has been extensively cleared and/or drained for agriculture, sand-mining, resort and residential development, and the establishment of pine plantations.

5.3 Habitat Degradation

5.3.1 Trampling of Reed Beds

In areas with high levels of human visitation (e.g. lakes on Fraser Island and North Stradbroke Island), trampling of reed beds has led to significant loss of WSF habitat. This could impact seriously on WSF numbers at a local level (Meyer *et al*. 2006).

5.3.2 Changes in Hydrology and Habitat Eutrophication and Pollution

All acid frogs require freestanding water at some stage of their life cycle. Of primary importance to acid frogs is the maintenance of water quality (Hines *et al*. 1999) and possibly acidic conditions i.e. less than pH 7 (Barker *et al*. 1995; Czechura 1995). In general, the

acidity of waterbodies within wallum communities ranges between pH 3.6 to 6.0 (Meyer *et al*. 2006).

Acidification within wallum communities occurs due the natural processes resulting from leaching of acid sulphate soils and/or release of humic acids from the breakdown of organic matter such as tannins and lignins.

Population monitoring of WSF in northern NSW found that frog population variability was high between censuses (Lewis and Goldingay 2005). Variability in habitat use by frogs after rainfall events was suggested as a possible reason for this variability in abundance.

Increased and/or altered stormwater flows have the potential to adversely impact on WSF through variations in physio-chemical indicators of water quality (Hines *et al*. 1999). Such indicators include:

- Increases in water turbidity;
- Increase stormwater flow rates resulting in erosion and sedimentation of waterbodies and scouring of vegetation;
- Increases in organic and inorganic nutrients, resulting in eutrophication of waterbodies;
- Increase in salinity of waterbodies; and
- Introduction of pollutants such as oils or chemical residues from adjacent pesticide/herbicide applications.

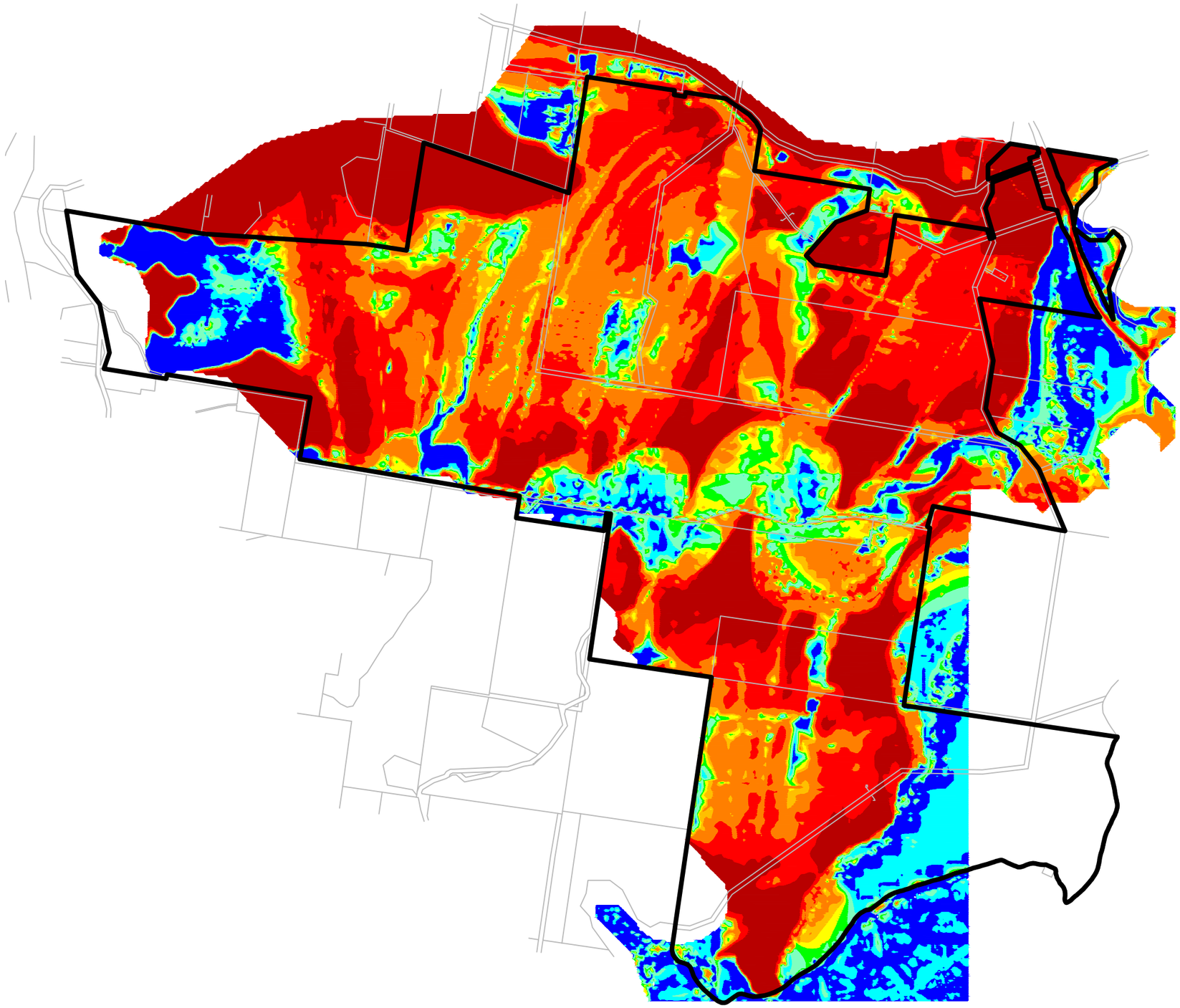
Altered groundwater regimes (e.g. reduced groundwater flows, changes in groundwater levels etc.) can also result in impacts on the location, extent and quality of WSF habitat. The proposed development will likely result in changes to site hydrology which has the potential to degrade WSF habitat to the extent that the carrying capacity of the habitat is reduced in the long-term. These impacts may also continue to operate/occur in the long term during the occupational phase of the subdivision.

FIGURES 13 and **14** show the pre-development groundwater levels and post-development levels respectively. The results of modelling and the resultant predictions of impacts on groundwater levels surrounding the development allowed an analysis of the future plant/soil moisture environmental conditions. Mapping of proposed WSF compensatory habitat (offset) areas has been completed with consideration of the groundwater modelling and the particular plant species moisture requirements.

5.4 Habitat Fragmentation as a Result of Land Clearing

Construction and development activities in adjacent areas have the potential to alter WSF habitat. Such alterations may include:

- Creation of temporary and/or permanent barriers to movement including habitat fragmentation; and
- Intentional or unintentional modification or damage to native vegetation through:



N

LEGEND

Kings Forest Boundary

Cadastre

GILBERT & SUTHERLAND - PRE DEVELOPMENT DEPTH TO GROUNDWATER

- Water table above ground surface
- 0 to 0.1m
- 0.1 to 0.2m
- 0.2 to 0.3m
- 0.3 to 0.4m
- 0.4 to 0.5m
- 0.5 to 1m
- 1 to 2m
- >2m

0 500m

1 : 20 000

SOURCE: Gilbert & Sutherland (Ref: Exist_ Depth_20141016_trim_cont_f_region.shp)

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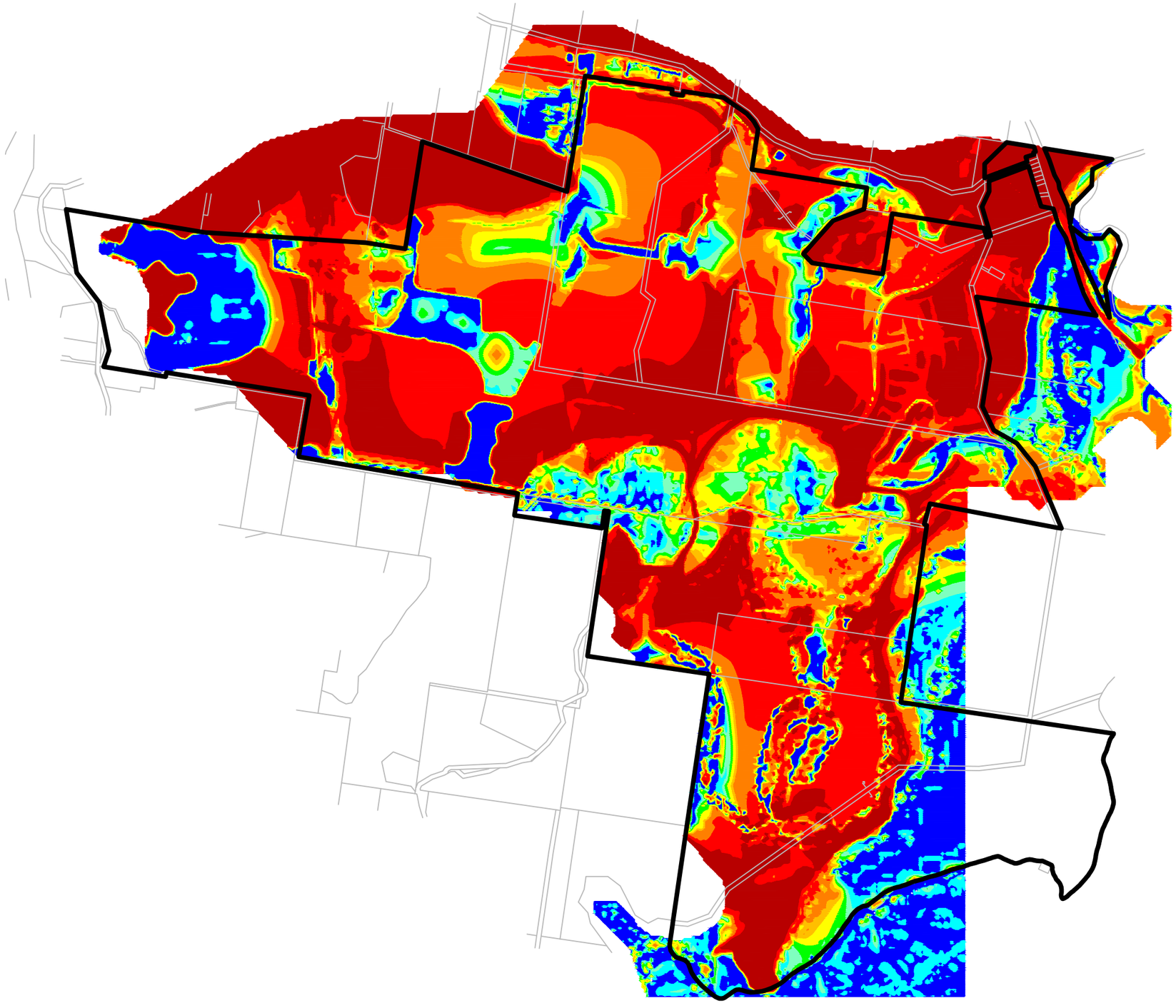
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FIGURE 13

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TITLE
PRE DEVELOPMENT GROUNDWATER MODEL



N

LEGEND

Kings Forest Boundary

Cadastre

GILBERT & SUTHERLAND - POST DEVELOPMENT DEPTH TO GROUNDWATER

- Water table above ground surface
- 0 to 0.1m
- 0.1 to 0.2m
- 0.2 to 0.3m
- 0.3 to 0.4m
- 0.4 to 0.5m
- 0.5 to 1m
- 1 to 2m
- >2m

0 500m

1 : 20 000

SOURCE: Gilbert & Sutherland (Ref: Dev_ Depth_20141016_trim_cont_f_region.shp)

SCALE: 1 : 20 000 @ A3

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FIGURE 14

PREPARED: BW
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FILE: N97017_G&S GW.dwg

TITLE
POST DEVELOPMENT GROUNDWATER MODEL

- Changes to the existing abiotic conditions of WSF habitat such as nutrients, soil pH, hydrology and sunlight exposure;
- Mechanical soil disturbance;
- Removal of plants;
- The deliberate or accidental introduction of competitive or prolific non-native species; and
- Fire.

These impacts have the potential to alter the floristic composition and/or structural complexity of wallum vegetation and the quantity, quality and hydro period of water within WSF habitat.

5.5 Inappropriate Fire Regimes

An increase in the frequency or intensity of fires could significantly affect frog numbers through direct mortality or loss of vegetation, the loss of cover exposing frogs to predators, extremes of temperature and dehydration. Monitoring data from Lennox Head in northern NSW shows fire may have a significant impact on WSF numbers, at least in the short term (Lewis & Goldingay 2005). Lennox East was extensively burnt by wildfire in the summer of 1997-98 and no WSF were recorded during survey effort for 18 months following this event (Lewis & Goldingay 2005). Surveys in subsequent years recorded both adults and juveniles, and suggests recruitment from nearby sites had occurred. This indicates that WSF are capable of recolonising suitable habitat over relatively short distances (i.e. ~500 m), but the effects of repeated wildfire over larger areas may preclude recruitment for many years, if at all (Lewis & Goldingay 2005).

Long term monitoring data from Western Australia also suggest frog numbers may be slow to recover following fire, even when heath vegetation is quick to do so (Driscoll & Roberts 1997). Frequent fires, especially over large areas, could therefore pose a serious threat to the long-term viability of WSF populations.

Dry periods, when sedge swamps are devoid of water, are likely to increase the vulnerability of WSF populations to fire. Water in the swamps may allow frogs to shelter from the path of fire (Lewis & Goldingay 2005).

5.6 Predation by the Introduced Mosquito Fish and Cane Toads

Exotic predators such as the Cane toad (*Rhinella marina*) and Mosquito fish (*Gambusia holbrooki*) have the potential to become a significant threatening process for WSF populations on the site following disturbance and habitat modification.

Cane toads are a generalist species that are able to breed in almost any permanent or temporary water source (including acidic and saline waters) and have no specialised dietary requirements. They have a tough, leathery epidermis, (in contrast to most Australian frogs), which allows them to tolerate water loss up to 50% and variability in ambient temperature. This feature, combined with a tolerance to broad environmental and climatic conditions, has

enabled them to occupy a variety of habitats generally to the detriment of endemic amphibians. Once established on a site, Cane toads will prey upon and permanently displace native frogs and tadpoles. Increased light spill from residential, commercial or industrial development may increase predator efficiency.

The Mosquito fish is a small freshwater fish originally introduced into Australian waterways in the 1920's to control mosquito larvae. This species is recognised as a voracious predator that will feed on other fish (adults and larvae), arthropods and amphibians (tadpoles and eggs). The introduction of this species into the waterways within the site has the potential to permanently exclude amphibians, including WSF, from the site.

5.7 Use of Biocides in Weed and Mosquito Control

Many widely used pesticides have been shown to be toxic to frogs causing deformities, hermaphroditism and death (Mann & Bidwell 1999). The widespread use of pesticides in weed and mosquito control in coastal areas is another potential threat to wallum frog species (Meyer *et al*. 2006).

5.8 Pig Damage

Feral pigs, which are known to occur in wallum frog habitat, are a potential threat to wallum frog species. Feral pigs may destroy breeding habitat when foraging or using breeding sites as wallows, rendering them unsuitable for wallum frog species (NSW DEH 2003). The threat posed by pigs to native species has led to the listing of predation and habitat degradation by pigs as a key threatening process under the EPBC Act (Meyer *et al*. 2006).

Population decline at Broadwater West in NSW was noted during surveying between 1996-2000 by Lewis and Goldingay (2005). Searches of adjacent habitat revealed that WSF still occurred broadly throughout the site and the localised disappearance may have been due to habitat disturbance by feral pigs (Lewis & Goldingay 2005).

5.9 Exotic Disease

Chytrid fungus is a waterborne pathogen (*Batrachochytrium dendrobatidis*) that causes the disease Chytridiomycosis in frogs (Berger *et al*. 1998). The fungus invades the skin of amphibians, including tadpoles, often causing sporadic deaths with up to 100% mortality in some populations (NSW DECC 2008). The fungus is spread through waterborne zoospores that are release from infected frogs in water. Symptoms of frogs with chytrid infection include lethargy, skin discolouration and/or lesions, swollen hind limbs, very thin or emaciated, infected eyes and abnormal behaviour (e.g. frog sitting in the open during the day and little or no movement when touched) (NSW DECC 2008).

The introduction of Chytrid fungus to the site may have severe impacts on the WSF populations in the area.

5.10 Vehicular Traffic

In northern NSW, significant mortality of adult WSF is known to occur on busy roads bisecting wallum swamps (R. Goldingay, unpub. data). Increased visitation and traffic numbers to the site may increase the risk of roadkill, particularly in areas adjacent to identified WSF habitat. Thus, in some areas, vehicular traffic may pose a threat to populations of this species (Meyer *et al*. 2006). From survey work undertaken by Goldingay, it is estimated that 10,000 WSF are killed per annum on a 4 km section of the Coast Road near Lennox Head (Dorey 2009).

6 IMPACT ASSESSMENT

6.1 Introduction

The following sections discuss the impacts on the WSF and their habitat resulting from the Kings Forest development. These impacts can be described as either direct or indirect. Direct impacts are those which can be attributable to an action which will have an immediate effect on the WSF (e.g. removal of habitat or the death of a WSF during habitat removal or during operational works). Indirect impacts are those which do not affect the WSF immediately, but which can be linked to the development in a tangible sense and may interfere with the recovery of the local WSF population (e.g. an increased risk of disease or vehicle strike).

6.2 Direct Impacts

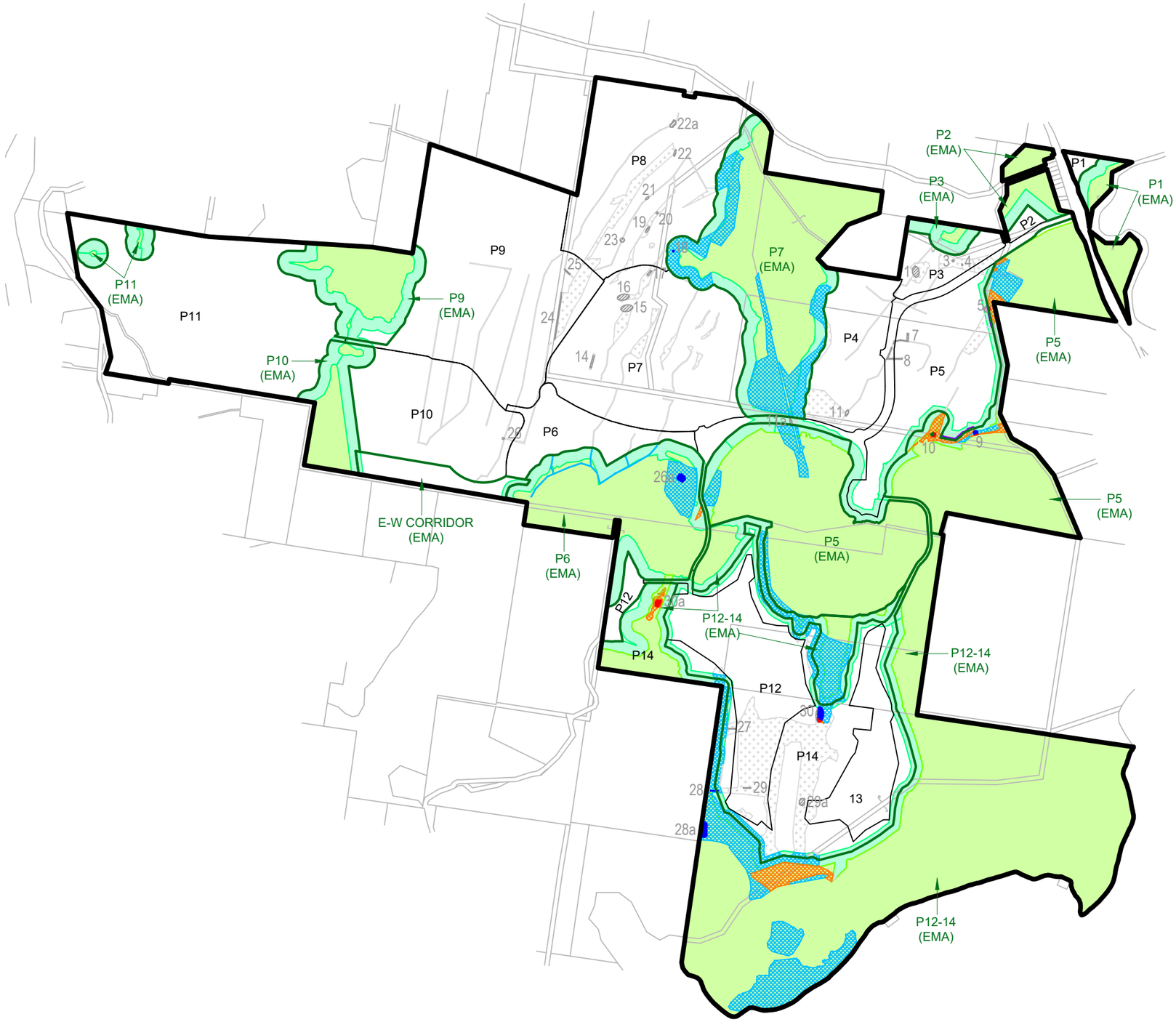
6.2.1 Habitat Loss

Existing WSF habitat on the Kings Forest site covers a total area of approximated 82.39 ha and is comprised of 1.50 ha of breeding habitat and 80.89 ha of foraging habitat (**FIGURE 12** and **TABLE 2**).

There will be a loss of 1.09 ha of breeding habitat and 36.01 ha of forage habitat as a result of the proposed development. Approximately 0.41 ha of existing WSF breeding habitat and 44.88 ha of existing WSF foraging habitat will be retained on the Kings Forest site. This equates to the retention of 27% and 55% of existing breeding and foraging habitat respectively. The extent of WSF habitat removal is depicted in **FIGURE 15** and detailed in **TABLE 2** below.

There is a risk of WSF mortality during the clearing of habitat and also during the construction stages of the development. This is, obviously, a short-term risk and is associated only with the land clearing activities and use of heavy vehicles/machinery during the bulk earthworks phase. The loss of habitat during construction works also has the potential to reduce the overall occupancy of WSF at the Kings Forest site.

The removal of WSF habitat will occur on a staged basis. It is intended to developed Precincts 1, 2, 5 and majority of Precinct 4 as Stage 1. The staging of development of remaining precincts will be then proceed in accordance with the approved Precinct Plan, however this may be subject change. Indicative stage and precinct specific WSF habitat impact calculations are provided in **TABLE 3**.



LEGEND

- Environmental Protection Zone (EPZ)
- 50m Buffer to EPZ
- Environmental Management Area (EMA) Boundary (#1)
- Precinct Boundary
- Kings Forest Boundary

WSF HABITAT THAT WILL BE REMOVED FOR DEVELOPMENT (32.65ha)

- WSF breeding habitat to be removed for development (0.97ha)
- WSF forage habitat to be removed for development (31.68ha)

WSF HABITAT THAT WILL BE POTENTIALLY REMOVED DUE TO INFRASTRUCTURE IN THE 20M OUTER BUFFER (0.14ha)

- WSF breeding habitat to be potentially removed due to infrastructure in the 20m outer buffer (0.01ha)
- WSF forage habitat to be potentially removed due to infrastructure in the 20m outer buffer (0.13ha)

WSF HABITAT THAT WILL LOSE HABITAT VALUE DUE TO GROUNDWATER CHANGES (4.19ha)

- WSF breeding habitat that will not maintain suitable groundwater conditions to support habitat post-development (0.10ha)
- WSF forage habitat that will not maintain suitable groundwater conditions to support habitat post-development (4.09ha)

WSF HABITAT THAT WILL BE POTENTIALLY LOST DUE TO UNCERTAINTY WITH GROUNDWATER MODEL ACCURACY [#2] (0.12ha)

- WSF breeding habitat to be potentially lost due to small size (0.01ha)
- WSF forage habitat to be potentially lost due to small size (0.11ha)

WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT (45.29ha)

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat post-development (0.41ha)
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat post-development (44.88ha)

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
Areas excluded based on groundwater model accuracy - defined as areas where total connected post-developed habitat (including compensatory habitat) is less than 400m².

SOURCE: JWA Site Investigations; BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater modelling

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FIGURE 15

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TITLE
WALLUM SEDGE FROG HABITAT TO BE LOST & RETAINED

TABLE 2
IMPACTS ON WSF HABITAT

Habitat Type	Existing Area	Area to be Removed/Impacted				Area Remaining After Development
		Area to be Removed for Development	Area that may be Removed within the 20 m Outer Buffer*	Area to be Impacted due to Groundwater Changes**	Area Impacted due to Size - Below 400 sqm	
Breeding habitat	1.50 ha	0.97 ha	0.01 ha	0.10 ha	0.01 ha	0.41 ha
Forage habitat	80.89 ha	31.68 ha	0.13 ha	4.09 ha	0.11 ha	44.88 ha
TOTAL	**82.39 ha**	**32.65 ha**	**0.14 ha**	**4.19 ha**	**0.12 ha**	**45.29 ha**

Notes:

* These areas may be impacted by construction of infrastructure (e.g. stormwater, pathways, etc.) within the outer 20 m buffer zone of Precinct 5 (additional to area to be removed for development).

** Although these calculations are related to indirect impacts, they have been included in this table for ease of reference and perspicuity. **SECTION 6.3.2** addresses indirect impacts on water table levels.

TABLE 3
PRECINCT SPECIFIC WSF HABITAT IMPACT CALCULATIONS

Precinct	Area to be Removed/Impacted								TOTAL	
	Area to be Removed for Development		Area that may be Removed within the 20 m Outer Buffer*		Area to be Impacted due to Groundwater Changes**		Area Impacted due to Size - Below 400 sqm			
	Breeding Habitat	Forage Habitat	Breeding Habitat	Forage Habitat	Breeding Habitat	Forage Habitat	Breeding Habitat	Forage Habitat	Breeding Habitat	Forage Habitat
Precinct 1	-	-	-	-	-	-	-	-	-	-
Precinct 2	-	-	-	-	-	-	-	-	-	-
Precinct 3	0.13 ha	1.43 ha	-	-	-	-	-	-	-	-
Precinct 4	0.03 ha	2.47 ha	-	-	-	-	-	-	-	-
Precinct 5	0.12 ha	1.98 ha	0.01 ha	0.13 ha	0.03 ha	1.47 ha	0.01 ha	0.04 ha	0.03 ha	4.54 ha
Precinct 6	0.02 ha	0.20 ha	-	-	-	0.07 ha	-	-	0.09 ha	2.90 ha
Precinct 7	0.29 ha	2.68 ha	-	-	-	-	-	-	-	12.82 ha
Precinct 8	0.15 ha	3.76 ha	-	-	-	-	-	-	-	-
Precinct 9	0.10 ha	2.79 ha	-	-	-	-	-	-	-	-
Precinct 10	0.01 ha	0.50 ha	-	-	-	-	-	-	-	-
Precinct 11	-	-	-	-	-	-	-	-	-	-
Precincts 12-14	0.12 ha	15.88 ha	-	-	0.07 ha	2.54 ha	-	0.07 ha	0.29 ha	24.62 ha
TOTAL	**0.97 ha**	**31.68 ha**	**0.01 ha**	**0.13 ha**	**0.10 ha**	**4.09 ha**	**0.01 ha**	**0.11 ha**	**0.41 ha**	**44.88 ha**

Notes:

* These areas may be impacted by construction of infrastructure (e.g. stormwater, pathways, etc.) within the outer 20 m buffer zone of Precinct 5 (additional to area to be removed for development).

** Although these calculations are related to indirect impacts, they have been included in this table for ease of reference and perspicuity. **SECTION 6.3.2** addresses indirect impacts on water table levels.

6.3 Indirect Impacts

6.3.1 Introduction

Indirect impacts may potentially result from the initial habitat removal, construction activities and resultant fragmentation. These indirect impacts can be linked to the:

- Alteration to water table levels surrounding the development area (DoE 2015);
- Increased risk of vehicle strike as there is a large increase in vehicle numbers after development (DoE 2015);
- Increased risk of fire due to vandalism (DoE 2015);
- Increased risk of retained habitat degradation (DoE 2015) i.e. edge effects;
- Detrimental changes to drainage patterns in known or potential habitats;
- Altered water quality i.e. elevated pH, nutrient levels and turbidity;
- Creation of habitat for pest species such as Mosquito fish and Cane toads;
- Creation of a barrier to movement to, between or within habitat critical to the survival of the WSF that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the WSF (DoE 2015); and
- Facilitation of the introduction or spread of disease or pathogens for example Chytrid fungus, to habitat critical to the survival of the WSF, that are likely to significantly reduce the reproductive output of WSFs (DoE 2015).

Indirect impacts that may potentially occur as a result of the loss of habitat, fragmentation of habitat, alterations to site hydrology and subsequent residential development are discussed in the following sections.

6.3.2 Alteration to Water Table Levels

The proposed development will result in changes to site hydrology which has the potential to degrade WSF habitat to the extent that the carrying capacity of the habitat is reduced in the long-term. Areas of existing WSF habitat that are expected to be lost due to groundwater changes have been quantified (**FIGURE 15** and **TABLE 3**).

Project 28 have completed an extensive assessment of groundwater conditions on and adjacent to the Kings Forest site (G&S 2013, 2014 and 2015). The collection of groundwater data and input into groundwater models was considered the most efficient and accurate method to determine impacts of filling and/or excavation on groundwater levels. The results of this modelling and the resultant predictions of impacts on groundwater levels surrounding the development allowed an analysis of the future plant/soil moisture environmental conditions. Alteration to water table levels has been considered in the preparation of the WSF compensatory (offset) habitat proposal (**SECTION 7.8**).

Appropriate monitoring and maintenance arrangements will be put in place so that mitigation measures are effective for the life of the impacts. Evaluating the mitigation

measures over time may also allow for better and more cost-effective mitigation measures to be pursued in the future.

6.3.3 Increased Risk of Vehicle Strike

The proposed development may result in an increase in WSF fatalities due to vehicle-strikes and there is potential for multiple, ongoing mortalities, particularly in areas where roadways are constructed adjacent to identified WSF habitat.

6.3.4 Increased Risk of Fire

The proposed development may potentially result in an increased risk of wildfires which could significantly affect frog numbers through direct mortality or loss of vegetation, the loss of cover exposing frogs to predators, extremes of temperature and dehydration.

6.3.5 Habitat Degradation and Edge Effects (Weeds, Noise and Light)

The proposed development will result in the loss of WSF habitat as detailed in **SECTION 6.2** and shown in **FIGURE 15**. Newly created and existing habitat edges will be subjected to the influence of weed incursion, noise and light as the construction proceeds. These impacts may also continue to operate/occur in the long term during the operational phase of the development.

A wide variety of weed species have been recorded on the Kings Forest site including highly invasive species such as Lantana (*Lantana camara*), Slash pine (*Pinus elliottii*), Groundsel (*Baccharis halimifolia*), Broad–leaved paspalum (*Paspalum wettsteinii*), Winter senna (*Senna coluteoides*), Blue billygoat weed (*Ageratum houstonianum*), Devil's fig (*Solanum torvum*) and Bitou Bush (*Chrysanthemoides monilifera*). Occupation of the site has the potential to contribute to the spread of these existing weeds and the introduction of additional weed species (e.g. through garden escapes and the dumping of garden waste).

There is little information available on the effects of noise on animals, however, the information available suggests that long term exposure to noise may have an effect on the behaviour and possibly even the habitat of some wildlife. In Australia there are no noise studies presently available that deal with noise impacts on native species for long term exposure. Studies of potential impacts from military noise (USACERL 1996) indicate that military and civilian blast noise had no unusual effects beyond those encountered as the result of other human generated noise. After construction work has ceased the ongoing residential noise will be relatively low.

The development has the potential to increase the level of artificial light in the nearby habitats. Increased night light levels may adversely impact wildlife by direct glare, chronic or periodic increased illumination and temporary unexpected fluctuations in light levels (Saleh 2007, Longcore and Rich 2010). WSF are most active at night in terms of foraging and social behaviour. The construction activities will provide very little light spill into nearby WSF habitats. It is highly unlikely that there will be any construction work at night. There may be lighting in some areas as security for vehicle compounds. Some light spill into nearby habitats at night may occur during the occupational phase of the development.

6.3.6 Detrimental Changes to Drainage Patterns in Known or Potential Habitats

Areas of WSF habitat occurring on the Kings Forest site are likely to be reliant on groundwater particularly during drought periods. At some locations these habitat areas are in part supported by shallow, groundwater systems that effectively arrest the infiltration of surface waters. These systems are thus surface water reliant with the shallow groundwater acting as a local storage that reduces effective evaporation and sustains suitable habitat for WSF. Elsewhere groundwater is sourced from further afield and is brought to the surface due to impediment to flow or via a topographic low.

Construction activities within and adjacent to WSF habitat areas could potentially impact on existing drainage patters by blocking subsurface flows, drainage passages and groundwater flows. Changes in hydraulic flow as a result of culverts and bridges (such as flow velocities and levels) may also result in barriers to WSF movements and changes to aquatic habitat including a gradual decrease in water depth and increased sediment and turbidity leading to change in the suitability of the habitat.

6.3.7 Altered Water Quality

The construction and operation phases of the development have the potential to impact on water quality. Potential impacts on water quality during the construction phase may include:

- Increased turbidity and nutrients in waterway as a result of sediments from earthworks stockpiles being washed into waterways.
- Stockpiles of vegetation from cutting of trees and shrubs may result in tannins leaching into the waterways and increased organics. This can increase stream Biological Oxygen Demand (BOD) and decrease dissolved oxygen which can affect aquatic life.
- Construction of the project will require significant areas of cut and fill which result in batter areas that can potentially lead to sedimentation, contamination and nitrification of waterways and wetlands.
- Nutrients or contaminants present in undisturbed sediments could be released through earthworks or surface run-off. High nutrient levels could lead to potentially toxic algal blooms resulting in negative impacts to aquatic fauna.
- Acid sulfate soils are known to occur within the region, and once disturbed, have the potential to enter water bodies, resulting in habitat degradation, fish disease or kills, losses in food resources, lowered potential for fish migration and recruitment, disturbance to water plant communities and secondary effects on water quality.

Increased pollutant load in road runoff is the main potential impact to water quality associated with the operational phase of the project. Pollutants in road runoff include nutrients, heavy metals, pesticides, herbicides and hydrocarbons which can impact negatively on the aquatic environment. Additional potential impacts on water quality during the operational phase may include:

- Increased sedimentation can reduce the availability of water refuge areas for aquatic biota and smother important habitat features such as beds of aquatic macrophytes and the substrate itself; and
- Increased turbidity can also result in a reduction of light penetration and in turn reduce the number of aquatic macrophytes or algae, altering the existing aquatic habitat.

6.3.8 Creation of Habitat for Pest Species

Potential changes to water quality, aquatic habitat and natural flow regimes due to the development may favour aquatic pest species, which can then predate on WSF such as Mosquito fish (*Gambusia holbrooki*). This fish species is a significant predator on native fish and tadpoles. The species proliferate in disturbed aquatic habitats and can out-compete and predate upon native species less tolerant of disturbed environments and poor water quality.

6.3.9 Barriers to Movement or Dispersal

The proposed development will create a barrier to the movements of some native fauna species. Obviously, highly mobile species (e.g. birds and bats) will be less affected by this barrier. However, less mobile species such as the WSF will be affected to some degree through the restriction of movements to, between or within habitat, that may be critical to the survival of the WSF.

Fragmentation of habitat has the potential to reduce the likelihood of re-colonisation of habitat areas following localised extinction of sub-populations after severe habitat disturbance (e.g. fire, drought). Impediments to WSF dispersal between populations or sub-populations may also lead to genetic deficiencies (e.g. inbreeding, genetic drift) (Meyer *et al*. 2006), which could compromise the long-term viability of the local population.

6.3.10 Facilitating the Introduction or Spread of Disease

The proposed development has the potential to facilitate the introduction or spread of disease or pathogens (e.g. Chytrid fungus) to WSF habitat. This has the potential to significantly reduce the reproductive output of the local population of WSF.

7 PROPOSED MANAGEMENT ACTIONS

7.1 Introduction

The WSF will be protected during the pre-construction, construction (including all clearing activities, bulk earthworks, road construction and building) and operational phases of the development. Management actions to be implemented as part of this WSFMP are discussed in **SECTIONS 7.2 – 7.14** and include:

- Construction phase management measures, including:
  - Education of site personnel;
  - Vegetation management protocols;
  - Pre-clearing WSF surveys and fauna spotter catcher;
  - Restrictions to be placed on construction vehicles;
  - Fauna incident reporting protocols.
- Erosion and sediment control measures;
- Stormwater management;
- Avoidance and management of acid sulphate soils;
- Exclusion fencing, fauna underpasses, road crossings and other infrastructure;
- Management of retained WSF habitat;
- Compensatory WSF habitat;
- Improving habitat connectivity and linkage corridors;
- Disease management;
- Controlling pest species (i.e. Mosquito fish and Cane toad occurrence);
- Transfer of land to public ownership;
- Fire management;
- Engaging with the relevant Local Government, NPWS and community groups; and
- Raising community awareness.

7.2 Construction Phase Management Measures

7.2.1 Education of Site Personnel

An induction program will be developed by the Proponent to highlight the potential presence of the WSF on the site. The induction program is to be approved by a suitably qualified person prior to construction commencing and all construction personnel, and any other persons/contractors completing works within or adjacent to WSF habitat need to complete the induction prior to commencing work on the site.

The general induction of all construction personnel will aim to ensure contractors are aware of WSF related issues and of responsibilities and procedures in relation thereto. The induction program will cover such matters as:

- Identification of WSF and their habitat;
- Areas of the site in which WSF are most likely to be encountered;
- Threats to WSF associated with construction activities;
- Site hygiene management for the control of disease in frogs;
- Management actions required during construction work to protect WSF and their habitat; and
- Requirements of the Kings Forest Vegetation Management Plans (VMP) (JWA 2020a, b and c), particularly protocols for vegetation clearing and measures to protect native vegetation.

Specific detail in relation to education protocols will be provided in the Kings Forest Stage 1 Construction and Environment Management Plan (CEMP).

7.2.2 Vegetation Management Protocols

Vegetation management protocols have been prepared in the Kings Forest precinct specific Vegetation Management Plans (JWA 2020a, b and c).

All areas to be cleared and retained will be identified on construction plans and in the field prior to the commencement of clearing. No clearing shall occur outside nominated clearing zones.

7.2.3 Pre-clearing WSF Surveys and Fauna Spotter Catcher

7.2.3.1 Provision of Spotter Catcher

A suitably qualified fauna spotter catcher will be appointed to conduct a pre-clearing site inspection and is to be present during clearing. The spotter catcher is also to direct the civil works contractor in relation to any fauna issues. The contractor will provide access to equipment that may be required by the spotter-catcher (e.g. cherry picker, chainsaw) as well as qualified operators.

7.2.3.2 Pre-clearing WSF Surveys

Prior to the commencement of construction associated with each precinct, pre-clearance surveys for WSF within and adjacent to areas of WSF habitat to be removed will be completed by a suitably qualified ecologist/fauna spotter catcher. Pre-clearing surveys will commence no more than one (1) day prior to the commencement of bulk earth moving activities within each precinct.

The following actions will be completed as part of the pre-clearance surveys:

- Targeted active searches of potential WSF habitat. Habitat resources typically associated with the lifecycle components of the WSF (e.g. ponded areas and sedges forming vegetation cover) will be searched during a diurnal visual inspection. Following the diurnal habitat searches, a nocturnal habitat search may be completed to assess nocturnal usage (i.e. breeding/calling) in the habitat area using the following methods:
  - Searching of habitat features which were searched during the day;
  - Spotlighting; and/or
  - Call play-back.
- Record the size of the area of WSF habitat to be removed by the proposed action; and
- Relocate any WSF found within habitat to be removed to suitable retained habitat.

A report will be prepared after each pre-clearing event and prior to the commencement of bulk earthworks. Reports will be included in the Annual Wallum Sedge Frog Monitoring Report (**SECTION 8.7.2**) and forwarded to all relevant agencies including TSC.

7.2.3.3 Procedure for WSF Located During Construction Phase

In the event that a frog is observed within the disturbance areas of the subject site either during or outside of the pre-clearance surveys and is thought to be a WSF, the following procedure will be initiated prior to the commencement of construction in that area:

1. If the observer is not the Site Ecologist, they will notify the Site Ecologist of the frog's location;
2. The Site Ecologist will capture the frog;
3. If the frog appears to be healthy, a release location will be determined by the Site Ecologist (i.e. within suitable habitat to be retained on the subject site). The frog will be released into the relocation area in accordance with the procedures outlined in the Threatened Species Management Information Circular No. 6 Hygiene Protocol for the Control of Disease in Frogs (NSW DECC 2008). Any frog to be relocated will be held in a cool, dark, moist place until nightfall. Where practicable, relocation will be timed to coincide with periods of recent rainfall to optimise the frog's chance of survival.
4. If the frog does not appear to be healthy, the protocols discussed in **SECTION 7.10.2** will be implemented.

7.2.3.4 WSF Relocation Record Keeping

Details of WSF relocations completed during pre-clearance surveys and general construction works will be recorded and reported. For each WSF located within the disturbance area the following details will be recorded:

- The location where the frog was found;

- The health of the frog;
- The action taken (i.e. relocated or removed from site);
- If the frog was relocated, the location where the frog was released; and
- The lifecycle stage and sex of individuals if possible.

7.2.4 Restrictions to be Placed on Construction Vehicles

Vehicles shall be restricted to a maximum speed of 50 kph and shall operate only in daylight hours for the duration of the construction phase. Where roads traverse the environmental protection areas vehicles shall be restricted to a maximum speed of 40 kph to minimise the risk of vehicle strike.

7.2.5 Fauna Incident Reporting

Any WSF observation or incident during the construction phase should result in an observation/incident report. In accordance with Project Approval (MP08_0194) Condition 76 the report should contain as a minimum, the date, time and location (grid references) and nature of the incident. Where appropriate, cause (or likely cause) of the incident, general condition of the animal (evidence of disease, weight, etc.) should be collected as discussed in **SECTION 7.2.3.4.** The report should also describe what action has been taken to date, and any proposed measures to address the incident. This information will be forwarded to OEH and/or TSC. All fauna incident reports will be included in the annual reporting on the WSFMP.

7.3 Erosion and Sediment Control Measures

Erosion and sediment control measures will be implemented during the construction phase of the development in accordance with the Erosion and Sediment Control Plan (G&S 2020d). Erosion and sediment control measures will be installed prior to disturbance and maintained until such time as the disturbed areas are stabilised by revegetation upon completion of the earthworks. Runoff and erosion controls will include:

- Diversion of upslope runoff around cleared and/or disturbed areas in a way that minimises erosion, minimises the upslope catchment and diverts waters to a legal point of discharge;
- Sediment control fences or other measures shall be installed at the downslope perimeter of cleared and/or disturbed areas; and
- Maintenance of all erosion control measures at operational capacity until land is effectively rehabilitated.

The above measures will ensure that retained areas of WSF habitat are not degraded due to the erosion and sedimentation of waterbodies.

7.4 Stormwater Management

Stormwater shall be managed during the construction phase of the development in accordance with the Overall Water Management Plan (OWMP) (G&S 2020b) and the Stormwater Management Plan (SMP) (G&S 2020c).

Surface water controls (i.e. sediment detention basins and clean water diversion channels) will be constructed prior to commencement of bulk earthworks. Bio-retention swales will be utilised in accordance with the OWMP and SMP to ensure stormwater is separated from WSF habitat. All stormwater infrastructure will be located offline from any WSF breeding habitat. Culverts and structures allowing the passage of clean water from the upper catchment areas during the construction phase will remain in place throughout the maintenance period of the operational phase, minimising the volume of water traversing exposed areas of the site. Regular maintenance of all stormwater control structures will be carried out to:

- Ensure the structural integrity of the treatment measures;
- Ensure inlets and outlets are not blocked; and
- Ensure that sediment, debris and litter accumulation does not impair operational efficiency.

These measures will ensure that retained areas of WSF habitat are not degraded as a result of altered hydrology or potential decline in water quality (i.e. from chemical or nutrient-laden run-off from urban areas or golf course area).

7.5 Avoidance and Management of Acid Sulfate Soils

A detailed Acid Sulfate Soils Management Plan (ASSMP) (G&S 2012) has been prepared for the subject site in accordance with the Acid Sulfate Soil Assessment Guidelines (Stone *et al*. 1998). The ASSMP provides details of appropriate acid sulfate soil management, with consideration of WSF and their habitats on and adjacent to the subject site. Where soil testing prior to the commencement of construction identifies the presence of acid sulfate soils, adherence to the ASSMP shall be applied in accordance with the Acid Sulfate Soil Assessment Guidelines (Stone *et al*. 1998).

7.6 Exclusion Fencing, Fauna Underpasses and Other Infrastructure

7.6.1 Introduction

The Kings Forest development proposal adopts an ‘exclusion’ approach utilising exclusion fencing, grids and underpasses where appropriate to effectively separate fauna and their habitats from the development and its related threats, whilst maintaining and enhancing existing habitat linkages. By preventing fauna from entering residential areas, exclusion fencing, and associated structures are also likely to prohibit fauna from dog and road related injury or death. Exclusion fencing is also a highly effective measure of reducing impacts on retained habitat. Temporary fencing around important fauna habitats (exclusion zones) has been used by the Roads and Maritime Service (RMS) on multiple highway upgrades including the Pacific Highway and Hume Highway for the past 20 years. It has become a standard procedure as part of the Construction Environment Management Plan (CEMP) and is

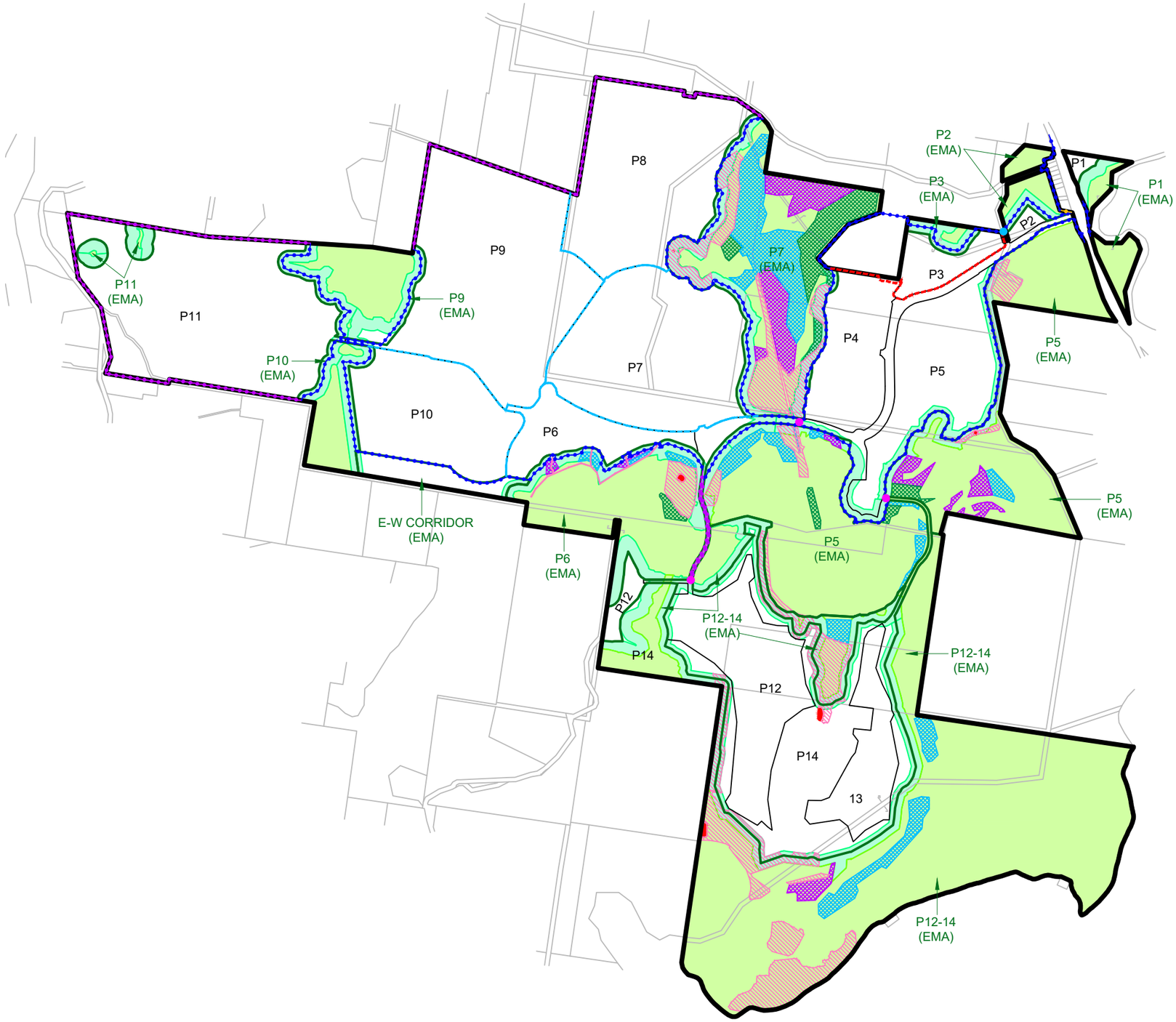
inspected during construction. When combined with standard training of contractors it has become a highly effective measure at avoiding impacts to important habitats adjacent to construction areas (NSW RMS 2016).

All infrastructure designed to mitigate impacts on WSF will be in place prior to the commencement of construction in each relevant Precinct. Fauna underpasses will be constructed as part of road construction.

7.6.2 Fauna Exclusion Fencing

Exclusion fencing will be utilised where necessary to effectively separate fauna and their habitat from the development and its related threats. Exclusion fencing will consist of both temporary fencing during construction and permanent fencing during the operational phase. Temporary fencing will be utilised during the construction phase of the development to exclude fauna from work areas. Permanent exclusion fencing will be constructed at the end of the construction phase of the development of each applicable Precinct (refer **SECTION 9**). In some areas temporary fencing will not be required as permanent fencing will be installed prior to commencement of construction activities on site (refer **SECTION 9**). All exclusion fencing will be in place prior to the commencement of construction in each relevant Precinct. Temporary fencing will only be removed once fencing in the adjacent precinct is erected.

Temporary fencing will be comprised of 1.5 m high wire mesh held upright by star pickets (**PLATE 1**). In addition, sediment fencing will be fixed to temporary fencing to prevent frog access during construction works. Temporary fencing within Stage 1 (Precincts 1, 2, Part of 4 and 5) will be located in accordance with **FIGURE 16**. The locations of temporary fencing in all other precincts will be determined at the detailed design stage for each precinct and will be addressed in revised versions of the WSFMP (in accordance with Conditions B1 and C2 of the Concept Plan Approval 06_0318, MOD 6). Indicative locations for temporary fencing in Precincts 6-11 is shown in **FIGURE 16**.



LEGEND

- Environmental Protection Zone (EPZ)
- 50m Buffer to EPZ
- Environmental Management Area (EMA) Boundary (#1)
- Precinct Boundary
- Kings Forest Boundary

PROPOSED FENCING PLAN (#2)

- Permanent exclusion fence
- Acoustic fence with anit-climb panneling
- Temporary exclusion fence during Stage 1
- Temporary exclusion fencing to be replaced with permanent exclusion fencing at the end of the construction phase of the Precinct
- Indicative location of temporary exclusion fencing between Precincts to be removed once fencing in adjacent precinct is installed
- Permanent grid
- Temporary grid

EXISTING WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT (45.29ha)

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat after development (0.41ha)
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat after development (44.88ha)

WSF COMPENSATORY HABITAT (47.36ha)

- Compensatory WSF breeding habitat (9.76ha)
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat (24.26ha)
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat (13.34ha)
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
The locations of temporary fencing between precincts and any additional temporary fencing will be determined at the detailed design stage for each precinct and will be addressed in a revised version of the WSFMP.

The locations of permanent fencing within Precincts 12-14 will be determined at the detailed design stage and will be addressed in revised versions of the WSFMP.

0 500m
1 : 20 000

SOURCE: JWA Site Investigations; BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling; JWA KPOM (2020)
SCALE: 1 : 20 000 @ A3

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FIGURE 16

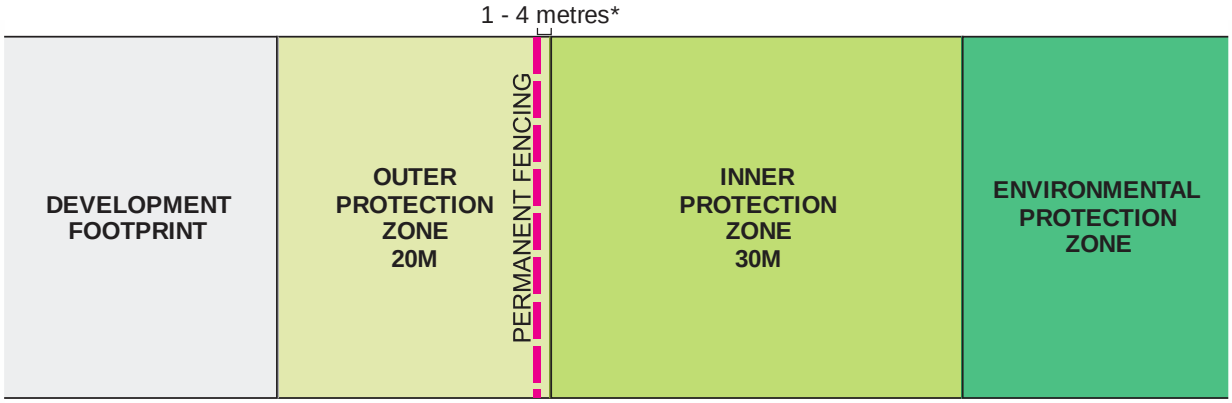
PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP.dwg

TITLE
PERMANENT & TEMPORARY EXCLUSION FENCING & GRIDS



PLATE 1 – EXAMPLE OF TEMPORARY FENCING

Permanent fencing will be located along the edges of environmental protection zones and on both sides of all roads in environmental protection zones. Where the permanent fencing occurs in buffer zones, the fencing will be located within the 20 m Outer Protection Zone, generally 1 – 4 m to the development side of the boundary between the 30 m Inner Protection Zone and 20 m Outer Protection Zone (dependant on the final design of bio-swales etc.). **PLATE 2** provides a visual guide to the location of permanent fencing.



* Note: Final location of fence subject to detailed design of bio-swales, access and bushfire considerations.

PLATE 2 – INDICATIVE FENCING LOCATION GUIDE

The locations of permanent fencing within Precincts 1-11 are shown in **FIGURE 16**. The locations of permanent fencing within Precincts 12-14 will be determined at the detailed design stage and will be addressed in revised versions of the WSFMP (in accordance with Conditions B1 and C2 of the Concept Plan Approval 06_0318, MOD 6).

The design of the permanent fauna exclusion fencing to be utilised over the entire Kings Forest site is shown in **FIGURE 17**. Permanent fauna exclusion fencing will incorporate at ground level a 600 mm high scratch panel (sheet metal) and galvanised steel overhang to impede climbing by WSF. It is considered that this design will provide a suitable barrier to deter frog movement through the fence and into road corridors/development areas and act to funnel WSF to underpasses. This design feature, in association with strategic placement of created WSF habitat at underpass entrances (refer **SECTION 7.8**), will assist WSF movements between areas of existing and created habitats and reduce the likelihood of vehicle related mortality.

Where the length of fencing (permanent or temporary) in buffer zones is greater than 100 m, a gate will be provided to allow access for routine rehabilitation work and monitoring. Given the number of gates that may be provided on the entire site, no locks on the gates will be required for the duration of the site development. Secure fastening structures must, however, be provided for each gate. At the completion of the monitoring program locks will be provided to all gates. Keys will be held by TSC and NPWS where appropriate. Locked gates may be opened in the event of bushfire to allow fauna to escape.

7.6.3 Fauna Underpasses

7.6.3.1 Background

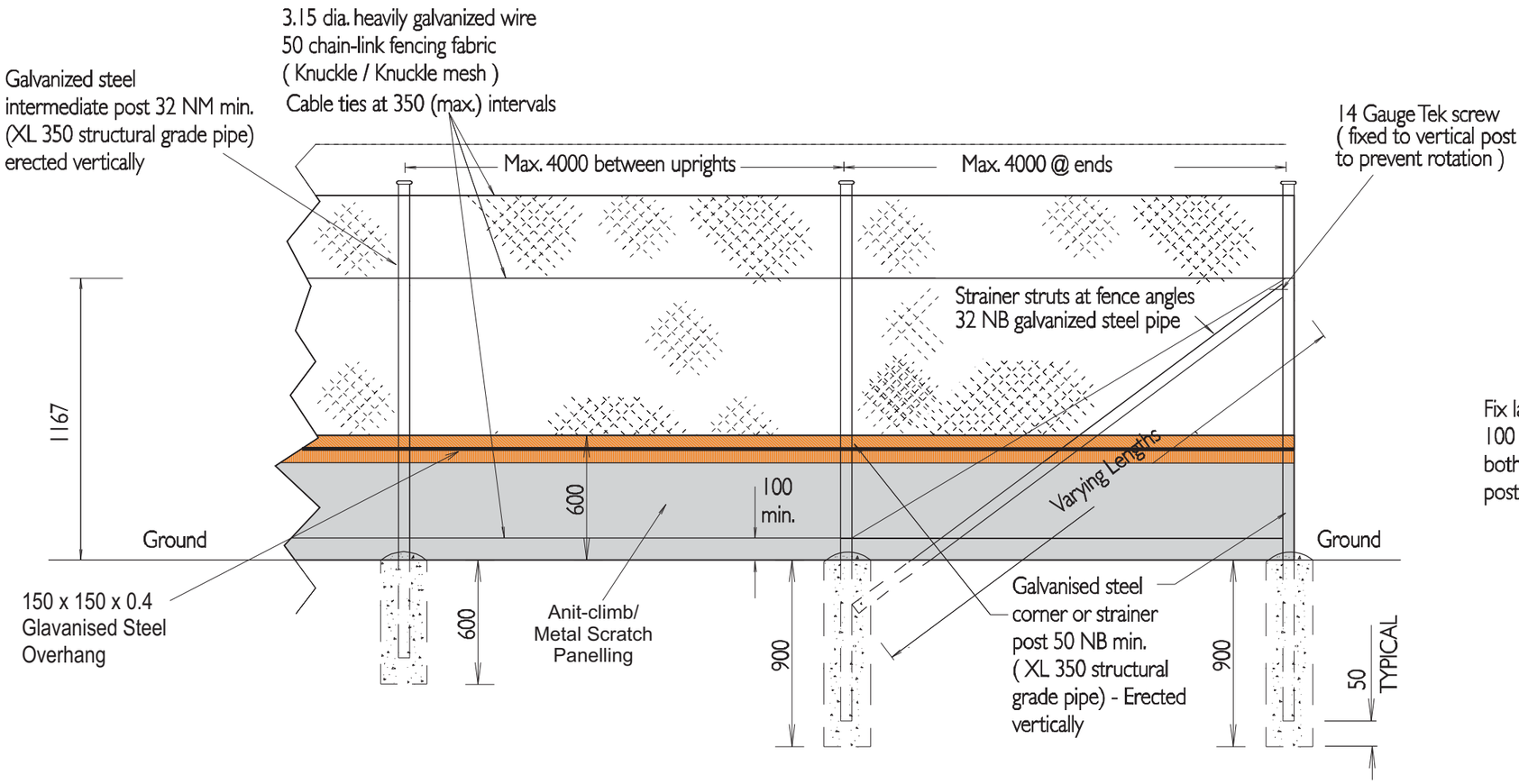
Fauna underpasses will be installed at strategic locations throughout the development to allow for the continued movement/dispersal of native terrestrial fauna species. Nine (9) locations along the main Kings Forest road network have been identified as sites for underpasses (**FIGURE 18A**). An additional underpass (shown as number 10 in **FIGURE 18A**) will be constructed under the Tweed Coast Road approximately 75 m south of the Depot Road/Tweed Coast Road intersection. All underpasses locations will be subject to detail design at the relevant stages of development.

7.6.3.2 Fauna Underpasses On-site

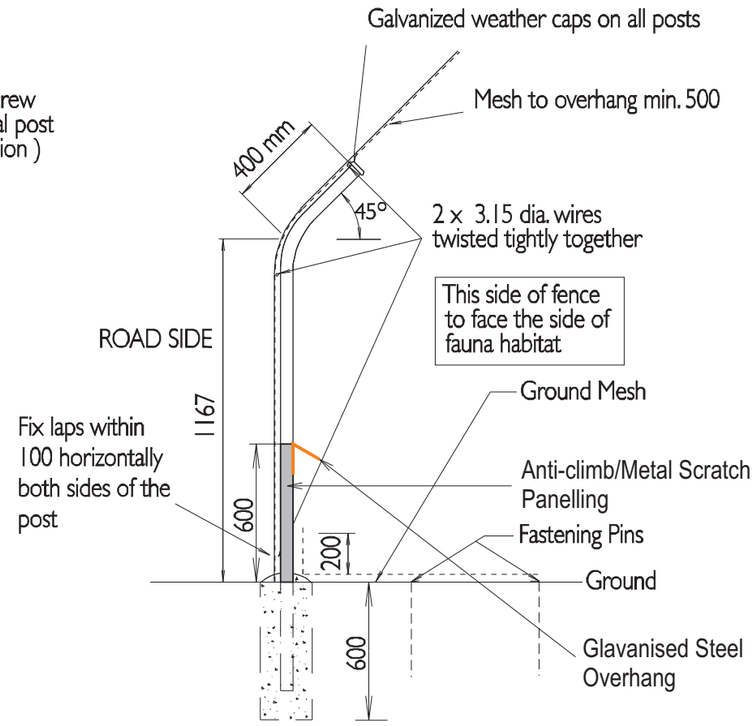
FIGURE 18B - 18C show indicative design of all culvert and fauna underpass locations occurring on the Kings Forest site. Underpasses 4, 5 and 9 in particular will be important for maintaining connectivity between existing and created WSF habitat. All on-site underpasses will be installed during road construction in each relevant Precinct.

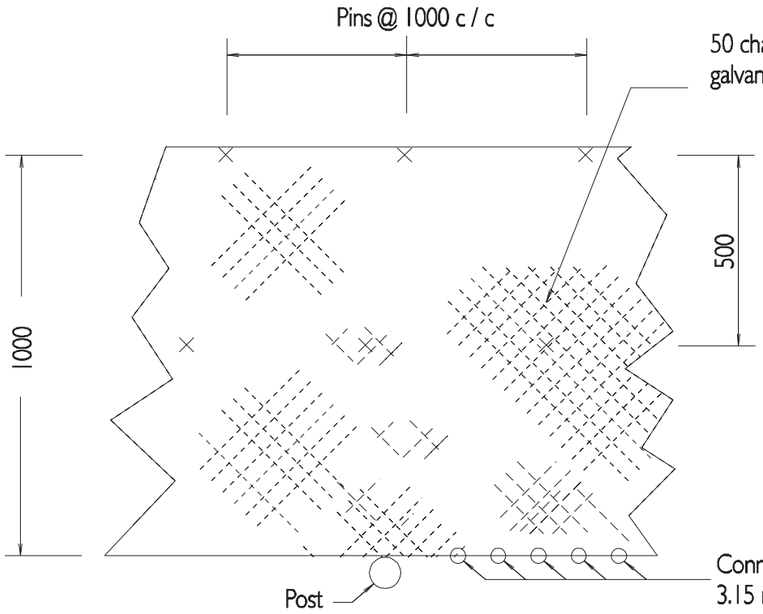
Exclusion fencing will be configured so as to funnel WSF and other fauna to underpasses for facilitated movement between protection areas (**FIGURE 19).** All culvert/fauna underpass design will be subject to detailed design but will generally be constructed in accordance with the following design features:

- Underpasses will be 1.8 m high x 2.4 m wide reinforced concrete box culverts.



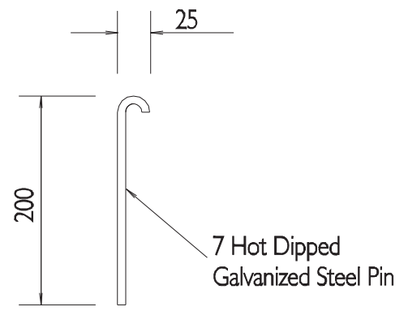
ELEVATION





GROUND MESH FIXING DETAIL

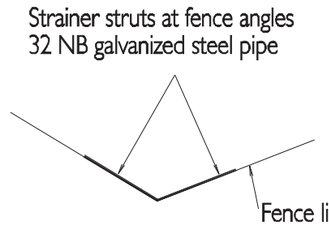
Special requirements may apply to the erection procedures for fences installed near high voltage transmission lines. The relevant Electricity Authority should be contacted prior to the installation of the fence.



NOTE

For loose or sandy soils
350 (min.) galvanised
fastening pins must be used

FASTENING PIN DETAIL



PLAN OF FENCE ANGLE

NOTE

Min internal angle 135°

All dimensions are in millimetres unless otherwise shown.

SOURCE: NSW RTA Design Ref Documents - Koala Exclusion Fence; NSW RMS Woolgoolga to Ballina Pacific Hwy Upgrade Threatened Frog Mgt Plan Plate5-1

SCALE: Not to Scale

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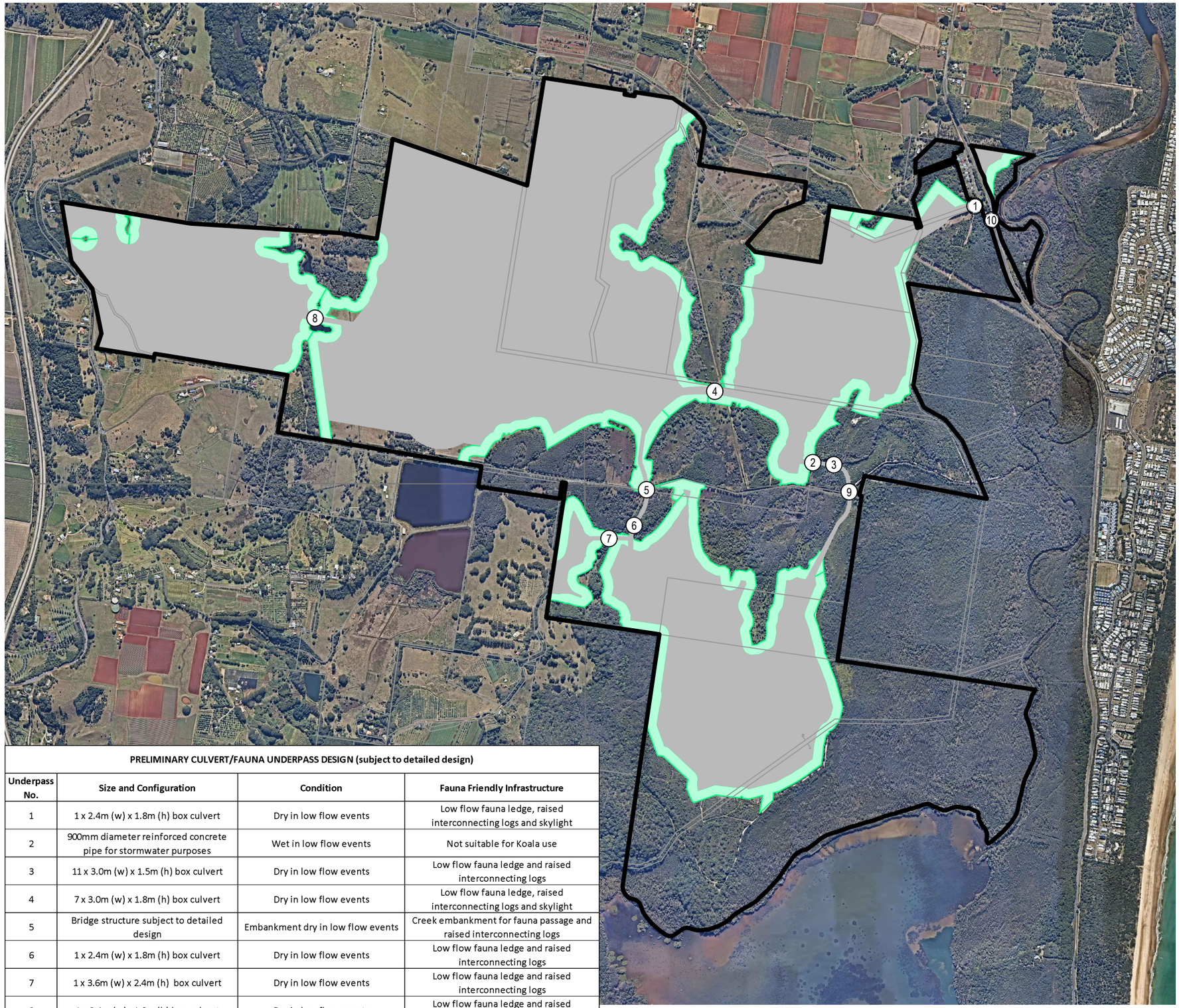
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FIGURE 17

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Design Fencing.cdr

TITLE

PERMANENT EXCLUSION FENCING DESIGN



N

LEGEND

- (#) Indicative underpass location
- Development Footprint
- 50m Buffer to EPZ (only the inner 30 metres to be utilised for offsetting and dedication purposes)
- Kings Forest Boundary

PRELIMINARY CULVERT/FAUNA UNDERPASS DESIGN (subject to detailed design)

Underpass No.	Size and Configuration	Condition	Fauna Friendly Infrastructure
1	1 x 2.4m (w) x 1.8m (h) box culvert	Dry in low flow events	Low flow fauna ledge, raised interconnecting logs and skylight
2	900mm diameter reinforced concrete pipe for stormwater purposes	Wet in low flow events	Not suitable for Koala use
3	11 x 3.0m (w) x 1.5m (h) box culvert	Dry in low flow events	Low flow fauna ledge and raised interconnecting logs
4	7 x 3.0m (w) x 1.8m (h) box culvert	Dry in low flow events	Low flow fauna ledge, raised interconnecting logs and skylight
5	Bridge structure subject to detailed design	Embankment dry in low flow events	Creek embankment for fauna passage and raised interconnecting logs
6	1 x 2.4m (w) x 1.8m (h) box culvert	Dry in low flow events	Low flow fauna ledge and raised interconnecting logs
7	1 x 3.6m (w) x 2.4m (h) box culvert	Dry in low flow events	Low flow fauna ledge and raised interconnecting logs
8	1 x 2.4m (w)x 1.8m (h) box culvert	Dry in low flow events	Low flow fauna ledge and raised interconnecting logs
9	1 x 2.4m (w)x 1.8m (h) double span 40m bridge structure	Embankment dry in low flow events	Creek embankment for fauna passage and raised interconnecting logs
10	1 x 2.4m (w) x 1.2m (h) box culvert	Dry in low flow events	Low flow fauna ledge and skylight

0 500m
1 : 20 000

SOURCE: MUS (Ref: SMUS17101715300.pdf) Near Map 08/08/18 Aerial

SCALE: 1 : 20 000 @ A3

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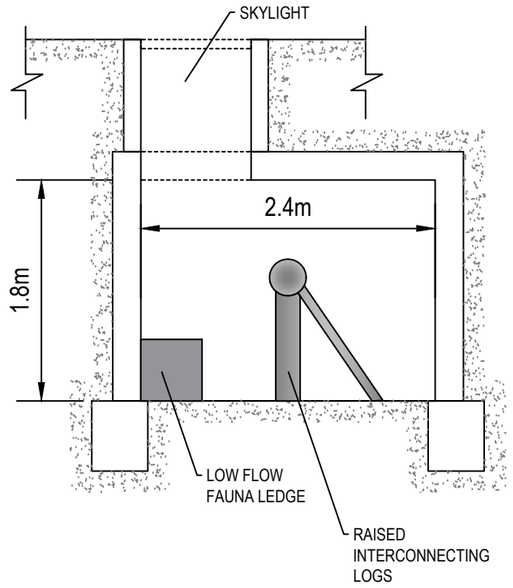
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FIGURE 18A

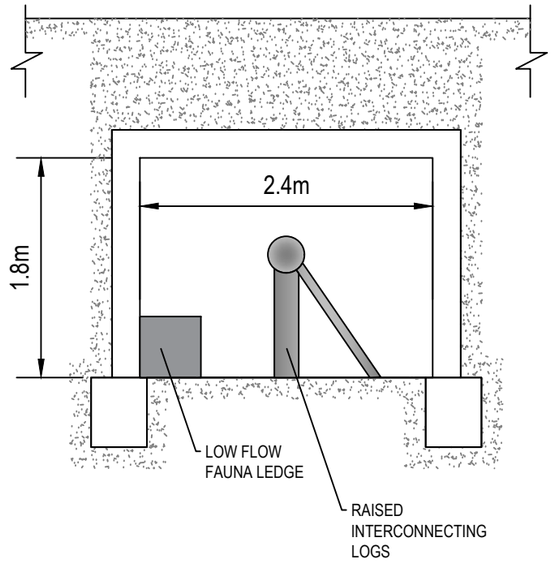
PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Underpasses.dwg

TITLE
INDICATIVE FAUNA UNDERPASS LOCATIONS

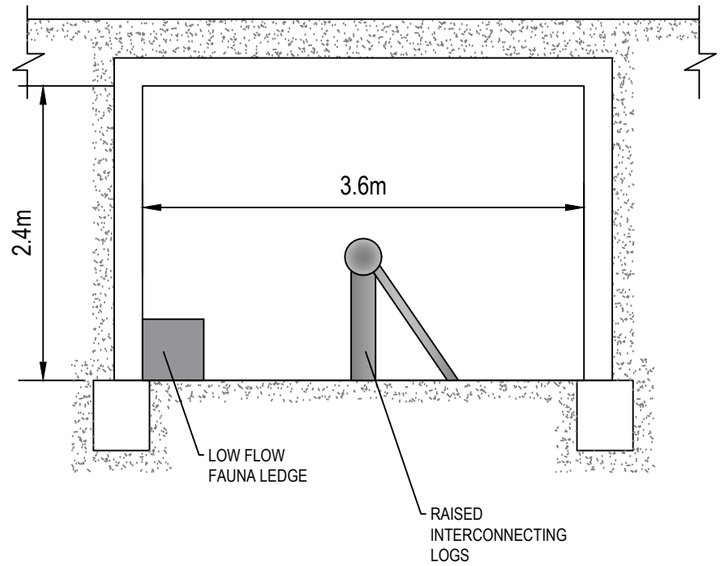
UNDERPASS 1
2.4M x 1.8M RCBC CULVERT WITH SKYLIGHT &
FAUNA FRIENDLY INFRASTRUCTURE



UNDERPASS 6 & 8
2.4M x 1.8M RCBC CULVERT WITH
FAUNA FRIENDLY INFRASTRUCTURE

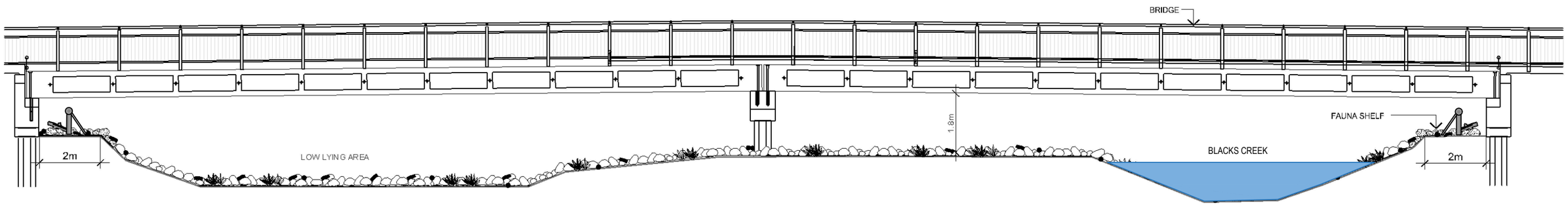


UNDERPASS 7
3.6M x 2.4M RCBC CULVERT WITH
FAUNA FRIENDLY INFRASTRUCTURE



UNDERPASS 9 (#)
DOUBLE SPAN 40M BRIDGE STRUCTURE 2.4M x 1.8M
WITH FAUNA FRIENDLY INFRASTRUCTURE

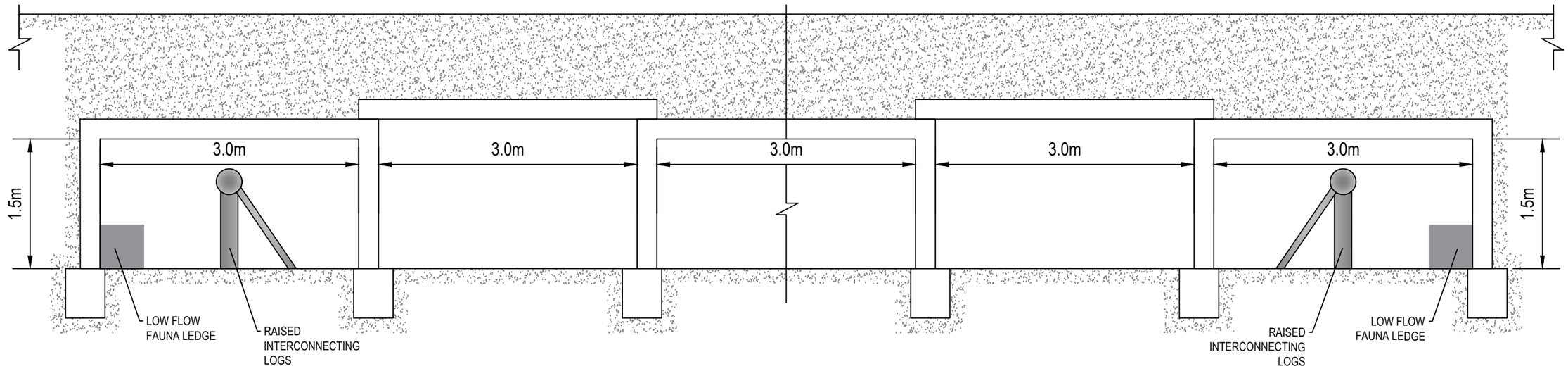
ALSO INDICATIVE OF UNDERPASS 5 DESIGN



SOURCE: MUS (Ref: 123-01_SK_022 FIGURE 4.dwg); SPLAT Augustine Heights Lanscape Concept Plan (Ref: 061602-01 SPLAT Woogaroo.pdf) SCALE: Not to Scale *JWA PTY LTD* *Ecological Consultants*	CLIENT Project 28 Pty Ltd PROJECT Wallum Sedge Frog Management Plan Kings Forest Melaleuca Drive, Duranbah, NSW Shire of Tweed	FIGURE 18B PREPARED: BW DATE: 07 April 2020 FILE: N97017_Underpasses.dwg	TITLE INDICATIVE FAUNA UNDERPASS SECTIONS

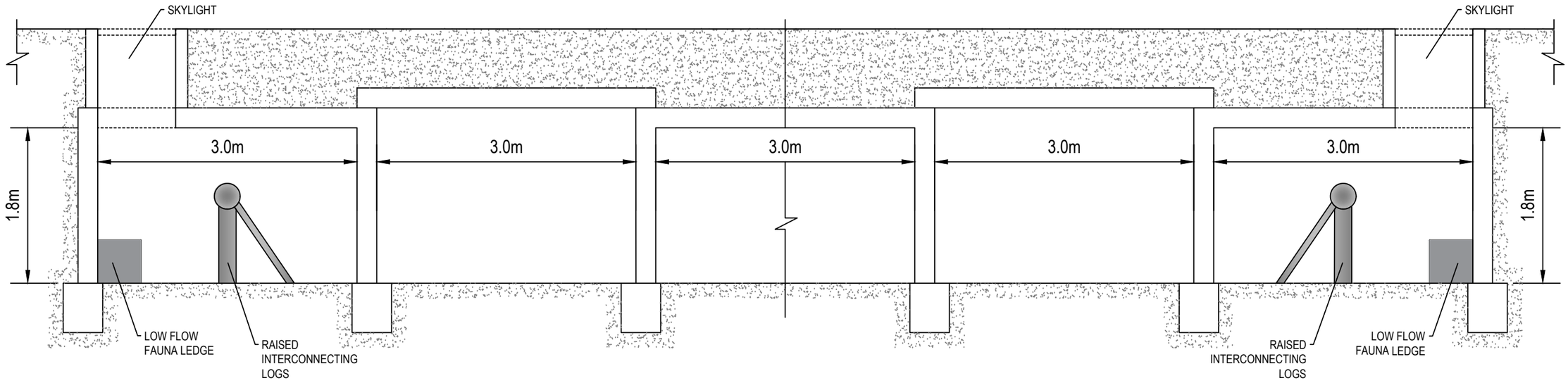
UNDERPASS 3

MULTIPLE 3.0M x 1.5M RCBC CULVERTS
WITH FAUNA FRIENDLY INFRASTRUCTURE



UNDERPASS 4

MULTIPLE 3.0M x 1.8M RCBC CULVERTS
WITH SKYLIGHT & FAUNA FRIENDLY INFRASTRUCTURE



SOURCE: MUS (Ref: 123-01_SK_022 FIGURE 4.dwg)

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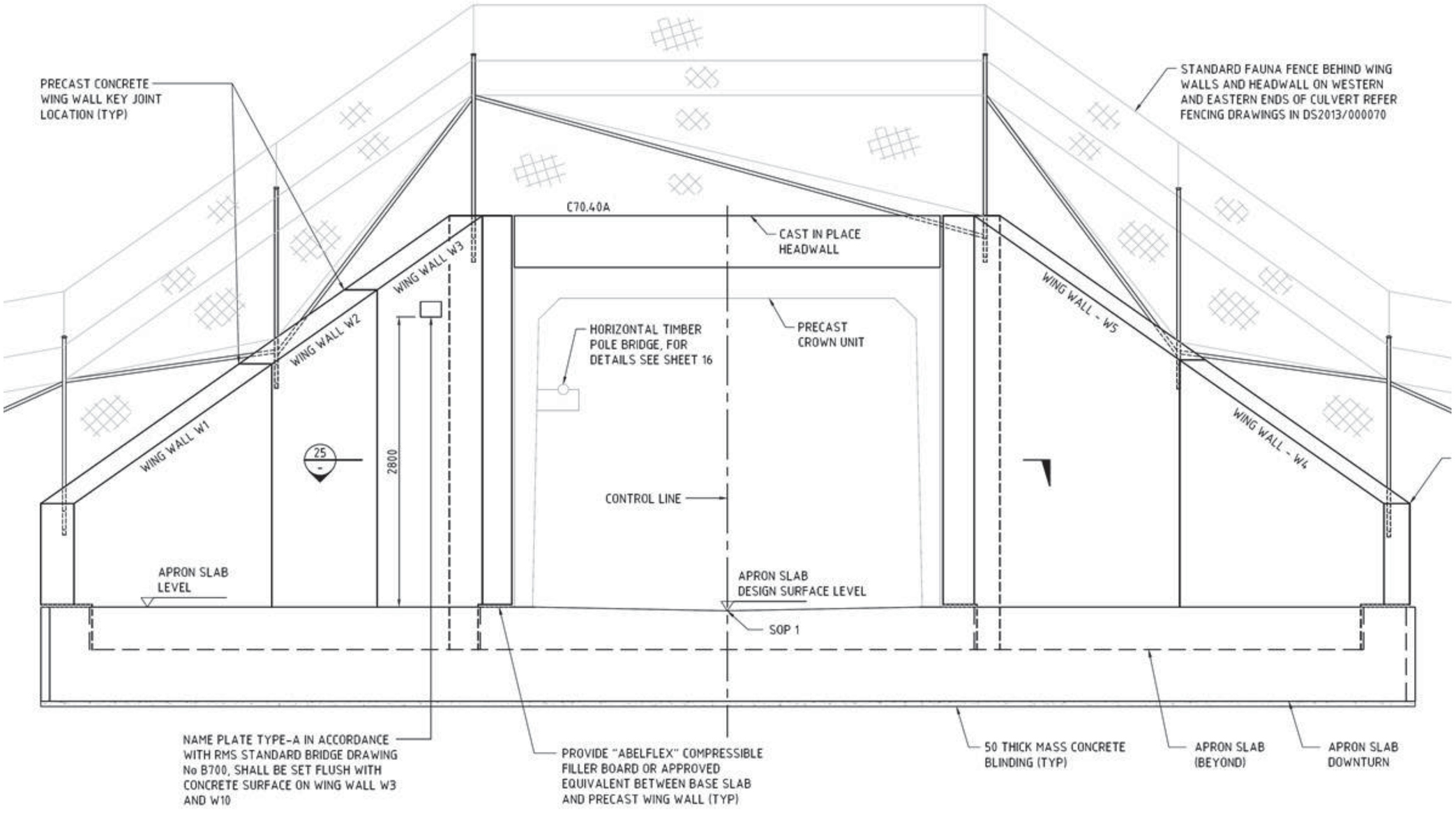
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Shire of Tweed

FIGURE 18C

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Underpasses.dwg

TITLE
INDICATIVE FAUNA UNDERPASS SECTIONS



SOURCE: Pacific Hwy Upgrade - Warrell Creek to Nambucca Heads DoE Info Request 3 Task 13 & 14
SCALE: Not to Scale

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FIGURE 19

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Underpass Fence.cdr

TITLE
INDICATIVE FAUNA EXCLUSION FENCING AROUND UNDERPASSES

- Where an underpass crosses beneath a dual carriageway or a road with a centre island, skylights will be incorporated.
- All fauna underpasses on the Kings Forest site will be fitted with wet weather ledges and internal timber furniture (poles/logs etc.) (**PLATE 3**). The vertical logs will be secured to the invert of the concrete base slab and soffit of the culvert ceilings by suitable attachment brackets. In addition, underpasses will incorporate a low flow channel to ensure dry fauna access is provided during normal flow conditions.
- Revegetation works will be completed on both sides of these underpasses within a radius of 20 m of the openings, consistent with the immediately adjacent restored habitat. Underpasses 4, 5 and 9 will include WSF habitat revegetation works within this area in accordance with the specifications provided in **SECTION 7.9.**



PLATE 3 – EXAMPLE OF UNDERPASS FURNITURE

7.6.4 Signage

Temporary signage (during construction phases) including the following will be installed:

- Beside temporary roads/haul routes noting a 50 km/hr speed limit, or 40 km/hr speed limit where roads traverse the environmental protection areas; and
- At approximately 100 m intervals along all fencing stating "Environmental Protection Zone – No Unauthorised Entry".

Permanent signage (during operational phase) shall be provided where appropriate and maintained:

- On the fauna exclusion fencing at intervals of no more than 100 m to be installed in conjunction with the permanent fencing, and including:
  - Notification of conservation area; and
  - Contact information for incident reporting.

7.6.5 Other Infrastructure

All street lighting will be capped and/or positioned to minimise light spill into retained habitat and habitat rehabilitation areas.

7.6.6 Maintenance Requirements

Fauna exclusion fencing, underpasses and signage are to be regularly checked and maintenance issues addressed as they arise, including vegetation in close proximity to the fencing, in accordance with **SECTION 9** of this WSFMP. Fence maintenance will remain the responsibility of the Proponent until ownership of the land is transferred to a third party.

Regular inspections will be completed (at not less than 1 monthly intervals). Any damage to fences, underpasses or signage will prompt immediate repair, within two (2) working days of the discovery of the damage, by Site or independent contractors as determined by the Site Manager.

7.7 Management of Retained WSF Habitat

Retained WSF habitat on the subject site (**FIGURE 15**) will be clearly identified on site with marking pegs prior to commencement of construction works. Retained habitat will be maintained/improved through weed control and assisted natural rehabilitation in accordance with the protocols as described in **SECTION 7.8** and the following documents:

- Kings Forest Precincts 1 - 5 Vegetation Management Plan (JWA 2020a);
- Kings Forest Precincts 6 - 11 Vegetation Management Plan (JWA 2020b);
- Kings Forest Precincts 12 - 14 Vegetation Management Plan (JWA 2020c);
- Kings Forest Precincts 1 - 5 Weed Management Plan (JWA 2020k);
- Kings Forest Precincts 6 - 11 Weed Management Plan (JWA 2020l); and
- Kings Forest Precincts 12 - 14 Weed Management Plan (JWA 2020m).

The following additional management strategies will be implemented to ensure that the retained WSF habitat is protected and managed:

- Erosion control;
- Providing appropriate access and/or fire trails;
- Weed control;

- Fire hazard reduction;
- Storm damage rectification;
- Re-instatement of natural areas;
- Removal of significant risk vegetation and
- Fencing construction and maintenance.

Implementation details and performance criteria for the management of retained habitat are contained within the relevant Vegetation and Weed Management Plans. In particular, the control of Slash pine wildings at the Kings Forest site is a key consideration and has been address in detail in these Management Plans. The management measures required to ensure the removal of Slash pine will not result in the removal of WSF habitat.

7.8 Compensatory WSF Habitat

7.8.1 Introduction

The retention of existing WSF habitat and the mitigation of indirect impacts will not be sufficient to mitigate all anticipated impacts on the WSF on or near the Kings Forest site. Offsetting is an accepted method to compensate for the loss/fragmentation of habitat and indirect impacts. The Kings Forest development proposes a significant vegetation rehabilitation program to offset the (direct) loss of WSF habitat resulting from the development.

An offset package for the loss of WSF habitat has been agreed between Project 28 and DAWE (Condition 13 of EPBC Approval 2012/6328).

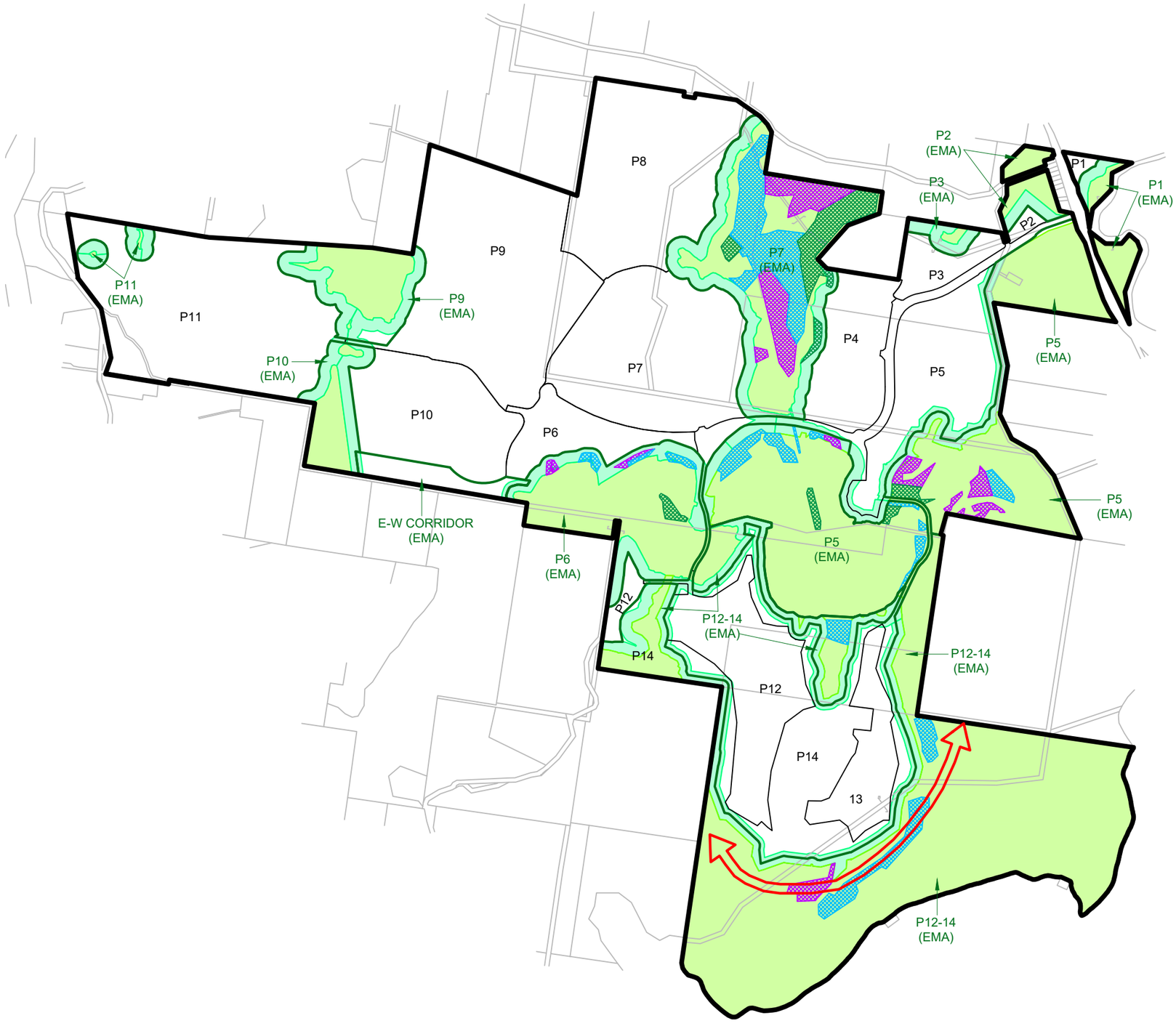
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs) throughout the WSFMP.

The following sections outline the location and extent of compensatory WSF habitat proposed, rehabilitation specifications and details of the staging of proposed offset works.

7.8.2 Proposed WSF Compensatory Habitat Areas

Approximately 32.80 ha of WSF habitat will be directly removed as a result of the proposed development (**FIGURE 15**). To compensate for unavoidable losses of WSF habitat, 47.36 ha of land has been identified as suitable for providing compensatory WSF habitat. **TABLE 4** outlines the proposed compensatory WSF habitat including habitat types, vegetation community type and structure to be recreated, and the species to be used for planting. The location of proposed WSF compensatory habitat is shown in **FIGURE 20**. **FIGURE 21** shows the distribution of WSF retained habitat and compensatory habitat after development.

The proposed WSF compensatory habitat areas will result in a net gain of 10.24 ha (after direct impacts of 32.80 ha) of WSF habitat in the medium to long term and will enhance existing movement corridors.



LEGEND

- Environmental Protection Zone (EPZ)
- 50m Buffer to EPZ
- Environmental Management Area (EMA) Boundary (#1)
- Precinct Boundary
- Kings Forest Boundary

WSF COMPENSATORY HABITAT (47.36ha) [#2]

- Compensatory WSF breeding habitat (9.76ha)
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat (24.26ha)
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat (13.34ha)
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)
- Restored Corridor (i.e. after revegetation and regeneration of heath)

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
Areas which will become WSF habitat after rehabilitation. Identified as areas with:

a) pre-clearing vegetation categorised as wetland (Terrestria 2014), and

b) developed depth to groundwater of:

(i) less than 1m for breeding habitat, or

(ii) 1 to 2m for forage habitat.

0 500m
1 : 20 000

SOURCE: JWA Site Investigations; BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling

SCALE: 1 : 20 000 @ A3

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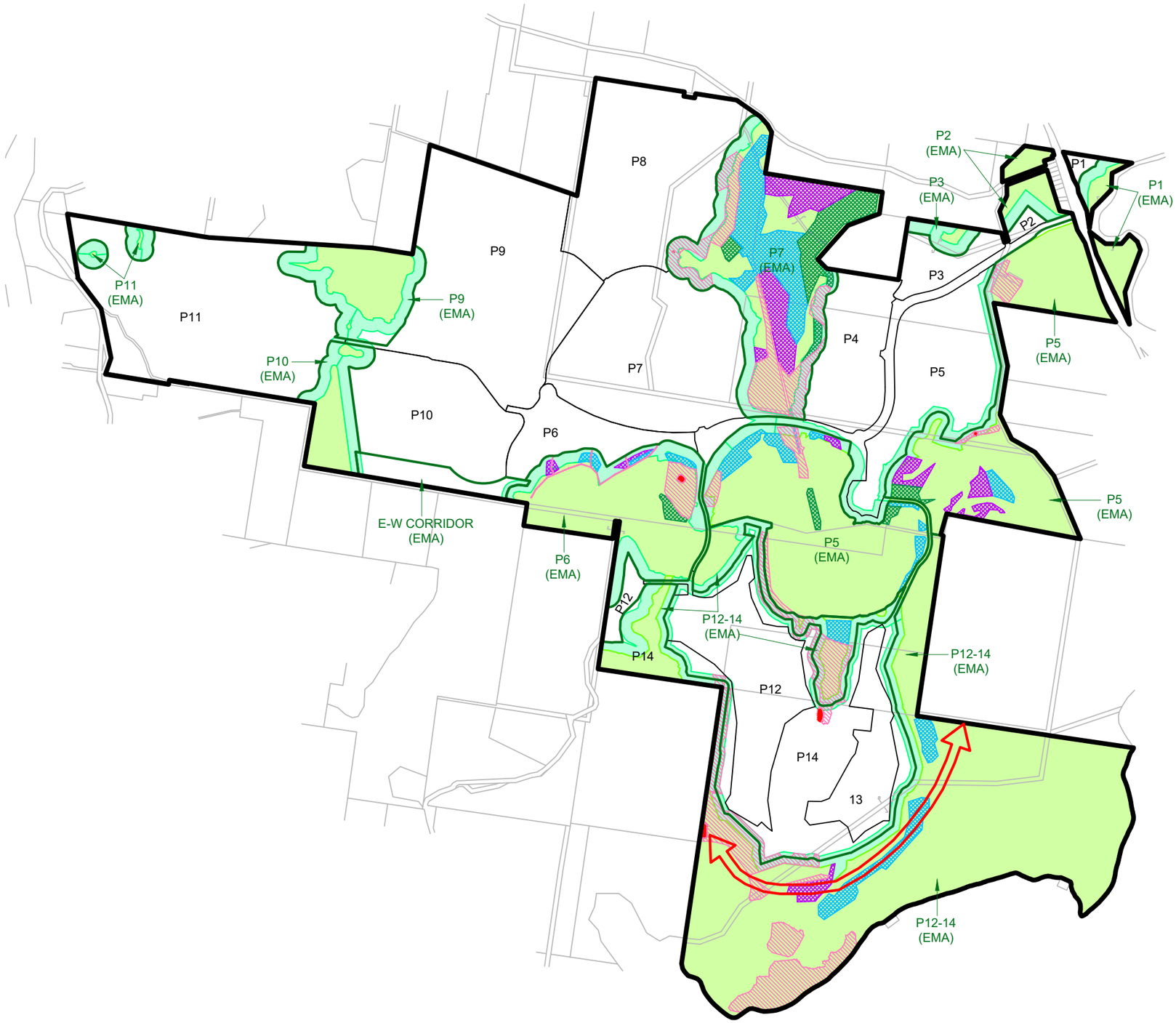
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Kings Forest
Melaleuca Drive, Duranbah, NSW
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FIGURE 20

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP.dwg

TITLE
WALLUM SEDGE FROG COMPENSATORY HABITAT



LEGEND

- Environmental Protection Zone (EPZ)
- 50m Buffer to EPZ
- Environmental Management Area (EMA) Boundary (#1)
- Precinct Boundary
- Kings Forest Boundary

EXISTING WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT (45.29ha)

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat after development (0.41ha)
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat after development (44.88ha)

WSF COMPENSATORY HABITAT (47.36ha) [#2]

- Compensatory WSF breeding habitat (9.76ha)
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat (24.26ha)
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat (13.34ha)
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)
- Restored Corridor (i.e. after revegetation and regeneration of heath)

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
Areas which will become WSF habitat after rehabilitation. Identified as areas with:

a) pre-clearing vegetation categorised as wetland (Terrestria 2014), and
b) developed depth to groundwater of:
   (i) less than 1m for breeding habitat, or
   (ii) 1 to 2m for forage habitat.

0 500m
1 : 20 000

SOURCE: JWA Site Investigations; BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling
SCALE: 1 : 20 000 @ A3

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FIGURE 21

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP.dwg

TITLE
WALLUM SEDGE FROG RETAINED & COMPENSATORY HABITAT

The extent of each WSF compensatory habitat category on a precinct-by-precinct basis is summarised in **TABLE 5.** The overall plant numbers to be planted in each of the proposed compensatory WSF habitat areas within each Precinct are provided in **TABLE 6**.

Currently, extensive areas of the EPZ that are weed infested and support pine plantations. In addition to the creation of new habitat (breeding and forage habitat), rehabilitation works will be completed within retained WSF core breeding and forage habitat and other retained vegetation where necessary in accordance with the relevant Vegetation Management Plans (JWA 2020a, b and c). Rehabilitation works in these areas will extend potential WSF habitat areas.

TABLE 4
PROPOSED WSF COMPNESATORY HABITAT PLANTING DETAILS

WSF Compensatory Habitat Type	Total Area	Depth to Groundwater	Vegetation Community to be Recreated (PCT* / TVMS#)	Broad Structure of the Vegetation Type to be Created	Trees, Shrubs, or Groundcover Plant Species to be Planted
Compensatory breeding habitat – sedgeland and at underpass entrances (as appropriate)	9.76 ha	0m to 0.2m	PCT 1290 / TVMS 701	Sedgeland	**Ground –** *Baloskion pallens, Baumea arthrophylla, Baumea articulata, Baumea rubiginosa, Cladium procerum, Eleocharis sphacelate, Lepironia articulata, Leptocarpus tenax, Schoenus brevifolius.*
Compensatory breeding habitat – wet heath	24.26 ha	0.2m to 1m	PCT 1297 / TVMS 502	Wet heathland	**Small trees/Shrubs –** *Baeckea frutescens, Baeckea linifolia, Banksia ericifolia subsp. macrantha, Banksia oblongifolia, Banksia robur, Leptospermum juniperinum, Leptospermum liversidgei, Melaleuca nodose, Sporadanthus interruptus, Xanthorrhoea fulva* **Ground –** *Eurychorda complanata, Pteridium esculentum, Sprengelia sprengelioides*
Compensatory forage habitat – dry heath	13.34 ha	1m to >2m	PCT 663 / TVMS 501	Dry heathland	**Small trees/Shrubs –** *Allocasuarina littoralis, Banksia aemula, Boronia pinnata, Calytrix tetragona, Dillwynia retorta, Leptospermum semibaccatum, Leptospermum trinervium, Melaleuca nodosa, Monotoca scoparia, Phyllota phylicoides, Xanthorrhoea glauca, Leptospermum polygalifolium.* **Ground –** *Caustis recurvata, Coleocarya gracilis, Platysace lanceolata, Pteridium esculentum.*

*****Relevant Plant Community Type (PCT) descriptions which were accessed via the NSW Office of Environment & Heritage (OEH) database (i.e. the BioNet Vegetation Classification System).

#Refer to Tweed Vegetation Management Strategy (Kingston *et al*. 2004)

TABLE 5
PRECINCT SPECIFIC WSF COMPENSATORY HABITAT CATEGORIES

Precinct/ EMA	WSF Compensatory Habitat (PCT* / TVMS#)			
	Compensatory Breeding Habitat - Sedgeland (PCT 1290 / TVMS 701)	Compensatory Breeding Habitat - Wet Heath (PCT 1297 / TVMS 502)	Compensatory Forage Habitat - Dry Heath (PCT 663 / TVMS 501)	Total
Precinct 1	-	-	-	**-**
Precinct 2	-	-	-	**-**
Precinct 3	-	-	-	**-**
Precinct 4	-	-	-	**-**
Precinct 5	1.78 ha	4.61 ha	3.13 ha	**9.52 ha**
Precinct 6	0.67 ha	1.07 ha	0.51 ha	**2.25 ha**
Precinct 7	7.31 ha	12.24 ha	8.27 ha	**27.83 ha**
Precinct 8	-	-	-	**-**
Precinct 9	-	-	-	**-**
Precinct 10	-	-	-	**-**
Precinct 11	-	-	-	**-**
Precincts 12-14	-	6.33 ha	1.42 ha	**7.75 ha**
TOTAL	**9.76 ha**	**24.25 ha**	**13.34 ha**	**47.35 ha**

*****Relevant Plant Community Type (PCT) descriptions which were accessed via the NSW Office of Environment & Heritage (OEH) database (i.e. the BioNet Vegetation Classification System).

#Refer to Tweed Vegetation Management Strategy (Kingston *et al*. 2004)

TABLE 6
TOTAL NUMBER OF PLANTINGS IN EACH PRECINCT

Precinct/ EMA	WSF Compensatory Habitat - Number of Plants (*)					
	Planting Density (plants / 25 sq. metres)		Compensatory Breeding Habitat – Sedgeland (PCT 1290)	Compensatory Breeding Habitat – Wet Heath (PCT 1297)	Compensatory Forage Habitat – Dry Heath (PCT 663)	Total
Precinct 1	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 2	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 3	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 4	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 5	Shrubs	8	0	14,760	10,016	**24,776**
	Ground covers	16	11,375	29,520	20,031	**60,926**
Precinct 6	Shrubs	8	0	3,421	1,639	**5,060**
	Ground covers	16	4,285	6,842	3,277	**14,405**
Precinct 7	Shrubs	8	0	39,176	26,475	**65,651**
	Ground covers	16	46,802	78,352	52,950	**178,104**
Precinct 8	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 9	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 10	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 11	Shrubs	8	-	-	-	-
	Ground covers	16				
Precincts 12-14	Shrubs	8	-	20,254	4,543	**24,797**
	Ground covers	16		40,508	9,086	**49,594**
TOTAL	**Shrubs**	**8**	**0**	**77611**	**42672**	**120284**
	Ground covers	**16**	**62461**	**155223**	**85344**	**303029**

7.8.3 Rehabilitation Specifications

Proposed WSF compensatory habitat offsets will be completed by a suitably qualified[2] Bush Regeneration Company in accordance with the specifications contained in **APPENDIX 4**. These specifications provide details of the proposed rehabilitation phases, site preparation, weed control, natural regeneration, revegetation works and rehabilitation monitoring. Performance indicators and targets for the proposed rehabilitation strategy to be achieved during the

[2] A Bush Regeneration Company that has demonstrable experience in the rehabilitation or revegetation of native vegetation communities in the Tweed region.

establishment and maintenance period of the project are contained in **SECTION 8.5**, along with corrective actions that are to be implemented if performance targets are not met.

7.8.4 Identification of WSF Habitat

Areas of compensatory WSF habitat and areas of retained WSF habitat requiring rehabilitation will be allocated an individual identifying number and will be clearly marked and identified on the ground (where necessary). Flat (5 cm x 1 cm) pegs (painted in white at the top) with the allocated identifying area number written on the white paint will be placed at each truncation on the boundaries of each polygon. However, where management polygons are encircled by another polygon requiring similar management (e.g. small WSF retained habitat polygon within a larger koala retained habitat polygon), only the outer boundary of the larger polygon will be pegged rather than the individual smaller polygons.

7.8.5 Staging of Offsets

Staging of offsets is the most practical method for offset provision, in this case. A staged approach to providing offsets is practical given that there may well be long periods between the development of the various precincts. To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs) throughout the WSFMP. Works within the EMAs will be completed in accordance with the calculations provided in **TABLE 7.**

The offsets will be substantially established[1] in any Precinct prior to the commencement of construction in any subsequent Precinct. Prior to the issue of each Construction Certificate authorising the clearing of WSF habitat, the Proponent shall provide evidence to the Certifying Authority that the compensatory WSF habitat in the preceding stage meets the relevant establishment period completion criteria.

[1] "Substantial establishment" of the WSF habitat/plantings means "the habitat/plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and a suitably qualified horticultural/environmental specialist has provided a short report confirming that the plantings are established."

TABLE 7
DEVELOPMENT STAGE/PRECINCT SPECIFIC OFFSETS

Development Stage	Precinct/EMA	WSF Habitat to be Retained	WSF Habitat to be Removed/ Impacted	WSF Offset Created Habitat	Cumulative Net Gain/Loss
Stage 1	Precinct 1	0	0	0	+ 3.21 ha
	Precinct 2	0	0	0	
	Majority of Precinct 4	0	2.50 ha	0	
	Precinct 5	4.57 ha	3.80 ha	9.52 ha	
Stage 2	Precinct 3	0	1.56 ha	0	+ 1.66 ha
	Remainder of Precinct 4	0	0	0	
Stage 3	Precinct 6	2.99 ha	0.29 ha	2.25 ha	+ 3.62 ha
Stage 4	Precinct 7	12.83 ha	2.97 ha	27.83 ha	+ 28.47 ha
Stage 5	Precinct 8	0	3.90 ha	0	+ 24.57 ha
Stage 6	Precinct 9	0	2.89 ha	0	+ 21.68 ha
Stage 7	Precinct 10	0	0.51 ha	0	+ 21.17 ha
Stage 8	Precinct 11	0	0	0	+ 21.17 ha
Stage 9	Precincts 12-14	24.91 ha	18.68 ha	7.75 ha	+ 10.24 ha
	TOTAL	**45.29 ha**	**37.11 ha**	**47.35 ha**	

7.8.6 Bond for Environmental Restoration and Maintenance Works

In accordance with Major Projects Condition 50, prior to commencement of bulk earth works for each precinct, and every two (2) years thereafter, a cash bond or bank guarantee shall be lodged with TSC to ensure that the relevant environmental management plans for the associated Potential Council Land (PCL) are implemented. The amount of such bond will be based on 135% of the cost of the environmental works (repair and/or enhancement) for the associated precinct/PCL for the establishment period specified in the approved environmental management plans. Two (2) written quotes from suitably experienced and qualified contractors must be submitted to the TSC which detail the cost of all works required within each two (2) year period.

The above cash bond or bank guarantee will be refunded at the end of each two (2) year maintenance period, following the Secretary's written approval of the environmental audit (refer to **SECTION 8.7.3**). Bi-annual bonding will no longer be required following the Proponent providing evidence to the Secretary that the final audit has been conducted in accordance with Major Projects Condition 49 (**SECTION 8.7.3**) which demonstrates that the relevant works have been completed and written evidence is provided to the Secretary that the lands have been transferred into public ownership.

7.9 Improving Habitat Connectivity and Linkage Corridors

The maintenance of habitat patches of sufficient size to support existing populations and provide for future population expansion is fundamental to WSF population and habitat management (BEC 2014). The following three (3) recommendations are proposed:

1) Retention of WSF habitat *in-situ* in the first instance, with a focus on occupied habitat;
2) Maintenance and creation of vegetated linkages between habitat patches and source populations; and
3) Strategic revegetation work with the aim of consolidation of existing habitat patches and habitat creation. Revegetation work will focus primarily on "gap-filling" in large habitat blocks within and adjacent to mapped source populations, edges of habitat blocks and within linkage areas. Indicative linkage areas for the focusing of habitat retention and creation are provided (**FIGURE 22**).

A Key Action to be implemented in accordance with this WSFMP is the maintenance of a high degree of connectivity to service the site WSF population, as well as those WSF whose home ranges are located largely on adjacent areas of habitat (e.g. Cudgen Nature Reserve). The use of underpasses at key strategic locations will allow for unimpeded WSF movements.

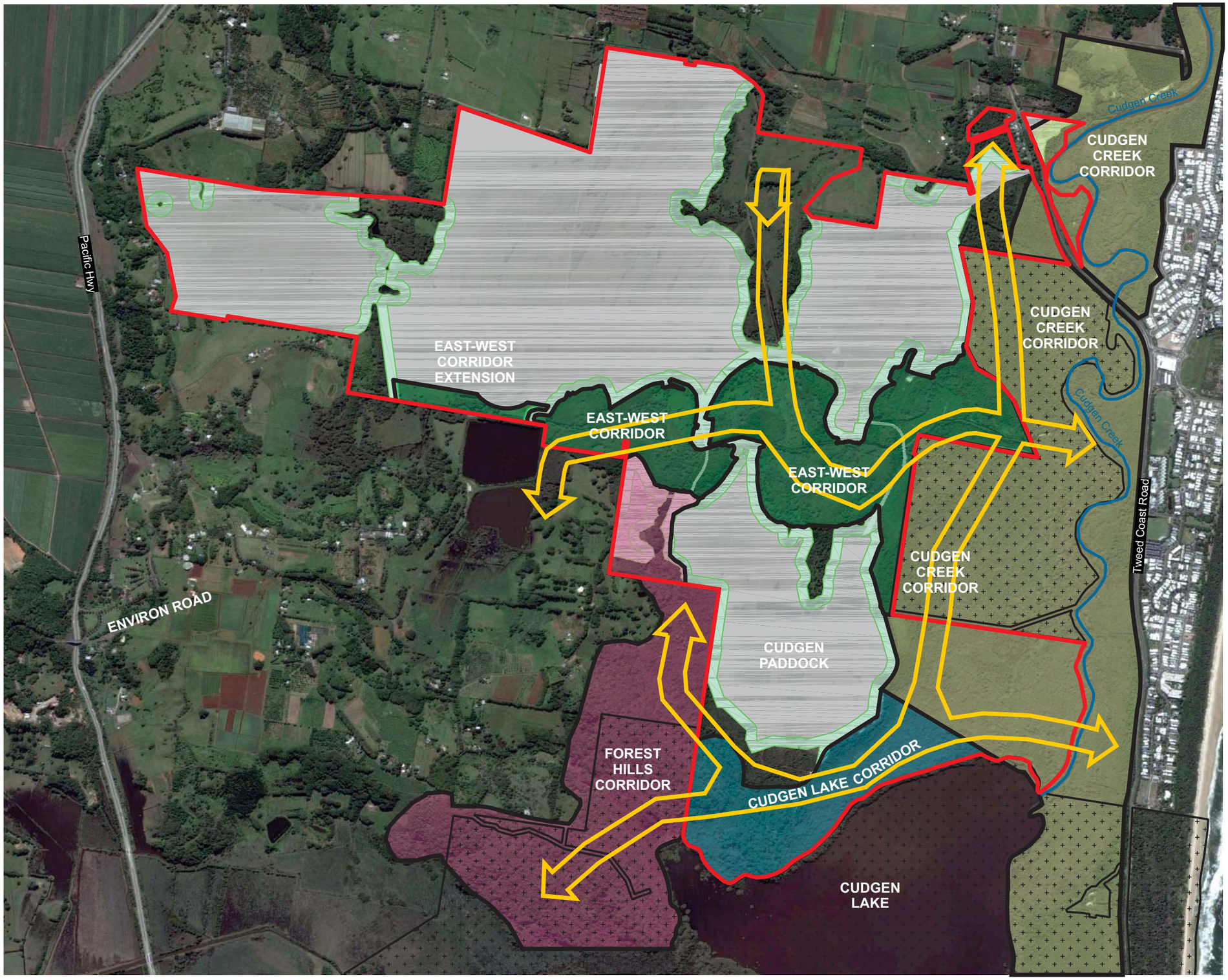
Whilst the proposed development of the site will result in the loss of some of the remnant wallum vegetation, this is proposed to be offset by the provision of compensatory habitat areas close to retained habitat areas. The development of the site will also isolate some areas of existing habitat however frog dispersal and interconnectivity of habitat will be retained along natural drainage routes and areas of wet heath. Underpasses 4, 5 and 9 in particular (**FIGURE 18A)** will be important for maintaining connectivity between existing and created WSF habitat. In the central area, WSF breeding habitat will be recreated as none currently exists in this area.

All significant movement/dispersal corridors (**FIGURE 22**) will be retained as part of the proposed development and the East-West and Cudgen Lake corridor will be bolstered and enhanced through the revegetation of understorey species. Therefore, connectivity and genetic dispersal between significant WSF populations identified adjacent to Kings Forest site will be maintained. With the revegetation/rehabilitation of proposed compensatory habitat areas and the other enhancement measures proposed, the development of the Kings Forest site should allow these frogs to continue to survive indefinitely on the site.

7.10 Disease Management

7.10.1 Site Hygiene Management Training

In order to minimise the potential of spreading Chytrid fungus, all project staff and contractors involved in activities occurring in WSF habitat will be trained in site hygiene management in accordance with the Threatened Species Management Information Circular No. 6 Hygiene Protocol for the Control of Disease in Frogs (NSW DECC 2008). The training program is to be approved by a suitably qualified person prior to construction commencing on the site.



SOURCE: JWA; NSW DPI Cadastre; Google Earth Apr 2017 Aerial

SCALE: 1 : 20 000 @ A3

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FIGURE 22

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_Linkages.cdr

TITLE **WILDLIFE CORRIDORS & PROPOSED KINGS FOREST LINKAGES**

Site hygiene management training will focus on measures to prevent the introduction of Chytrid fungus to WSF habitats such as:

- Frogs shall only be handled when necessary.
- Footwear and non-disposable equipment are to be thoroughly cleaned and disinfected at the commencement of fieldwork and in the case of monitoring activities, between each sampling site.
- For monitoring activities, disposable equipment shall be used for sampling where possible and changed between each sampling site.

7.10.2 Procedures for Handling of Sick or Dead Frogs

Sick or dying frogs can exhibit a range of symptoms including:

- Appearance:
  - Darker or blotchy upper (dorsal) surface;
  - Reddish/pink-tinged lower (ventral) surface and/or legs and/or webbing or toes;
  - Swollen hind limbs;
  - Very thin or emaciated;
  - Skin lesions, sores or lumps;
  - Infected eyes; and
  - Obvious asymmetric appearance.
- Behaviour:
  - Lethargic limb movements, especially hind limbs;
  - Abnormal behaviour (e.g. a nocturnal burrowing frog sitting in the open during the day and making no vigorous attempt to escape when approached); and
  - Little or no movement when touched.

Sick frogs will generally fail one or more of the following tests:

- Gently touch with finger:
  - A healthy frog will blink.
  - A sick frog will not blink.
- Turn frog on its back:
  - A healthy frog will flip back over.
  - A sick frog will remain on its back.
- Hold frog gently by its mouth:
  - A healthy frog will use its forelimbs to try to remove grip.
  - A sick frog will not respond.

In the event that sick or dead frogs believed to be infected with Chytrid fungus are encountered on site, they shall be collected, prepared and transported to a designated frog recipient in accordance with the procedures outlined in the Threatened Species Management Information Circular No.6 Hygiene Protocol for the Control of Disease in Frogs (NSW DECC 2008) and listed below:

- Disposable gloves will be worn when handling sick or dead frogs.
- To prevent cross-contamination, new gloves and a clean plastic bag will be used for each frog specimen.
- Frogs exhibiting one or more of the symptoms for sick frogs listed above and considered unlikely to survive transportation will be euthanised.
- Sick frogs likely to survive transportation will be placed into either a moistened cloth bag or into a plastic bag (to be partially inflated before sealing) with damp leaf litter. All frogs will be kept separate during transportation.
- Dead frogs will be kept cool and preserved as soon as possible. The belly of the frog will be cut open and the specimen placed in preservative (approximately 10 times the volume of the specimen). Specimens will be preserved in either 65% ethanol or 10% buffered formalin.
- The recipient of the sick or dead frog will be contacted to confirm the appropriate procedure prior to transport.
- Containers will be labelled and will provide the following details: date, location and species (if known).
- A standardised collection form will be filled out and a copy sent with the specimen.
- Individual containers will be used for each specimen.

Details of designated recipients of sick or dead frogs are as follows:

Karrie Rose
Australian Registry of Wildlife Health
Taronga Conservation Society, Australia
PO Box 20
MOSMAN NSW 2088
Phone: 02 9978 4749
Krose@zoo.nsw.gov.au

Diana Mendez or Rick Speare
School of Public Health,
Tropical Medicine and Rehabilitation Sciences
James Cook University, Douglas Campus
TOWNSVILLE QLD 4811
Phone: 07 4796 1735
Diana.Mendez@jcu.edu.au
Richard.Speare@jcu.edu.au

Michael Mahony
School of Biological Sciences
University of Newcastle
CALLAGHAN NSW 2308
Phone: 02 4921 6014
bimjm@cc.newcastle.edu.au

7.11 Controlling Pest Species

As outlined in **SECTION 5.6**, Cane toads and Mosquito fish have the potential to be a significant threat to the long-term viability of WSF populations on the site. Cane toads and Mosquito fish on the site shall be monitored and managed within both retrained and created habitat in accordance with the strategies outlined in the Feral Animal Management Plan (JWA 2020i). Management strategies will include habitat management, light traps and cane toad musters.

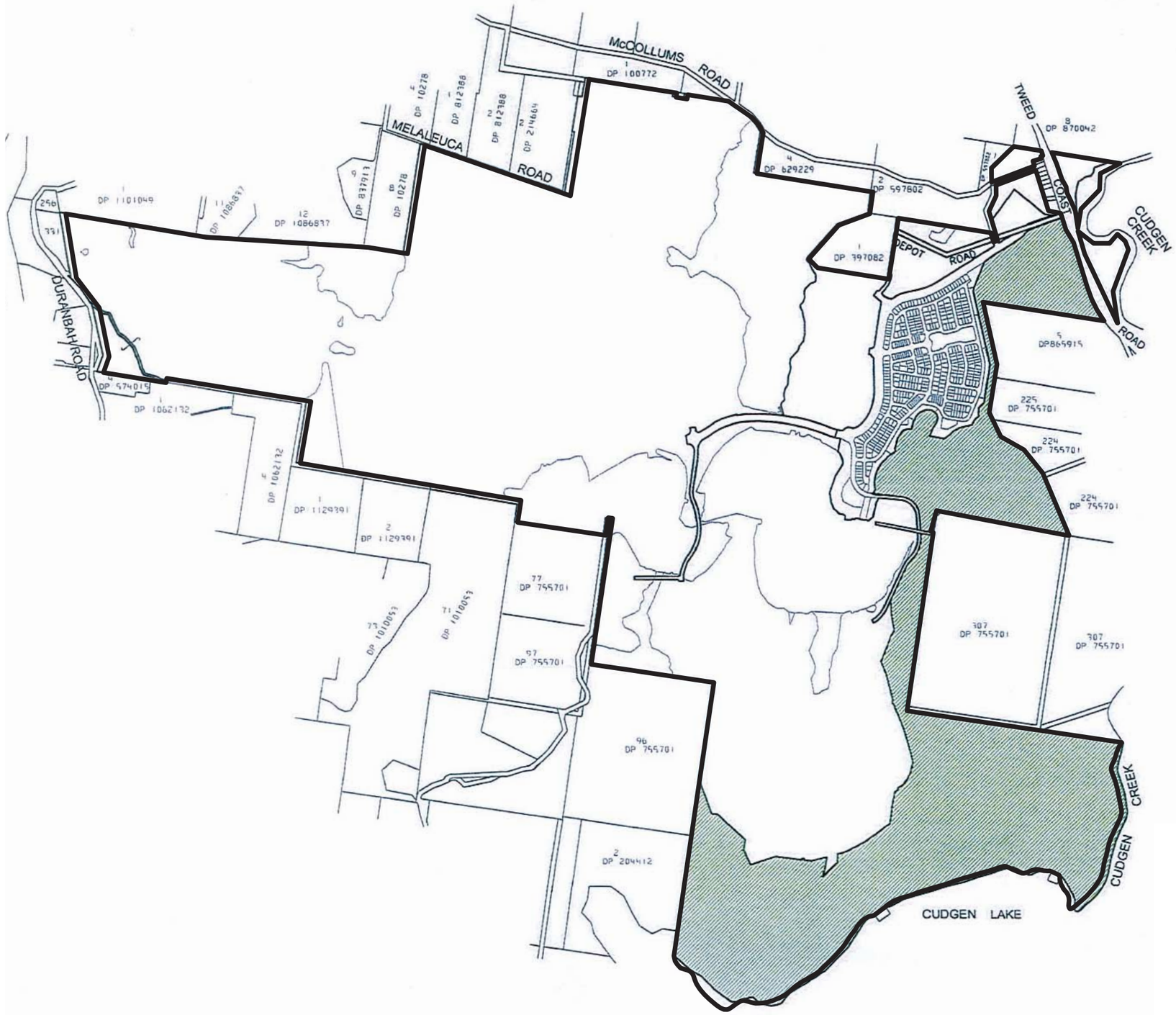
The use of pesticide for mosquito control also has the potential to be a threat to WSF populations on site as many widely used pesticides have been shown to be toxic to frogs causing deformities, hermaphroditism and death (Mann & Bidwell 1999). Tweed Shire Council has been actively involved in mosquito abatement since 1983 and undertakes larvae control programs in selected areas during warmer months. The following mosquito related activities are carried out by Tweed Shire Council's Pest Management Program Area:

- Monitoring: Council monitors Mosquito species and abundance with CO2 light traps.
- Habitat reduction: Council has carried out some innovative forms of habitat modification to reduce the breeding potential of mosquitoes in semi-tidal saltmarsh habitat without the use of chemicals.
- Mosquito larvae control: When extensive areas hatch mosquito larvae following heavy rain or higher than usual tides. Larger areas are treated by aircraft, whereas smaller areas are treated with on-ground works. Only Biological larvicides are used. These are:
    - *Bacillus theringiensis* - Council uses a bacterial larvicide called Bti to spray mosquito breeding areas when warranted. This larvicide is specific to mosquitoes and several other closely related flies. Bti poses no harm to other aquatic non-target organisms.
    - Methoprene – This chemical is an insect growth regulator with sustained release formulations to inhibit mosquito larvae from turning into adult mosquitoes.

Mosquito control on the Kings Forest site, if considered necessary, will be undertaken in accordance with Council's mosquito abatement, control and prevention (i.e. habitat reduction) policies.

7.12 Transfer of Land to Public Ownership

The transfer to public ownership of a minimum of 150 ha (in accordance with Concept Plan condition C3) of the Kings Forest site, contiguous with Cudgen Nature Reserve is proposed as part of this WSFMP (**FIGURE 23**). This undertaking was originally contained in the Proponent's



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LEGEND

Indicative Areas to be dedicated to NPWS

Conservation offset (Nature Reserve addition) land approx total area 180 ha
(150 ha per concept plan condition C3,
additional 30 ha subject to agreement with NPWS)

Kings Forest Boundary

Note: Final boundaries are subject to agreement with Dept of Planning and Infrastructure

NSW GOVERNMENT
Planning

Issued under the Environmental Planning and Assessment Act 1979

Approved Application No. 08_0194

granted on the 11/8/13

Signed.....

Sheet No. 38 of 41

0 500m
1 : 20 000

SOURCE: Landsurv (Ref: Landsurv Revision C.pdf dated 23.08.12)

SCALE: 1 : 20 000 @ A3

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Ecological Consultants

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Project 28 Pty Ltd

PROJECT
Wallum Sedge Frog Management Plan
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 23

PREPARED: BW
DATE: 07 April 2020
FILE:N97017_Landsurv NPWS ded.cdr

TITLE
PROPOSED AREAS TO BE DEDICATED TO NPWS

Statement of Commitments forming part of the approved Concept Plan and includes approximately 9.73 ha (12%) of existing WSF habitat and 6.72 ha (14%) of created compensatory habitat (**FIGURE 21**). These areas will be protected by Nature Reserve zoning and status under the NPWS Act in perpetuity.

The remaining EPZs and ecological buffers across the site may also be transferred to public ownership, subject to agreement with Tweed Shire Council. These areas included a further 35.56 ha (43%) of existing WSF habitat and 40.63 ha (86%) of created compensatory habitat on the Kings Forest site.

In accordance with Condition 3 of the Major Project Application 08_0194, Project 28 will submit to the Secretary a form of dealing(s) which will be registered on the title to the Potential Council Land (PCL) and future OEH land. This registration will bind all future landowners to manage the dedicated land for conservation purposes, ensure compliance with relevant management plans (in particular this WSFMP), permit access by the Department, Council and OEH at all times and provide a release for any public authority from the registered dealing(s).

Prior to the commencement of works in a precinct, a registered surveyor will prepare survey plans and permanently mark the boundaries of the PCL and the future OEH land. These plans will be lodged with the Department on a precinct-by-precinct basis.

In accordance with Condition A13 of MP08_0194 (as modified) the proponent will manage all Potential Council Land (PCL) and future OEH land until such time as an agreement is reached regarding the dedication of the land. The Proponent's intention is to dedicate land on a precinct by precinct basis, with all lands proposed to be dedicated prior to 2035. The maintenance of WSF infrastructure on land dedicated with each relevant Precinct will become the responsibility of the new landowner at the time of dedication.

7.13 Fire Management

Bushfire management actions on the Tweed Coast will be co-ordinated under the Tweed Coast Comprehensive Koala Plan of Management (TCCKPoM), guided by the Tweed Coast Koala Fire Management Plan (potentially with funding under the Saving Our Species (SOS) program). The proponent will be responsible for bushfire management in the conserved bushland and wetland areas until ownership is transferred. The Kings Forest Stage 1 Bushfire Management Plan (BMP) (BushfireSafe 2020) has been prepared to further outline risk management strategies that aim to protect property and life and to reduce the threat to ecological and environmental assets.

A fundamental strategy of the BMP is to assess and manage fuel loads within the Kings Forest site. The risk of high intensity fires will be reduced through controlled low intensity burns or mechanical means if and where appropriate. High-intensity hazard reduction burns and wildfires that result in crown scorch or crown fires should be avoided.

It has previously been noted (**SECTION 2.7**) that continued infestation of native vegetation with Slash pine wildings is occurring over the Kings Forest site. As well as decreasing the diversity and competing with native species, pine invasions can also lead to altered fire

regimes. There is often a complete absence of fire where pine plantations occur due to the need to maintain the plantation as an economic resource. However, when fires do occur, they are of high intensity due to the highly flammable nature of pine trees and accumulated leaf litter (Skull 1995, 1998). The control of Slash pine wildings at the Kings Forest site is therefore a key consideration for the control of any future wildfires.

Within Kings Forest, large habitat areas within the central wetlands are proposed to be crossed by roads in three (3) places. These roads will constitute a valuable asset for the control of both prescribed burns as well as any wildfires in these areas, and vegetation adjacent to these roads should be managed with this in mind.

Adjacent to Kings Forest, the particular area of concern in terms of bushfire threat is the Cudgen Nature Reserve, including the lands currently forming part of the Kings Forest site to be added to the Reserve. The Cudgen Nature Reserve Fire Management Plan should be amended to include these additional areas prior to these areas being transferred to BCD. Furthermore, WSF and their habitat should be particularly considered in a review of the Fire Management Plan.

Condition 34 of the MP 08_0194 requires that Project 28 engage with OEH, Council and the Rural Fire Service to amend the Bushfire Management Plan so as to ensure that a co-operative effort to minimise the potential for wildfires and fire frequencies occurs.

7.14 Raising Community Awareness

7.14.1 Environmental Awareness and Extension Program

Public awareness of the environment relates to an emotional understanding of the surrounding world, including the laws of the natural environment, sensitivity to changes occurring in the environment, understanding of cause-and-effect relationships between the quality of the environment and human behaviour, an understanding of how the environment works as a system, and a sense of responsibility for the common heritage of the Earth, such as natural resources – with the aim of preserving them for future generations (UNEP-IETC 1999). A Key Action to be implemented in accordance with this WSFMP is an environmental awareness and extension program for new residents with the objective of raising awareness and promoting community ownership of environmental management (including the conservation of the local WSF population).

The following management actions are proposed:

- Provision of an information package for purchasers of land at Kings Forest. The package shall include a brochure or booklet to all original purchasers of Kings Forest properties and made available through appropriate service outlets within the Kings Forest estate. This brochure/booklet shall contain a reference to a web page which will contain the relevant/required information;
- Design and create a web page that contains information intended to raise and shape awareness of WSF issues at Kings Forest;
- Advertise information relating to WSF management in local newspapers;

- Conduct community presentations/information days at local schools and/or public spaces on a biennial basis; and
- Provide feedback forms in order to confirm that awareness and education in the community is being built as a result of the environmental awareness and extension program. The results of the feedback form assessment to be provided to DPI&E and TSC for comment.

With respect to the protection of WSF, the information provided via the above actions will cover such matters as:

- WSF identification and behaviour;
- WSF habitat areas in Kings Forest site;
- The importance of protecting the WSF population in the Kings Forest area;
- Areas of the site in which WSF are most likely to be encountered;
- Threats to WSF associated with residential development;
- Protection of WSF habitat and habitat linkages;
- Measures undertaken to avoid WSF deaths or injuries;
- Assistance that can be given relating to the protection of WSF generally; and
- The contact details of relevant State agencies such as BCD and of the TSC, and web addresses where further information on WSF may be obtained.

This strategy will last for the duration of the construction phase of the project and for twelve (12) months after completion of construction of the final precinct, or, until 31 December 2035, whichever occurs first.

7.14.2 Kings Forest Representative

Project 28 will ensure that either a company employee or resident's representative will be appointed to maintain a strong and regular connection with TSC, the NSW Environmental Protection Authority and the BCD in relation to WSF issues.

7.14.3 Environmental and Community Liaison Officer(s)

In accordance with project approval (MP08_0194) condition 70, a community liaison officer will be engaged by the proponent.

In accordance with project approval (MP08_0194) condition 71, an appropriately qualified Environmental Officer(s), approved by DPI&E (formerly DoPE), must be engaged by the Proponent for the duration of works. Their role shall be to oversee environmental compliance until all conditions have been satisfied.

The Environmental Officer(s) may also act as the community liaison officer required above, to consult with potentially affected property owners and the department before and during construction works and shall respond to complaints of an environmental impact nature.

The Environmental Officer(s) must submit a report to the Secretary Director-General within three (3) weeks of the completion of each earthworks stage detailing the project's compliance with relevant conditions, management plans and progress on-site.

A sign is to be erected at a suitable and highly visible location to clearly advise the environmental/community liaison officer's details and contact number. These details are also to be documented in the Construction Environmental Management Plan (CEMP).

8 WSF MONITORING AND REPORTING

8.1 Introduction

Monitoring will be undertaken to determine the effectiveness of mitigation measures implemented. Monitoring will be required during the 'establishment period[2]' and 'maintenance period[3]' of the project as defined within the Project approval (MP08_0194).

Monitoring (and reporting on) of the following management strategies will be addressed in the following sections:

- Water quality;
- WSF occupancy rates;
- Retained WSF habitat;
- Compensatory plantings; and
- Infrastructure, Construction and Operational management.

All survey data collected for the project must be collected and recorded so as to conform to draft or approved EPBC Act survey guidelines and/or policy statements relevant to WSF as made available on the Department's website. When requested by the Department, the approval holder must provide to the Department all species and ecological survey data and related survey information from ecological surveys undertaken for the WSF. This survey data must be provided within thirty (30) business days of request, or in a timeframe agreed to by the Department in writing. The Department may use the survey data for other purposes.

8.2 Water Quality Monitoring

8.2.1 Baseline monitoring

The OWMP (G&S 2020b) prepared for the site contains details of the water quality monitoring program that will be implemented within the construction site and should be read in conjunction with this WSFMP.

Baseline water quality monitoring will be completed prior to construction to establish appropriate discharge criteria for the construction phase. Performance criteria will be set by monitoring the following parameters for a minimum of eight (8) monitoring rounds prior to commencement of construction works:

- pH;

[2] means the period commencing with the implementation of the relevant approved environmental management plan(s) and ending when the works specified in that plan meet the establishment period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary. The establishment period represents the time necessary to carry out initial environmental repair, restoration and monitoring prior to ongoing maintenance.

[3] means the period commencing immediately after the end of the establishment period during which environmental management and monitoring works specified in the relevant approved environmental management plan(s) are to be carried out in accordance with the maintenance period performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

- Electrical conductivity;
- Turbidity;
- Dissolved oxygen;
- Temperature;
- Suspended solids;
- Total nitrogen and nitrate, nitrite and ammonium;
- Total and soluble phosphorus;
- Oil and grease;
- Calcium;
- Magnesium;
- Total and dissolved iron;
- Dissolved manganese;
- Filtered aluminium;
- Bicarbonate;
- Carbonate;
- Chloride;
- Sulfate; and
- Colour

8.2.2 Ongoing monitoring

Surface water monitoring will be completed within the construction site monthly during the construction phase and following the first monthly rainfall event (defined as >25mm in 24 hours) for the following parameters:

- pH;
- Electrical conductivity;
- Turbidity;
- Total and soluble nitrogen and phosphorus;
- Suspended solids;
- Dissolved oxygen; and
- Oil and grease.

If the parameters of the surface water within the construction site do not comply with the release criteria range, then such waters will be contained within detention basins and adjusted to within the range prior to release.

Surface water monitoring will also be completed within adjacent WSF breeding habitat (**FIGURE 12**). The monitoring will be completed at the same period and frequency as the annual WSF monitoring (3 sampling events during September - March), and on an episodic basis i.e. during a very wet period and also during a very dry period.

Water quality on the construction site will continue to be maintained during the maintenance period of the operational phase through utilisation of appropriate water sensitive urban design measures. Stormwater traversing the site in each catchment will be directed through a series of stormwater treatment devices in order to minimise flow velocities and allow the settling of entrained sediment/uptake of nutrients prior to discharge. The above measures will ensure that retained areas of WSF habitat are not degraded due to potential decline in water quality.

8.2.3 Performance Criteria and Corrective Actions

TABLE 8 provides the performance criteria and targets for the water quality monitoring programs. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 8
WATER QIUALITY MONITORING PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Performance Indicator	Target	Corrective Actions
pH	Stable pH between 4.0 and 5.5	• Investigate reason for relevant parameter/s outside of baseline levels/range and take immediate action to stop the cause of the problem and prevent the problem from occurring again. • Return the relevant parameter/s to performance target levels prior to subsequent monitoring event.
Conductivity	Conductivity of <350uS.cm-1	
Turbidity	Below baseline levels	
Suspended solids	Below baseline levels	
Nutrient levels	Below baseline levels	
Temperature	Within baseline range	
Dissolved oxygen	Within baseline range	
Pollutants	No evidence of pollutants	

8.3 WSF Occupancy Rates

8.3.1 Introduction

This section discusses the proposed monitoring program for WSF occupancy rates at the Kings Forest site including the key monitoring objectives, methodologies to be implemented for baseline and annual monitoring, and the specific requirement for WSF monitoring to be completed after bushfire events.

8.3.2 Monitoring Program

8.3.2.1 Baseline WSF Monitoring

The aims of the baseline monitoring are to establish survey sites and protocols and to collect data which will allow future monitoring:

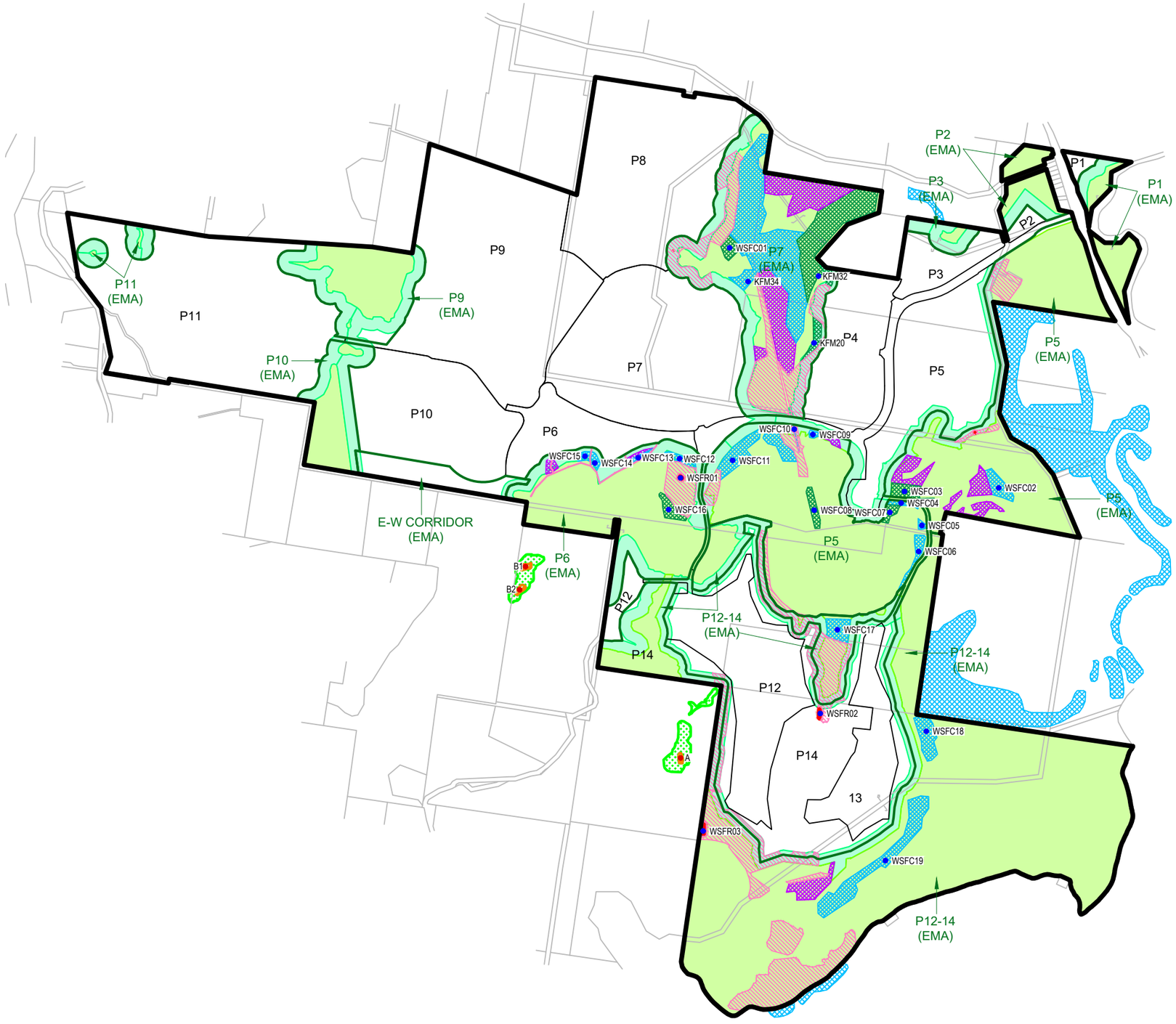
1. To determine any changes in the distribution and level of WSF activity within the Kings Forest site; and
2. To assess any changes in WSF occupancy rates within the Kings Forest site.

Data gathered during the eight (8) week WSF habitat survey, detailed in JWA (2013), surface/ground water characteristics to be monitored in accordance with the Overall Water Management Plan (G&S 2020b), surveys completed by Dr Arthur White in August and December 2014, and surveys to be completed immediately prior to the commencement of construction for each Precinct will form the baseline data against which data collected during subsequent monitoring events will be compared.

Baseline WSF monitoring will be completed prior to the commencement of works within each relevant stage of the development by suitably qualified and/or accredited persons in accordance with the following methodology.

All surveys will be completed in accordance with the Commonwealth Department of the Environment, Water, Heritage and the Arts "Survey guidelines for Australia's threatened frogs" (DEWHA 2010) and the New South Wales Department of Environment and Climate Change "Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians" (NSW DECC 2009). In particular, the following methods are considered essential for the Kings Forest site:

- Baseline monitoring will be undertaken during the WSF breeding season (i.e. between late September and early March) during appropriate weather conditions.
- Monitoring surveys will be completed following rainfall events greater than 25 mm in 24 hours. The nearest Bureau of Meteorology rainfall recording station to the site is Kingscliff (Woram Place) weather station (#058137), which is located approximately 5 km to the north of the site. The nearest Bureau of Meteorology temperature recording station to the site is Murwillumbah (Bray Park) weather station (#058158) approximately 15 km from south-west of the site. To assist in interpretation of survey results, details of the weather conditions experienced during the surveys and rainfall readings for the five (5) days up to and including the survey events, taken at the Kingscliff and Murwillumbah weather stations, are to be included.
- At a minimum, the methodology will include the installation of a permanent 50 m transect in each area of suitable habitat onsite relevant to the development stage. **FIGURE 24** shows the locations of monitoring sites. Each transect is to cross retained or created breeding habitat.
- Permanent 50 m transects will also be installed and surveys completed in two (2) high quality off-site WSF habitats. These two (2) areas have each been identified in BEC (2014) as Areas A and B (**FIGURE 24**). The data from the surveys in Areas A and B will provide benchmarks for site data.



LEGEND

- Annual WSF Monitoring Location - Onsite (WSFR#, WSFC#, KFM#)
- Annual WSF Monitoring Location - Offsite (A, B1, B2)
- Environmental Protection Zone (EPZ)
- 50m Buffer to EPZ (only the inner 30 metres to be utilised for offsetting and dedication purposes)
- Precinct Boundary
- Kings Forest Boundary

EXISTING WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT (45.29ha)

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat after development (0.41ha)
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat after development (44.88ha)

WSF COMPENSATORY HABITAT (47.36ha)

- Compensatory WSF breeding habitat (9.76ha)
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat (24.26ha)
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat (13.34ha)
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)

WSF HABITAT OFFSITE (47.98ha)

- WSF breeding habitat (0.28ha)
- WSF forage habitat (3.25ha)
- WSF potential habitat (44.45ha)

0 500m
1 : 20 000

SOURCE: JWA Site Investigations; BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling

SCALE: 1 : 20 000 @ A3

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PROJECT
Wallum Sedge Frog Management Plan
Kings Forest
Melaleuca Drive, Duranbah, NSW
Shire of Tweed

FIGURE 24

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP.dwg

TITLE
WALLUM SEDGE FROG MONITORING LOCATIONS

- The observer/s will walk transect whilst listening for calling frogs or observing non-calling individuals. All species of frog calling of observed (including pest species) will be recorded. A count will be completed of all WSF recorded within 1 m of each survey transect.
- All transect count surveys will commence at least 30 minutes after dark when wallum sedge frogs have had an adequate amount of time to emerge from their diurnal retreat sites (Lewis & Goldingay 2005). Performing surveys in this way allows for some direct comparison with long term monitoring of this species performed by Lewis and Goldingay (2005) across the broader region.
- Dip netting/tadpole searches and egg clutch surveys will be completed within any suitable areas (i.e. standing water) along the transects.
- If individual frogs are observed then their age class will be classified as adults >16 mm, sub adults <16 mm and juveniles as showing some evidence of a tail stub.
- In areas where a 50 m transect can't be established a timed 30 min search including an inspection of emergent macrophyte cover, dip netting/tadpole searches and egg clutch surveys within potential breeding habitat will be used as a substitute.
- If WSF are not heard calling and no non-calling individuals are observed at a survey site call playback will be implemented in an attempt to elicit a response.

8.3.2.2 Annual WSF Monitoring

WSF monitoring shall be completed in association with each relevant stage of the Kings Forest development on an annual basis as a responsibility of the Proponent, from the date of "commencement" of works in each relevant development stage, and will continue for a period extending to five (5) years after completion of the relevant development stage or until the retained habitat associated with the relevant development stage is dedicated, whichever is sooner.

Annual WSF monitoring will comprise three (3) sampling events undertaken per WSF breeding season (i.e. between late September and early March) during appropriate weather conditions and will be completed following the methodology described in **SECTION 8.3.2.1** above.

In the event that a suspected diseased WSF is observed during monitoring, appropriate disease management protocols (**SECTION 7.10**) must be implemented. Any records of diseased WSF will be included in the results of the Annual WSF Monitoring Report.

8.3.2.3 WSF Monitoring After Fire

In the event of an uncontrolled bushfire occurring on the Kings Forest site, an additional WSF monitoring event will be completed by a suitably qualified ecologist. This will be completed in accordance with the above methodology described in **SECTION 8.3.2.1** above to monitor the impacts of fire on the local WSF population.

8.3.3 Data Analysis

An abundance measure of WSF will be obtained by counting all WSF within 1 m of each survey transect to derive a standard unit of measure expressed as the number of frogs per 100 m^2 of habitat.

A test of significance utilising the Paired Student t-test will be completed after each monitoring event to determine if a statistically significant reduction in WSF occupancy rates has occurred (i.e. to test the hypothesis that pre-development WSF occupancy rates are higher than the post-development WSF occupancy rates). As sample sizes are relatively small, however, the value of p (typically 0.05 or 0.01 in order for significance to be determined) should be raised to something that better reflects the limitations of the sample size. A p of 0.25 as the statistical benchmark of significant change should be considered, further qualified by a requirement that a major review should be initiated only after consideration of the monitoring data from two (2) successive monitoring events.

8.3.4 Performance Criteria and Corrective Actions

TABLE 9 provides the performance criteria and targets for the WSF monitoring program. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 9
WSF MONITORING PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Performance Indicator	Corrective Action	Responsibility
For monitoring purposes, the benchmark habitat occupancy rate to be achieved for WSF populations inhabiting the Kings Forest site will be equal to or greater than baseline levels	Investigate habitat usage on the Kings Forest site. Determine which areas of potential habitat are not being utilised by the population. Consult with BCD and WSF experts to develop a strategy to improve/ facilitate the usage of the potential WSF habitat. Implement the strategy.	Ecologist
Notwithstanding the influence of events beyond the control of the Proponent, the WSFMP can only be considered successful if the extent of habitat being utilised by WSF across the Kings Forest site does not deviate significantly from the estimate of habitat occupancy rate established by baseline monitoring [#]		
Notes: [#] Generally, conclusions relating to changes in the occupancy rate across the Kings Forest site should only be made at every second monitoring event (i.e. every 2 years) by examining both the occupancy trend over the intervening two (2) year period and by a direct comparison to the occupancy estimate of two (2) years previous.		

8.4 Retained WSF Habitat

The monitoring of retained WSF habitat will be completed in accordance with performance criteria contained in the approved Kings Forest Vegetation Management Plans (VMPs). The Annual WSF Monitoring Reports will also discuss the monitoring results for the retained WSF habitat contained within the VMPs.

8.5 Compensatory Planting

8.5.1 Introduction

The monitoring of the WSF compensatory habitat will be completed during the Establishment period to enable verification of revegetation success. The monitoring program comprises the following components:

- Identification of Performance Indicators;
- Survey site and plot selection;
- Plot based surveys;
- Photo-point monitoring; and
- Targets for the performance indicators during the Establishment and Maintenance periods, including corrective actions if required.

8.5.2 Identification of Performance Indicators

The selection of Performance indicators is an important process as it enables an accurate measurement to be made of the success of the planting program. The success of the planting program is a critical step in the aims and objectives of the WSFMP i.e. to ensure the viability of the Kings Forest WSF population.

The following performance indicators (criteria) will be utilised as targets for the Establishment and Maintenance phase assessment:

- Seedling survival;
- Native canopy cover;
- Weed presence; and
- Shrub and groundcover recruitment.

8.5.3 Survey Site and Plot Selection

8.5.3.1 Background

To assess if the project completion criteria have been met, vegetation assessments will be completed using transects and quadrats (plots) at the locations shown in **FIGURE 24**. Field site selection has been based on the need to ensure representative sampling of compensatory habitat areas and types. Where compensatory habitat polygons are small in size or are not covered by transect and plot surveys, photo point monitoring will be completed in accordance with **SECTION 8.5.4.**

8.5.3.2 Plot-Based Vegetation Surveys

Plot-based vegetation surveys will be undertaken in appropriate locations within the WSF compensatory habitat planting areas. Vegetation survey sites will be permanently marked (i.e. star pickets or wooden stakes) and the end positions identified on a sitemap using a hand-held Global Positioning System (GPS).

The plot-based vegetation survey will be based on a 20 m × 20 m plot (or 400 m^2 equivalent for linear areas).

The minimum number of plots/transects that must be sampled for each vegetation zone is detailed in **TABLE 10** below.

TABLE 10
MINIMUM NUMBER OF PLOTS AND TRANSECTS REQUIRED IN EACH PLANTING POLYGON

Planting Polygon Area (ha)	Minimum Number of Plots/Transects
<2	1 plot/transect
>2–5	2 plots/transects
>5–20	3 plots /transects

Survey plots should be established around a central 50 m transect as follows:

a) One 400 m^2 plot (standard 20 m x 20 m) is used to assess all performance indicators as set out in **TABLE 11** below.

b) Five 1 m^2 sub-plots can be added to the program for the first monitoring event to assess groundcover recruitment for the plot. A decision as to the utility of these plots can be made after the first or second monitoring events.

The assessor will assess the plot for the information contained in **TABLE 11**.

TABLE 11
VEGETATION SURVEY DATA TO BE COLLECTED

Attribute	Survey requirement
Seedling survival	The first monitoring event will require a count of the total number of seedlings, individual species counts and a count of the number of dead or dying seedlings of each species. Subsequent monitoring events will only require counts of dead or dying seedlings and their species identification.
Native Canopy Cover	Estimate the % foliage cover across the plot. Cover should be recorded in decimals if <1% (0.1, 0.2…), or whole numbers up to 5% (1,2,3), or to the nearest 5% where >5% cover (5,10,15,20,25…)
Weed Presence	Estimate the % cover in the plot of individual weed species. Count the number of each species.
Shrub and Groundcover Recruitment	Identify native shrub and groundcover species, their percentage cover and the numbers recruiting. The identification of individual recruits may not be possible when they first appear. These should be recorded as unidentified until the next or subsequent monitoring events.

The full species name (*Genus species*) must be recorded for all native species, unless insufficient diagnostic plant material is present, in which case the genus name followed by a species number must be used.

8.5.4 Photo Point Monitoring

Photo-monitoring points will be completed as a means of demonstrating compliance or otherwise with performance criteria. Permanent photo stations are to be located in each rehabilitation polygon. Where transects are to be established, photo points are to be located on each transect. Four (4) photos are to be taken from each photo point. Photos are to be taken to the north, south, east and west. Photos should be labelled with the:

- Transect code or photo point code;
- Direction of view; and
- Date and time.

Photos must be supplied in the Annual WSF Monitoring Reports in a form of prints no smaller than 4" x 6" and must be colour.

8.5.5 Timing of Monitoring Visits

Site visits should occur:

- To set up monitoring transects and quadrats and collect baseline data after 1st event of secondary weeding; and
- Six-monthly until the establishment period performance criteria are met; and
- Then annually during the maintenance period.

8.5.6 Performance Criteria and Corrective Actions

TABLE 12 provides the performance criteria and targets for the proposed rehabilitation strategy. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 12
COMPENSATORY HABITAT PERFORMANCE CRITERIA AND CORRECTIVE ACTIONS

Performance Indicator	Target – Establishment Period[1]	Target – Maintenance Period[2]	Corrective Actions
Survival and continued growth of seedlings (i.e. planted stock).	>90% survival of plantings during all monitoring events.	>90% survival of plantings during all monitoring events.	Irrigation if required. Replacement if planting required.
Establishment of native ground cover within revegetation areas (including at the entrances to underpasses where appropriate).	Plantings substantially established.[3]	Foliage Projective Cover (FPC) (%) of native groundcovers assessed using eye estimates or photo points: • >60% after 3 years; and • <80% after 5 years	Monitoring and maintenance period must be extended until the targets are met.
All identified weeds controlled to an acceptable level in accordance with the approved Kings Forest Weed Management Plans.	Foliage Projective Cover (FPC) (%) of weeds assessed using eye estimates or photo points reduced to <10% within first year.	Foliage Projective Cover (FPC) (%) of weeds assessed using eye estimates or photo points: • FPC of weeds reduced to <10% within first year; • <10% in second year; • <5% in the third year and consecutive years.	Weed control as necessary.
Natural recruitment of native species within rehabilitation areas (including at the entrances to underpasses).	Evidence of natural recruitment.	Increasing natural recruitment.	Additional/supplementary planting if required.

Notes:
[1] "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.
[2] "Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.
[3] "Substantial establishment" of the WSF habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and an independent restoration ecologist approved by the Secretary has provided a short report confirming that the plantings are established."

8.6 Infrastructure, Construction and Operational Management

8.6.1 Introduction

A wide variety of matters not related to matters in **SECTIONS 8.2 to 8.5** will require monitoring. These are issues that have not necessarily been mandated by consent conditions, but which are necessary for the successful implementation of the WSFMP. The Environmental Officer will be responsible for the monitoring of relevant construction activities and infrastructure during and after construction.

8.6.2 Monitoring Requirements

Relevant infrastructure consists of temporary and permanent fauna exclusion fencing and signage. The maintenance of this infrastructure is essential if the aims and objectives of the WSFMP are to be achieved i.e. preventing access by WSF to the development footprint and alerting Kings Forest residents and visitors to the residence of WSF in nearby bushland and their responsibilities in ensuring the safety and persistence of this population.

Monitoring activities during the construction/installation of temporary and/or permanent fences and signage should be completed by the Environmental Officer to ensure that:

- There has been no clearing of WSF habitat;
- There have been no isolated patches of compensatory WSF created;
- There have been no barriers to wildlife movement created;
- Until permanent fencing and underpass infrastructure is completed, temporary fencing is not to prevent WSF accessing habitat on the site;
- Fencing occurs on both sides of any road where it traverses an environmental area;
- There is sufficient functional maintenance zone each side of any fauna exclusion fence;
- Vandal proof signs are erected at regular intervals advising of the importance of fauna exclusion fences and their maintenance; and
- All fence damage is reported promptly and repaired in a timely fashion.

Visual inspections of relevant infrastructure by the Environmental Officer will be completed on a monthly basis until the land occupied by the infrastructure is dedicated to either TSC or BCD. Where damage or other failures to infrastructure are observed a report, including a photograph, will be prepared within 24 hours in accordance with Condition 76 of MP 08_0194. The damage or failure will be corrected within 48 hours of the reporting of the damage or failure.

In addition, the Environmental Officer will be responsible for monitoring the following relevant matters:

- Implementation of an induction/education program for construction personnel;
- All contractors provided with protocols to be followed if an animal is killed or injured; and

- Engagement of the community with local WSF issues and management.

Reporting on these matters will be included in the Annual WSF Monitoring Reports to be provided to DPI&E, BCD and TSC.

8.6.3 Performance Criteria and Corrective Actions

TABLE 13 provides the relevant performance criteria for the above additional items requiring monitoring to determine the successful implementation of the WSFMP. Corrective actions are provided that are to be implemented if performance criteria are not met.

TABLE 13
PERFORMANCE CRITERIA FOR CONSTRUCTION AND OPERATIONAL ISSUES TO BE MONITORED AND CORRECTIVE ACTIONS

Performance Indicator	Monitoring Frequency	Corrective Action	Responsibility
Exclusion fences and signage have been correctly installed (refer **SECTION 7.6**), remain effective and well maintained	Monthly until the land occupied by the infrastructure is dedicated to either TSC or BCD	Alternative fence design/location may be required, and potentially habitat restoration works where it is determined that there have been barriers created to wildlife movement, there is insufficient functional maintenance zone each side of any fauna exclusion fence, there has been clearing of WSF habitat, and/or there have been isolated patches of compensatory WSF habitat areas created. Any damage to fences or signage will be reported to the Site Manager and prompt immediate repair, within two (2) working days of the discovery of the damage, will be completed by site personnel or independent contractors as determined by the Site Manager. Repeated instances of vandalism to infrastructure will prompt the implementation of mobile security patrols by a commercial security specialist.	Principal Contractor/ Ecologist
High rates of diseased WSF are not detected	As required	Disease condition assessments will be carried out during the baseline monitoring assessment and in every annual assessment thereafter. Five (5) years after commencement of construction consultation will occur with relevant BCD scientists and other WSF experts as necessary or convenient. A report will be completed. If expert opinion considers that disease occurrence is over and above that which would be expected in a wild population of WSF or they consider that there has been a significant increase in diseased animals since the baseline assessment, then advice will be obtained from appropriate BCD scientists and/or other WSF experts as considered necessary or appropriate. The advice will be implemented.	Ecologist
Bushfire related deaths or	As required	If a bushfire occurs within land owned by Project 28 an investigation will	Project 28/

Performance Indicator	Monitoring Frequency	Corrective Action	Responsibility
damage to habitat are minimised		be triggered to assess damage to WSF and their habitat on the Kings Forest lands. The investigation will include a survey of the WSF population occurring on the Kings forest site (see **SECTION 8.3** for Methodology). Consultation will occur with RFS, TSC and BCD to determine the cause of the fire. A report will be prepared after the consultation. The report will address causes, impacts and proposed changes, if considered necessary, to Bushfire management plans.	Ecologist
Implementation of an induction/education program for construction personnel.	Monthly	Any construction personnel that has not completed the induction/education program are to cease work until completed.	Environmental Officer
All contractors provided with protocols to be followed if a native animal is killed or injured.	Monthly	To be provided as part of the induction/education program (see above).	Environmental Officer
Engagement of the community with local WSF issues and management.	As required	Appropriate community liaison/consultation completed (**SECTION 7.14**) as necessary.	Proponent/ Environmental Officer

8.7 Reporting

8.7.1 Baseline WSF Monitoring Report

Subsequent to the completion of baseline WSF monitoring, a report will be prepared outlining the results. The report will be provided to the Commonwealth DAWE, NSW DPI&E, NSW BCD and TSC and form the baseline for future monitoring. The baseline monitoring report will be available on the JWA website for twelve (12) months (www.jwaec.com.au/).

8.7.2 Annual WSF Monitoring Report

8.7.2.1 Introduction

An Annual WSF Monitoring Report is to be prepared and will include the results of monitoring of the following items (as detailed in the following sections):

- Water quality;
- WSF occupancy;
- Retained WSF habitat monitoring (to be completed as part of the approved Kings Forest Vegetation Management Plans);
- Compensatory planting; and
- Infrastructure, construction and operational management.

The Annual WSF Monitoring Reports will also include a reconciliation against all relevant State and Commonwealth conditions of approval, and a discussion of findings and any recommendations for corrective actions.

Each Annual WSF Monitoring Report will be provided to the Commonwealth DoE, NSW DPI&E, NSW BCD and TSC and will be available on the JWA website for a period of 12 months (www.jwaec.com.au/).

8.7.2.2 Water Quality

Water quality monitoring of retained WSF breeding habitat adjacent to each relevant stage of development will be completed in accordance with the methodology contained in the Overall Water Management Plan (G&S 2020b). The Annual WSF Monitoring Report will include the results of the relevant water quality monitoring, discussion of the results against the Monitoring Performance Criteria identified in **SECTION 8.2.3**, and the successful implementation of management actions (with reference to any relevant Corrective Actions).

8.7.2.3 WSF Occupancy

The Annual WSF Monitoring Report will include the results of the annual WSF monitoring, discussion of the results against the Monitoring Performance Criteria identified in **SECTION 8.3.4,** and the successful implementation of management actions (with reference to any relevant Corrective Actions)**.** The information provided should include, but not necessarily be limited to:

1. An aim will be to provide a scientifically based (repeatable) comparison of WSF occupancy rates with the baseline data;
2. A presentation of the results of any pre-clearing surveys and relevant management actions as required by **SECTION 7.2.3.2;**
3. A presentation of the results of the WSF survey for each particular monitoring event;
3. A detailed discussion of the results of each particular monitoring event;
4. A detailed comparison with the baseline parameters and with previous annual survey data;
5. An analysis of the occupancy rate and any statistical changes to this rate over time;
6. A statement of compliance with the Monitoring Performance Criteria identified in **SECTION 8.3.4;**
7. Successful implementation of management actions (with reference to any relevant Corrective Actions detailed in **SECTION 8.3.4**);
8. Adaptive management procedures to ensure that the separate management plans remain relevant and effective; and
9. An evaluation of the effectiveness of fencing, improvements in habitat quality (fixed photo points), success of replanting efforts, community education, bushfire management etc.

8.7.2.4 Retained WSF Habitat

The monitoring of retained WSF habitat will be completed in accordance with the methodology contained in the approved Kings Forest Vegetation Management Plans (VMPs). The Annual WSF Monitoring Report will include the results of the retained WSF habitat monitoring, discussion of the results against the Monitoring Performance Criteria identified in the approved Kings Forest Vegetation Management Plans (VMPs), and the successful implementation of management actions (with reference to any relevant Corrective Actions).

8.7.2.5 Compensatory Planting

The Annual WSF Monitoring Report will include the results of the annual compensatory planting monitoring, discussion of the results against the Monitoring Performance Criteria identified in **SECTION 8.5.6,** and the successful implementation of management actions (with reference to and relevant Corrective Actions). The information provided should include, but not necessarily be limited to:

- Works undertaken (i.e. A summary of Bush Regenerators daily reports);
- The progress of the compensatory planting areas against the performance indicators;
- Progress of compensatory planting areas using photos and tables showing the results of the monitoring visits;
- Any problems since the previous inspection (death of a significant number of seedlings, broken fences etc.) and what effects these issues have had on the regeneration area;

- Success or failure of measures implemented to rectify previously identified problems; and
- Measures to be taken to rectify new problems.

8.7.2.6 Infrastructure, Construction and Operational Management

The Annual WSF Monitoring Report will include a report prepared by the Environmental Officer detailing the results of all inspections and incidents within the previous twelve (12) month period, discussion of the results against the Monitoring Performance Criteria identified in **SECTION 8.6.3,** and the successful implementation of management actions (with reference to and relevant Corrective Actions)**.** Reports by the Environmental Officer will be required until the land containing the infrastructure is dedicated to either TSC or BCD.

8.7.3 Environmental Audit Reports

The requirement for an Audit report does not require additional monitoring to that which is required for the WSFMP, therefore, the Annual WSF Monitoring Report will provide the basis for the environmental audits report.

In accordance with Major Project Condition 49, the proponent will engage a suitably qualified independent environmental consultant, reviewed by TSC and approved by the Secretary to complete an environmental audit for each part of the Potential Council Land (PCL). The Audit will monitor the effectiveness of the environmental works (repair, enhancement and/or maintenance) and will aim to confirm that the establishment period and any relevant maintenance period criteria have been met.

The Initial Audit will be completed within three (3) months of the establishment period. Subsequent Audits will be completed within three (3) months of the first and third anniversaries, and then every two (2) years until the affected lands have been transferred into public ownership.

An Environment Audit report will be completed by the independent environmental consultant within six (6) weeks of completing each audit, or as otherwise agreed by the Secretary. The Environment Audit report will be submitted to the Secretary by the Proponent along with a response to any recommendations contained in the audit report.

Within three (3) months of submitting an audit report to the Secretary, the Proponent shall review and if necessary revise the relevant management plans and undertake additional management actions as required under this approval to the satisfaction of the Secretary.

Any supplementary or approved adaptive management works deemed necessary by the Audit shall be promptly undertaken once the need is identified.

9 IMPLEMENTATION SCHEDULES

9.1 Introduction

Specific management actions discussed in **SECTION 7** will be triggered and completed on a precinct by precinct basis. **TABLES 14 – 16** below, summarise all pre-construction, construction and operational phase management actions and identify the associated personnel, and timing. Performance measures to be achieved during the 'establishment period' and 'maintenance period' of the project (as defined within the Project approval MP08_0194) are also included in **TABLES 14 – 16** below where appropriate.

As discussed in **SECTION 7.6.2** temporary and permanent exclusion fencing will be utilised where necessary to effectively separate WSF and their habitat from the development and its related threats. It should be noted however that the location of temporary fencing outside of Stage 1 (i.e. Precincts 1, 2, Part of 4 and 5) will be determined at the detailed design stage for each precinct and will be addressed in revised versions of the WSFMP**.** Similarly, the locations of permanent fencing within Precincts 12 - 14 will be determined at the detailed design stage and will be addressed in revised versions of the WSFMP.

Precinct specific management actions within each precinct (excluding Precincts 12 - 14) are depicted in **FIGURES 25 - 29** as follows:

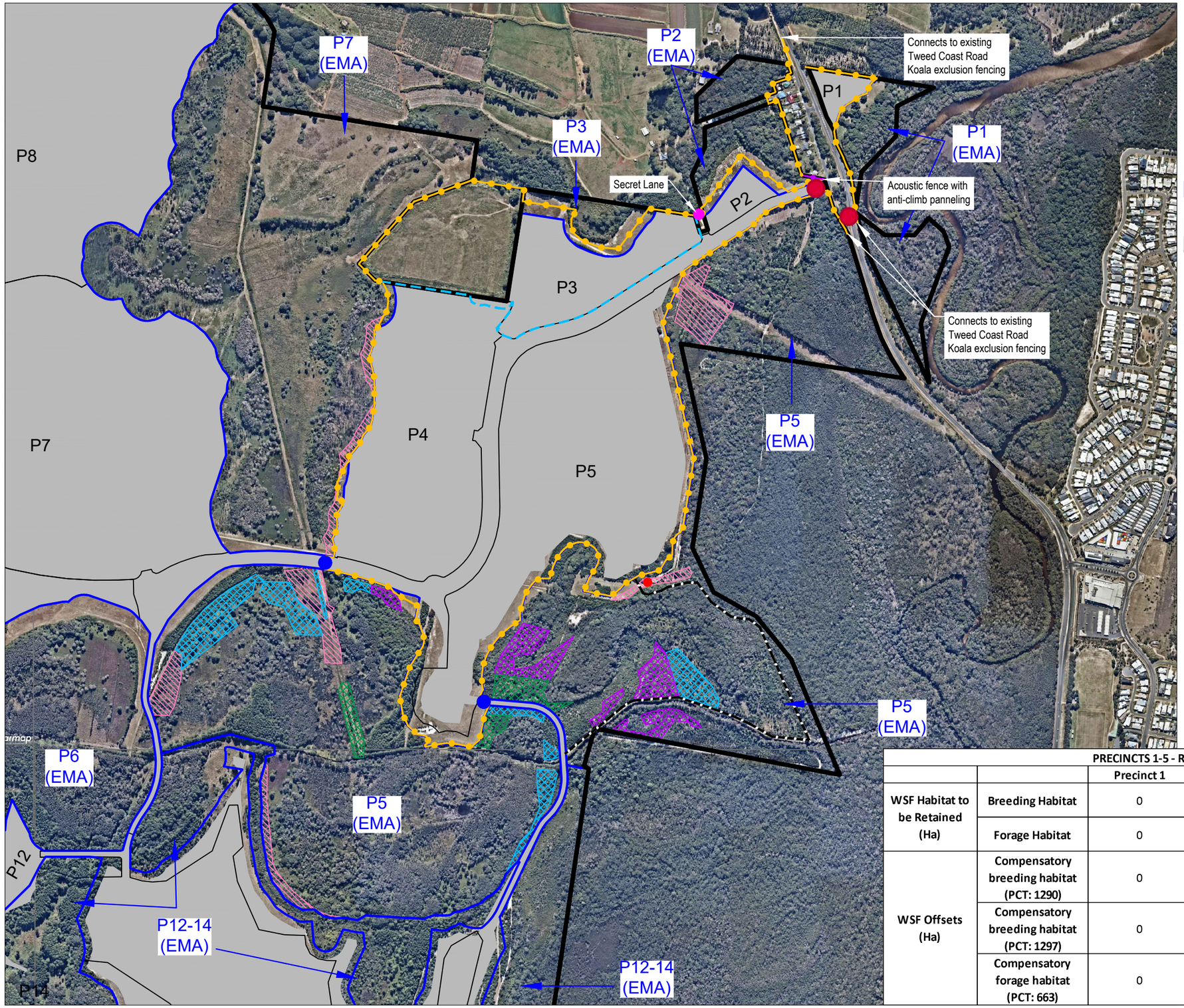
- **FIGURE 25** – Management actions to be implemented in Precincts 1 - 5;
- **FIGURE 26** – Management actions to be implemented in the East-West Corridor;
- **FIGURE 27** - Management actions to be implemented in Precinct 6;
- **FIGURE 28** - Management actions to be implemented in Precincts 7 - 8; and
- **FIGURE 29** - Management actions to be implemented in Precincts 9 - 11.

As discussed in **SECTION 3** and **SECTION 7.6.1,** retained vegetation and habitat areas across the site generally occur within Environmental Protection Zones (EPZs) and associated buffers. To assist in identifying the staging of rehabilitation and management actions, these EPZ and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs) on the above plans.

9.2 Development Phases

Management actions outlined in this WSFMP will be implemented in three (3) phases:

- **Pre-construction Phase** – The pre-construction phase of the development refers to all preliminary works required to be completed prior to commencement of construction e.g. preliminary survey work, baseline monitoring and commencement of compensatory habitat rehabilitation works.
- **Construction Phase** - The construction phase of the development refers to works completed to construct the development and includes clearing vegetation, bulk earthworks and the construction of infrastructure.
- **Operation Phase** - The operational phase of the development will commence post-construction and after registration of the plan/s of subdivision for each precinct.



N

LEGEND

- Environmental Management Area (EMA) Boundary (#1)
- Development Footprint
- Precinct Boundary
- Kings Forest Boundary
- Existing Track to be Maintained

PROPOSED FENCING PLAN (#2)

- Permanent exclusion fencing
- Acoustic fence with anti-climb panneling
- Temporary Koala exclusion fencing during Stage 1
- Indicative underpass location
- Permanent grid
- Temporary grid

EXISTING WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat after development
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat after development

WSF COMPENSATORY HABITAT

- Compensatory WSF breeding habitat
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)

PRECINCTS 1-5 - RETAINED WSF HABITAT & WSF OFFSETS

		Precinct 1	Precinct 2	Precinct 3	Precinct 4	Precinct 5
WSF Habitat to be Retained (Ha)	Breeding Habitat	0	0	0	0	0.03
	Forage Habitat	0	0	0	0	4.54
WSF Offsets (Ha)	Compensatory breeding habitat (PCT: 1290)	0	0	0	0	1.78
	Compensatory breeding habitat (PCT: 1297)	0	0	0	0	4.61
	Compensatory forage habitat (PCT: 663)	0	0	0	0	3.13

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
The locations of temporary fencing between precincts and any additional temporary fencing will be determined at the detailed design stage for each precinct and will be addressed in a revised version of the WSFMP.

0 300m
1 : 10 000

SOURCE: JWA KPOM (2020); BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling
SCALE: 1 : 10 000 @ A3

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Shire of Tweed

FIGURE 25

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_WSFMP Precincts.dwg

TITLE
WALLUM SEDGE FROG MANAGEMENT ACTIONS
- PRECINCTS 1-5



LEGEND

- Environmental Management Area (EMA) Boundary (#1)
- Development Footprint
- Precinct Boundary
- Kings Forest Boundary
- Maintenance Zone - 3m

PROPOSED FENCING PLAN (#2)

- Permanent exclusion fencing
- Indicative location of temporary exclusion fencing between Precincts to be removed once fencing in adjacent precinct is installed (#)

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
The locations of temporary fencing between precincts and any additional temporary fencing will be determined at the detailed design stage for each precinct and will be addressed in a revised version of the WSFMP.

0 150m
1 : 5000

SOURCE: JWA KPOM (2020); BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling

SCALE: 1 : 5000 @ A3

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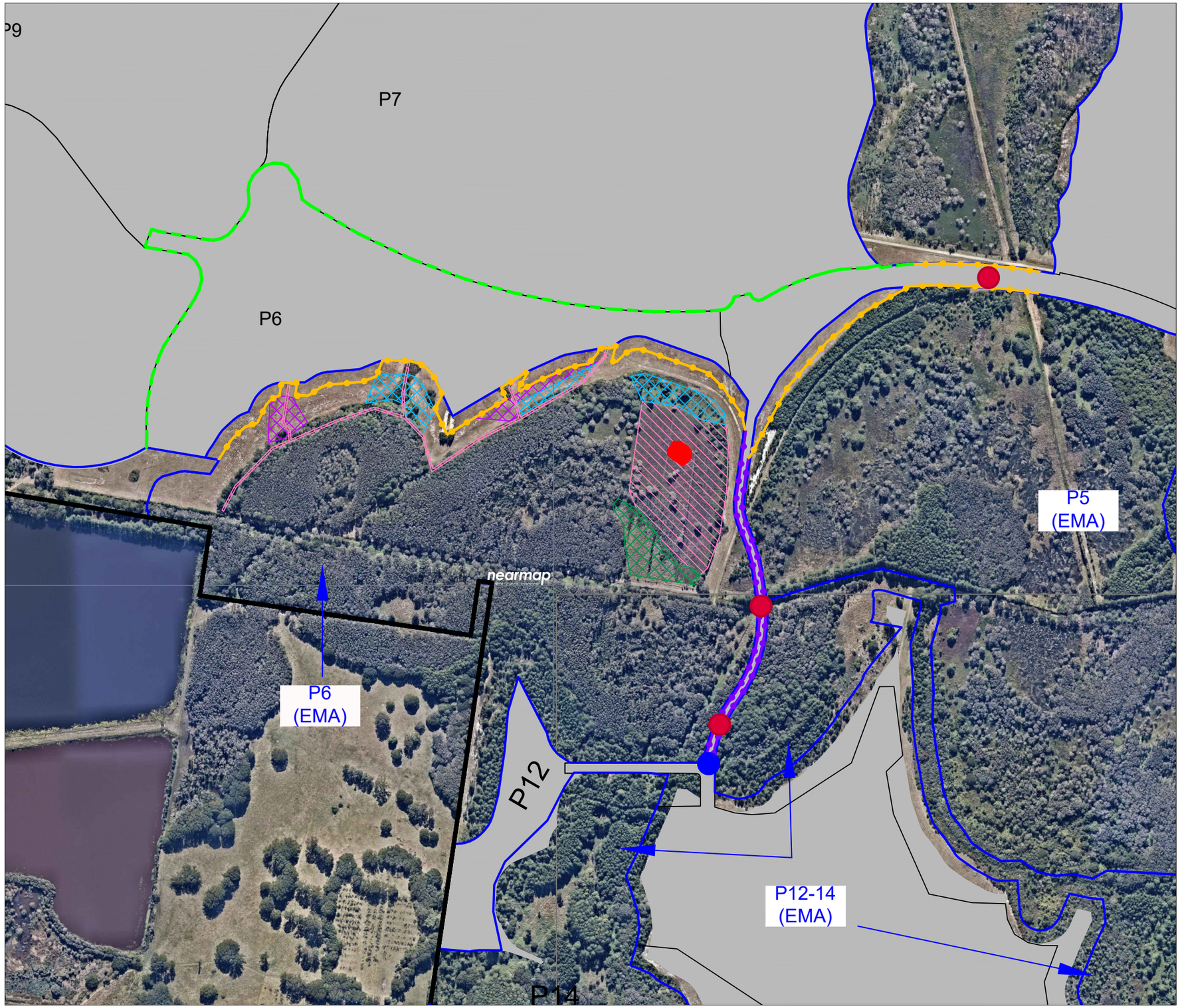
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FIGURE 26

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_KPOM Precincts.dwg

TITLE
WALLUM SEDGE FROG MANAGEMENT ACTIONS - EAST-WEST CORRIDOR



N

LEGEND

- Environmental Management Area (EMA) Boundary (#1)
- Development Footprint
- Precinct Boundary
- Kings Forest Boundary

PROPOSED FENCING PLAN (#2)

- Permanent exclusion fencing
- Temporary exclusion fencing to be replaced with permanent exclusion fencing at the end of the construction phase of the Precinct
- Indicative location of temporary exclusion fencing between Precincts to be removed once fencing in adjacent precinct is installed
- Temporary grid
- Indicative underpass location

EXISTING WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat after development
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat after development

WSF COMPENSATORY HABITAT

- Compensatory WSF breeding habitat
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)

PRECINCT 6 - RETAINED WSF HABITAT & WSF OFFSETS		
WSF Habitat to be Retained (Ha)	**Breeding Habitat**	0.09
	Forage Habitat	2.90
WSF Offsets (Ha)	**Compensatory breeding habitat (PCT: 1290)**	0.67
	Compensatory breeding habitat (PCT: 1297)	1.07
	Compensatory forage habitat (PCT: 663)	0.51

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
The locations of temporary fencing between precincts and any additional temporary fencing will be determined at the detailed design stage for each precinct and will be addressed in a revised version of the WSFMP.

0 150m
1 : 5000

SOURCE: JWA KPOM (2020); BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling

SCALE: 1 : 5000 @ A3

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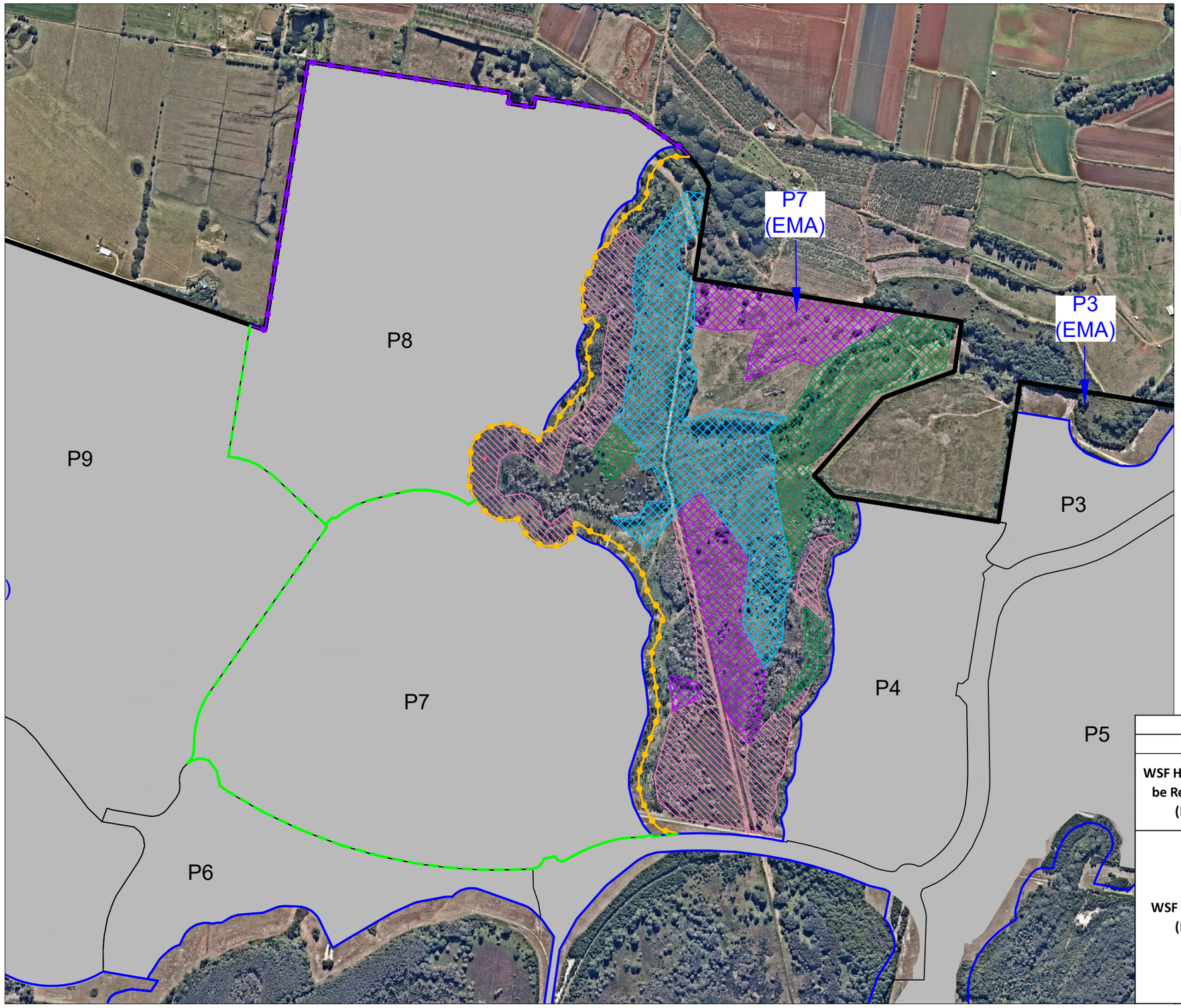
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FIGURE 27

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_KPOM Precincts.dwg

TITLE
WALLUM SEDGE FROG MANAGEMENT ACTIONS
- PRECINCT 6



N

LEGEND

- Environmental Management Area (EMA) Boundary (#1)
- Development Footprint
- Precinct Boundary
- Kings Forest Boundary

PROPOSED FENCING PLAN (#2)

- Permanent exclusion fencing
- Temporary exclusion fencing to be replaced with permanent exclusion fencing at the end of the construction phase of the Precinct
- Indicative location of temporary exclusion fencing between Precincts to be removed once fencing in adjacent precinct is installed

EXISTING WSF HABITAT THAT WILL REMAIN AS HABITAT AFTER DEVELOPMENT

- WSF breeding habitat with suitable groundwater conditions to remain as breeding habitat after development
- WSF forage habitat with suitable groundwater conditions to remain as forage habitat after development

WSF COMPENSATORY HABITAT

- Compensatory WSF breeding habitat
  - depth to groundwater = 0m to -0.2m
  - sedgeland plantings (PCT 1290 - Soft Twig-rush Sedgeland of North Coast Wallum Swamps)
- Compensatory WSF breeding habitat
  - depth to groundwater = -0.2m to -1m
  - wet heath plantings (PCT 1297 - Wet heathland and shrubland of coastal lowlands of the NSW North Coast Bioregion)
- Compensatory WSF forage habitat
  - depth to groundwater = -1m to >-2m
  - dry heath plantings (PCT 663 - Banksia dry shrubland on coastal sands of the NSW North Coast Bioregion)

PRECINCTS 7-8 - RETAINED WSF HABITAT & WSF OFFSETS

		Precinct 7	Precinct 8
WSF Habitat to be Retained (Ha)	Breeding Habitat	0	0
	Forage Habitat	12.82	0
WSF Offsets (Ha)	Compensatory breeding habitat (PCT: 1290)	7.31	0
	Compensatory breeding habitat (PCT: 1297)	12.24	0
	Compensatory forage habitat (PCT: 663)	8.27	0

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
The locations of temporary fencing between precincts and any additional temporary fencing will be determined at the detailed design stage for each precinct and will be addressed in a revised version of the WSFMP.

0 150m
1 : 6000

SOURCE: JWA KPOM (2020); BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling
SCALE: 1 : 6000 @ A3

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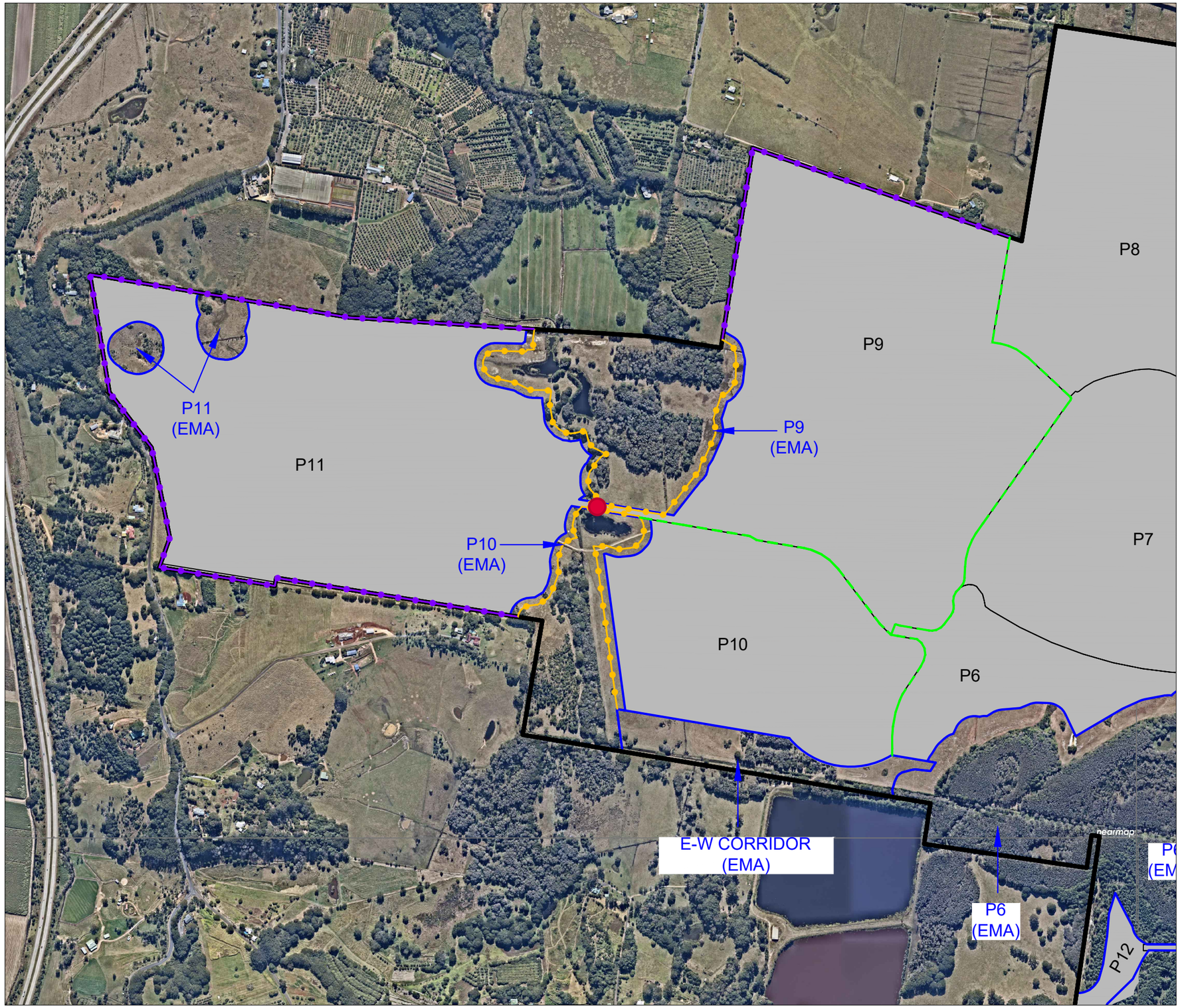
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FIGURE 28

PREPARED: BW
DATE: 07 April 2020
FILE: N97017_KPOM Precincts.dwg

TITLE
WALLUM SEDGE FROG MANAGEMENT ACTIONS
- PRECINCTS 7-8



LEGEND

- Environmental Management Area (EMA) Boundary (#1)
- Development Footprint
- Precinct Boundary
- Kings Forest Boundary

PROPOSED FENCING PLAN (#2)

- Permanent exclusion fencing
- Temporary exclusion fencing to be replaced with permanent exclusion fencing at the end of the construction phase of the Precinct
- Indicative location of temporary exclusion fencing between Precincts to be removed once fencing in adjacent precinct is installed
- Indicative underpass location

N

Note 1:
To assist in identifying the staging of rehabilitation and management actions, EPZs and buffer areas have been associated with a relevant development precinct and are collectively titled as Environmental Management Areas (EMAs).

Note 2:
The locations of temporary fencing between precincts and any additional temporary fencing will be determined at the detailed design stage for each precinct and will be addressed in a revised version of the WSFMP.

0 250m
1 : 8000

SOURCE: JWA KPOM (2020); BEC 2014 Habitat Mapping; Gilbert & Sutherland 2014 Groundwater Modelling

SCALE: 1 : 8000 @ A3

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Shire of Tweed

FIGURE 29

PREPARED: BW
DATE: 07 April 2020
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TITLE
WALLUM SEDGE FROG MANAGEMENT ACTIONS
- PRECINCTS 9-11

Commencement of construction is defined under Concept Plan Approval Condition B7 and Major Project Approval A13 as any physical works including clearing vegetation, the use of heavy duty equipment for the purpose of breaking ground for bulk earthworks, or infrastructure for the proposed project.

TABLES 14 - 16 detail the specific management actions that will be implemented within each development precinct during the pre-construction phase, construction phase and operational phases respectively.

9.3 Roles and Responsibilities

The successful implementation of this WSFMP requires a number of key personnel to complete various roles. As many of the contractors for the project are yet to be appointed, these will be specified and list of key contacts for the project contained in revised versions of the WSMP (in accordance with Condition C2 of the Concept Plan Approval 06_0318, MOD 6). A summary of key roles/personnel responsible for the management strategies identified in **TABLES 14 - 16** below includes:

Proponent
Project 28 Pty Ltd is the Proponent for the works as the approval holder.

Construction/Site Manager
The Construction/Site Manager (to be appointed) is a representative of the project team (typically the project engineer) and is responsible for coordinating the project consultants and construction contractor.

Principal Contractor
The Principal contractor (to be appointed) is responsible for the management of all activities involved in the construction phase of the development.

Site Supervisor
The Site Supervisor is a representative of the Principal Contractor (to be appointed) and responsible for overseeing all pre-clearing, clearing and construction activities are undertaken in accordance with the WSFMP and subsequent environmental management documentation.

Ecologist
For the purposes of this WSFMP means a qualified ecologist with appropriate training and at least five (5) years of experience in undertaking flora and fauna surveys.

Fauna Spotter Catcher
For the purposes of this WSFMP means a suitably qualified ecologist/fauna handler agreed to by the Department. It is noted that the Fauna Spotter Catcher must hold a relevant scientific license and ethics approvals and a copy of these permits along with their contact details will be passed on to the Site Supervisor. The engaged Fauna Spotter Catcher will be responsible for the management/relocation of native fauna during any clearing activities.

Bush Regeneration Company

For the purposes of this WSFMP means a suitably qualified Bush Regeneration Company that has demonstrable experience in the rehabilitation or revegetation of native vegetation communities in the Tweed region. It is noted that the Bush Regeneration Company must hold the necessary license and approvals. The engaged Bush Regeneration Company will be responsible for rehabilitation and weed management works on the site.

9.4 Implementation Table – Pre-construction Phase

TABLE 14
WSF MANAGEMENT STRATEGIES – PRE-CONSTRUCTION PHASE

Management Strategy	Management Action	Responsibility	Performance Measure
Environmental Officer(s)/Community Liaison Officer	Appointment of Environmental Officer(s)/ Community Liaison Officer in accordance with **MP08_0194 Condition 70.** Signage is to be erected clearly advising the Environmental Officer(s)/Community Liaison Officer details and contact number.	The Proponent	Environmental Officer(s)/ Community Liaison Officer appointed, and signage erected and maintained as detailed in **SECTION 7.14.3 p**rior to commencement of bulk earthworks*.
Baseline water quality monitoring	Baseline water quality monitoring will be completed prior to construction to establish appropriate discharge criteria for the construction phase.	Suitably Qualified Consultant	Baseline monitoring completed prior to the commencement of construction* in accordance with **SECTION 8.2.1.**
Baseline WSF survey and report	Baseline WSF monitoring will be completed prior to the commencement of works within each relevant stage of the development in accordance with **MP08_0194 Condition 37**.	Qualified Ecologist	Baseline monitoring and reports completed prior to the commencement of construction***** in accordance with **SECTION 8.3.2.1** and **SECTION 8.7.1.** Reports sent to Secretary and TSC.
Education of construction personnel	A construction personnel induction program shall be developed and implemented by the Proponent to highlight the potential presence of WSF on the site and ensure the awareness of WSF-related issues and of responsibilities and procedures in relation thereto.	Principal Contractor / Site Supervisor	Annual report prepared containing the induction procedure and personnel inducted in accordance with **SECTION 7.2.1**.
Survey plans and permanent marking of dedication areas	Mark the boundaries of proposed/future dedication areas as required by **MP08_0194 Condition 3.**	Registered Surveyor	Report prepared prior to commencement of construction* containing survey plans showing the boundaries of the proposed dedication areas in accordance with **SECTION 7.10**. Permanent pegs placed in the ground. Survey plans lodged with the NSW DPI&E.
Management of retained WSF habitat	Retained WSF habitat managed.	Suitably Qualified Bush Regeneration Company	Management Plans to be approved prior to commencement of construction* in each Precinct (**SECTION 7.7**). Weeds will be managed on an ongoing basis in accordance with protocols contained in **SECTION 7.8** and **APPENDIX 4** and the following relevant VMP's and WMP's: • Kings Forest Vegetation Management Plans (VMP) (JWA 2020a, b, c); and • Kings Forest Weed Management Plans (WMP) (JWA 2020k, l, m). Annual monitoring reports provided until the land is dedicated to either TSC or BCD.
Pre-clearing WSF surveys	Pre-clearance surveys for WSF to be completed in accordance with **EPBC_2012/6328 Condition 18.**	Fauna Spotter Catcher	Pre-clearing WSF surveys are completed prior to commencement of construction* in each Precinct in accordance with the protocols described in **SECTION 7.2.3**. Pre-clearing report/s prepared.
Fire Management	Implementation of the Bushfire Management Plan (BushfireSafe 2020).	The Proponent (until ownership is transferred)	The Kings Forest Bushfire Management Plan is to be implemented in accordance with **SECTION 7.13.**
Compensatory WSF creation and maintenance	WSF compensatory habitat areas to be clearly marked on the site.	Suitably Qualified Bush Regeneration Company	Each WSF compensatory habitat area will be identified and marked in the field in accordance with **SECTION 7.8.4** prior to commencement of construction* in each Precinct.
	WSF compensatory habitat rehabilitation works in accordance with **EPBC_2012/6328 Condition 13**.	Suitably Qualified Bush Regeneration Company	WSF compensatory habitat planting completed for Stage prior to commencement of construction*. Planting details and establishment period^ targets detailed in **SECTION 7.8** and **SECTION 8.5.6.** All plantings to be monitored during the maintenance period# in accordance with the protocols contained in **APPENDIX 4**. Results to be included in the Annual WSF Monitoring Report.
Environmental Audits	Environmental Audits completed in accordance with **MP08_0194 Condition 49.**	The Proponent	Initial Audit will be completed within three (3) months of the establishment period^ in

Management Strategy	Management Action	Responsibility	Performance Measure
		/ Independent Ecological Consultant	accordance with **SECTION 8.7.3.** Subsequent Audits will be completed within three (3) months of the first and third anniversaries, and then every two (2) years until the affected lands have been transferred into public ownership as discussed in **SECTION 8.7.3.**
Payment of bond and/or bank guarantee	In accordance with **MP08_0194 Condition 50, a** bond of 135% of the estimated maintenance and monitoring costs for the implementation of environmental management is to be lodged with TSC.	The Proponent	Prior to commencement of bulk earthworks for each precinct, and every two (2) years thereafter, a cash bond or bank guarantee shall be lodged with TSC to ensure that the relevant environmental management plans for the associated Potential Council Land (PCL) are implemented (**SECTION 7.6.7**). The above cash bond or bank guarantee will be refunded at the end of each two (2) year maintenance period, following the Secretary's written approval of the environmental audit (refer to **SECTION 8.6.5**). Bi-annual bonding will no longer be required following the Proponent providing evidence to the Secretary that the final audit has been conducted in accordance with **MP08_0194 Condition 49** (**SECTION 8.7.3**) which demonstrates that the relevant works have been completed and written evidence is provided to the Secretary that the lands have been transferred into public ownership.

Notes:

^ "Establishment period" means the period during which initial environmental repair, restoration and monitoring works required by the relevant approved environmental management plan(s) are undertaken. The establishment period ends when the works meet the establishment period performance criteria, as defined by the relevant approved environmental management plans, to the satisfaction of the Secretary.

"Maintenance period" means the period of environmental management and monitoring works commencing immediately after the end of the establishment period. Maintenance period works are to be carried out in accordance with the relevant performance criteria (as defined by the relevant approved environmental management plan) to the satisfaction of the Secretary.

* "Commencement of construction" for the purpose of this project, **CP06_0318 Condition B7** and **MP08_0194 Condition A13**, is taken to mean any physical works including clearing vegetation, the use of heavy duty equipment for the purpose of breaking ground for bulk earthworks, or infrastructure for the proposed project.

9.5 Implementation Table – Construction Phase

TABLE 15
WSF MANAGEMENT STRATEGIES – CONSTRUCTION PHASE

Management Strategy	Management Action	Responsibility	Performance Measure
Environmental Officer(s)/Community Liaison Officer	Environmental Officer(s)/ Community Liaison Officer to oversee environmental compliance until all conditions have been satisfied as required by **MP08_0194 Condition 70.** Environmental Officer(s)/ Community Liaison Officer to consult with potentially affected property owners and the department before and during construction works and shall respond to complaints of an environmental impact nature. Environmental Officer(s)/ Community Liaison Officer must submit a report to the Secretary Director-General within 3 weeks of the completion of each earthworks stage detailing the project's compliance with relevant conditions, management plans and progress onsite.	Environmental Officer(s)/Community Liaison Officer	A report submitted to the Secretary Director-General within 3 weeks of the completion of each earthworks stage detailing the project's compliance with relevant conditions, management plans and progress onsite, as detailed in **SECTION 7.14.3.**
Self-sustaining WSF population	WSF monitoring surveys to be completed to comply with **EPBC_2012/6328 Condition 12e.**	Qualified ecologist	Monitoring completed on an annual basis in accordance with the survey methodology described in **SECTION 8.3.** Results to be included in the Annual WSF Monitoring Report.
Avoidance and management of Acid Sulfate Soils	Where soil testing prior to the commencement of construction identifies the presence of acid sulfate soils, adherence to the Acid Sulfate Soils Management Plan (G&S 2012) shall be applied in accordance with the Acid Sulfate Soil Assessment Guidelines (Stone et al. 1998).	Site manager/Soil Quality Consultant	Acid sulfate soils left undisturbed or adequately managed in accordance with the Acid Sulfate Soils Management Plan.
Ensure water quality and hydrological processes are maintained	Water quality management and a detailed water quality monitoring regime are included in the OWMP (G&S 2020b). Appropriate groundwater hydroperiod and other ground and surface water chemistry aspects (particularly pH, conductivity, total suspended solids) will be maintained within retained and rehabilitated WSF habitats.	Site Manager/ Water quality consultant	No decline in surface water or groundwater quality in accordance with the OWMP.
	Bio-retention swales will be constructed in accordance with the OWMP (G&S 2020b) to ensure stormwater is separated from WSF habitat. All stormwater infrastructure will be located offline from any WSF breeding habitat.	Site Manager/ Water quality consultant	Stormwater effectively separated from WSF habitat and no decline in water quality in accordance with the OWMP.
Construction/ installation of infrastructure and signage	Fauna exclusion fencing, underpasses and signage to be installed and maintained.	Principal Contractor/ Site Supervisor/ Environmental Officer	All fencing (temporary and permanent) and underpasses to be constructed prior to commencement of bulk earthworks* in accordance with **SECTION 7.6.2** and **SECTION 7.6.3**. Temporary speed and EPZ signs to be installed prior to commencement of bulk earthworks* in accordance with **SECTION 7.6.4**. Fauna exclusion fencing, underpasses and signage to be regularly inspected (at not less than 1 monthly intervals) in accordance with **SECTION 7.6.6.** Any damage to fences, underpasses or signage will prompt immediate repair, within two (2) working days of the discovery of the damage, by Site or independent contractors as determined by the Site Manager. Discussion of the condition of the above infrastructure and any remedial actions required to be included in the Annual WSF Monitoring Report.
	Replacement of temporary fencing by permanent fencing where relevant**.**	Principal Contractor/ Site Supervisor	Permanent fencing will replace temporary fencing where applicable at the end of the construction phase of the development of each applicable Precinct in accordance with **SECTION 7.6.2**.
Minimise construction impacts on WSF and	A spotter catcher will be present during all vegetation clearing works in accordance with **MP08_0194 Condition 96** to ensure fauna safety during clearing.	Principal contractor / Fauna Spotter Catcher	Report provided at the end of clearing and prior to commencement of bulk earthworks*

Management Strategy	Management Action	Responsibility	Performance Measure
WSF habitat	Speed restrictions for construction vehicles.	All contractors and construction personnel on site	Vehicles shall be restricted to a maximum speed of 50 kph and shall operate only in daylight hours as discussed in **SECTION 7.2.4**. Where roads traverse the environmental protection areas vehicles shall be restricted to a maximum speed of 40 kph to minimise the risk of vehicle strike.
	Fauna exclusion fencing, underpasses and signage to be regularly checked**.**	Construction/Site Manager/Principal contractor until ownership of land is transferred or independent contractor	Fauna exclusion fencing, underpasses and signage to be regularly checked at no less that one (1) monthly intervals, including vegetation in close proximity to the fencing. Maintenance issues to be addressed within 48 hours and discussion to be included in the Annual WSF Monitoring Report.
	Monitoring of retained and compensatory habitat until the relevant land is dedicated and the terms of **CP06_0318 Condition B7** are satisfied.	Ecologist	Monitoring programs continue in accordance with the relevant methodologies discussed in **SECTION 8.5.** until the relevant land is dedicated and the terms of **CP Condition B7** are satisfied. Monitoring results to be included in the Annual WSF Monitoring Report.
Management and monitoring of retained WSF habitat	Retained WSF habitat managed in accordance with **EPBC_2012/6328 Condition 13.**	Suitably qualified Bush Regeneration company	Management of retained WSF habitat in accordance with protocols contained in **SECTION 7.7** and **APPENDIX 4** and the following relevant VMP's and WMP's: • Kings Forest Vegetation Management Plans (VMP) (JWA 2020a, b, c); and • Kings Forest Weed Management Plans (WMP) (JWA 2020k, l, m). Weeds will be managed on an ongoing basis and annual monitoring reports provided until the land is dedicated to either TSC or BCD.
	Retained WSF habitat is to be monitored.	Independent Restoration Ecologist	The monitoring of retained WSF habitat will be completed in accordance with performance criteria contained in the approved Kings Forest Vegetation Management Plans (VMPs). The Annual WSF Monitoring Reports will also include the monitoring results for the retained WSF habitat contained within the VMPs.
Management and monitoring of Compensatory WSF habitat	WSF compensatory habitat is to be managed in accordance **EPBC_2012/6328 Condition 13.**	Suitably qualified Bush Regeneration company	All compensatory habitat to be managed during the maintenance period[#] in accordance with protocols contained in **SECTION 7.8** until dedication to either TSC or BCD.
	WSF compensatory habitat is to be monitored.	Independent Restoration Ecologist Approved by the Secretary	All compensatory habitat to be monitored during the maintenance period[#] in accordance with protocols contained in **SECTION 8.5** until dedication to either TSC or BCD.
Fire Management	Reduction of fire risk**.**	The Proponent (until ownership is transferred)	The risk of high intensity fires should be reduced within WSF habitat areas through controlled low intensity burns, or mechanical means if and where appropriate, and in accordance with the Kings Forest Bushfire Management Plan (BushfireSafe 2020). High-intensity hazard reduction burns and wildfires that result in crown scorch or crown fires should be avoided.
WSF habitat creation near underpasses (Precincts 2-5, Precinct 6)	Planting of sedges around underpass openings to facilitate safe WSF dispersal across the site.	Proponent/Bush Regeneration company	Planting at underpass entries to be completed immediately after construction of underpasses, monitored and maintained. Planting to be in compliance with the planting strategy as described in **SECTION 7.8**. Management, maintenance and monitoring of plantings to be in accordance with the monitoring program in **SECTION 8.5**. Results to be included in the Annual WSF Monitoring Report.
Environmental Audits	Environmental Audits completed in accordance with **MP08_0194 Condition 49.**	The Proponent / Independent Ecological Consultant	Audits will be completed within three (3) months of the first and third anniversaries of the Initial Audit, and then every two (2) years until the affected lands have been transferred into public ownership as discussed in **SECTION 8.7.3**.
Payment of bond and/or bank guarantee	In accordance with **MP08_0194 Condition 50, a** bond of 135% of the estimated maintenance and monitoring costs for the implementation of environmental management is to be lodged with TSC.	The Proponent	Prior to commencement of bulk earth works for each precinct, and every two (2) years thereafter, a cash bond or bank guarantee shall be lodged with TSC to ensure that the relevant environmental management plans for the associated Potential Council Land (PCL) are implemented (**SECTION 7.8.6**). The above cash bond or bank guarantee will be refunded at the end of each two (2) year maintenance period, following the Secretary's written approval of the environmental

Management Strategy	Management Action	Responsibility	Performance Measure
			audit (refer to **SECTION 8.7.3**). Bi-annual bonding will no longer be required following the Proponent providing evidence to the Secretary that the final audit has been conducted in accordance with **MP08_0194 Condition 49** (**SECTION 8.7.3**) which demonstrates that the relevant works have been completed and written evidence is provided to the Secretary that the lands have been transferred into public ownership.
Construction Phase / Infrastructure Monitoring	The Environmental Officer will be responsible for the monitoring of relevant construction activities and infrastructure during construction.	Principal contractor/Site supervisor/Environmental Officer	As detailed in **SECTION 8.6,** all infrastructure will be monitored visually on a monthly basis until the land occupied by the infrastructure is dedicated to either TSC or BCD. The Environmental Officer will also monitor the additional relevant items listed in **SECTION 8.6.**
Reporting	Annual WSF Monitoring Report to comply with **EPBC Conditions 12a and 12e.**	Independent Restoration Ecologist Approved by the Secretary/ Principal contractor/Site supervisor/Environmental Officer/ Independent Ecological Consultant	An Annual WSF Monitoring Report will be prepared which discusses the results of the following: • Water quality monitoring; • WSF occupancy rates; • Retained WSF habitat monitoring (to be completed as part of the approved Kings Forest Vegetation Management Plans); • Compensatory Planting; and • Infrastructure, Construction and Operational Management. The report will discuss the results of the monitoring against the Monitoring Performance Criteria identified in **SECTIONS 8.2.3, 8.3.4, 8.5.6 and 8.6.3** and the successful implementation of management actions (with reference to any relevant Corrective Actions). The Annual WSF Monitoring Reports will also include a reconciliation against all relevant State and Commonwealth conditions of approval, and a discussion of findings and any recommendations for corrective actions. Each Annual WSF Monitoring Report will be provided to the Commonwealth DAWE, NSW DPI&E, NSW BCD and TSC and will be available on the JWA website for a period of 12 months (www.jwaec.com.au/).
	Environmental Audits report completed in accordance with **MP08_0194 Condition 49.**	The Proponent / Independent Ecological Consultant	An Environment Audit report will be completed by the independent environmental consultant within six (6) weeks of completing each audit, or as otherwise agreed by the Secretary in accordance with **SECTION 8.7.3.** The Environment Audit report will be submitted to the Secretary by the Proponent along with a response to any recommendations contained in the audit report.
Notes: * For the purpose of this project, **CP06_0318 Condition B7** and **MP08_0194 Condition A13**, commencement is taken to mean any physical works including clearing vegetation, the use of heavy duty equipment for the purpose of breaking ground for bulk earthworks, or infrastructure for the proposed project.			

9.6 Implementation Table – Operational Phase

TABLE 16
WSF MANAGEMENT STRATEGIES – OPERATIONAL PHASE

Management Strategy	Management Action	Responsibility	Performance Measure
Environmental Officer(s)/Community Liaison Officer	Environmental Officer(s)/ Community Liaison Officer to oversee environmental compliance until all conditions have been satisfied as required by **MP08_0194 Condition 70.**	Environmental Officer(s)/Community Liaison Officer	The Environmental Officer(s)/ Community Liaison Officer to oversee environmental compliance until all conditions have been satisfied as discussed in **SECTION 7.14.3.**
Maintenance of infrastructure	Infrastructure is maintained in good working order.	Site Manager (until ownership of land is transferred) or independent contractor	Maintenance inspections, repairs and reporting completed in accordance with **SECTION 8.6** at not less than three (3) monthly intervals. Damaged exclusion fencing, underpasses or signage mended or replaced. Vegetation growing on fences removed, and overhanging trees and shrubs pruned as detailed in **SECTION 7.6.6.** Reports completed.
Reduce light spill into WSF habitat	Place guards on, and direct lights away from, nearby WSF habitat.	Site Manager (until ownership of land is transferred) or independent contractor	Guards are placed over lights and the lights are directed away from WSF habitat as discussed in **SECTION 7.6.5.**
Environmental awareness and extension program	Provision of an information package for purchasers of land at Kings Forest.	The Proponent	An information package prepared prior to the sale of the first lot in accordance with **SECTION 7.14.1** and provided to all original purchasers.
	Design and create a web page that contains information intended to raise and shape awareness of WSF issues at Kings Forest.	The Proponent	A web site created and maintained for the duration of the construction phase of the project and for twelve (12) months after completion of construction of the final precinct, or, until 31 December 2035, whichever occurs first. The web site will contain relevant monitoring data summaries and information on WSF management initiatives in the locality in accordance with **SECTION 7.14.1**.
	Advertise information relating to WSF management in local newspapers.	The Proponent	Information relevant to WSF management on the Kings forest site publicised in the local newspapers in accordance with **SECTION 7.14.1** for the duration of the construction phase of the project and for twelve (12) months after completion of construction of the final precinct, or, until 31 December 2035, whichever occurs first.
	Carry out community presentations/information days at local schools and/or public spaces.	The Proponent	Community and/or school presentations relating to the Kings Forest development carried out in accordance with **SECTION 7.14.1** on a biennial basis. This strategy will last for the duration of the construction phase of the project and for twelve (12) months after completion of construction of the final precinct, or, until 31 December 2035, whichever occurs first.
	Provide feedback forms in order to confirm that awareness and education in the community is being built as a result of the environmental awareness and extension program.	The Proponent	Feedback forms provided to all residents and all persons attending school and/or community presentations in accordance with **SECTION 7.14.1** for the duration of the construction phase of the project and for twelve (12) months after completion of construction of the final precinct, or, until 31 December 2035, whichever occurs first. The results of the feedback form assessment to be provided to DPI&E and TSC for comment.
Kings Forest representative	Kings Forest representative to be appointed to liaise with TSC, NSW EPA and OEH as necessary.	The Proponent	Engagement with Local regulatory agencies and community groups as discussed in **SECTION 7.14.1** will last for the duration of the construction phase of the project and for twelve (12) months after completion of construction of the final precinct, or, until 31 December 2035, whichever occurs first.
Management and monitoring of retained WSF habitat	Retained WSF habitat managed in accordance with **EPBC_2012/6328 Condition 13.**	Suitably qualified Bush Regeneration company	Management of retained WSF habitat in accordance with protocols contained in **SECTION 7.7** and **APPENDIX 4** and the following relevant VMP's and WMP's: • Kings Forest Vegetation Management Plans (VMP) (JWA 2020a, b, c); and • Kings Forest Weed Management Plans (WMP) (JWA 2020k, l, m). Weeds will be managed on an ongoing basis and annual monitoring reports provided until the land is dedicated to either TSC or BCD.

Management Strategy	Management Action	Responsibility	Performance Measure
	Retained WSF habitat is to be monitored.	Independent Restoration Ecologist Approved by the Secretary	The monitoring of retained WSF habitat will be completed in accordance with performance criteria contained in the approved Kings Forest Vegetation Management Plans (VMPs). The Annual WSF Monitoring Reports will also include the results for the retained WSF habitat contained within the VMPs.
Management and monitoring of Compensatory WSF habitat	WSF compensatory habitat managed in accordance with **EPBC_2012/6328 Condition 13.**	Suitably qualified Bush Regeneration company	All compensatory WSF habitat to be managed during the maintenance period# in accordance with protocols contained in **SECTION 7.8** until dedication to either TSC or BCD.
	WSF compensatory habitat is to be monitored.	Independent Restoration Ecologist Approved by the Secretary	All compensatory WSF habitat to be monitored during the maintenance period# in accordance with protocols contained in **SECTION 8.5** until dedication to either TSC or BCD.
Access management	Gates on the site to be locked at the completion of the monitoring program**.**	Site Manager	At the completion of the rehabilitation program and monitoring program, gates will be locked, and keys handed over to Project 28 or TSC or BCD depending on where the gate is located and ownership of land.
Environmental Audits	Environmental Audits completed in accordance with **MP08_0194 Condition 49.**	The Proponent / Independent Ecological Consultant	Audits will be completed within three (3) months of the first and third anniversaries of the Initial Audit, and then every two (2) years until the affected lands have been transferred into public ownership as discussed in **SECTION 8.7.3**.
Payment of bond and/or bank guarantee	In accordance with **MP08_0194 Condition 50, a** bond of 135% of the estimated maintenance and monitoring costs for the implementation of environmental management is to be lodged with TSC.	The Proponent	Prior to commencement of bulk earth works for each precinct, and every two (2) years thereafter, a cash bond or bank guarantee shall be lodged with TSC to ensure that the relevant environmental management plans for the associated Potential Council Land (PCL) are implemented (**SECTION 7.8.6**). The above cash bond or bank guarantee will be refunded at the end of each two (2) year maintenance period, following the Secretary's written approval of the environmental audit (refer to **SECTION 8.7.3**). Bi-annual bonding will no longer be required following the Proponent providing evidence to the Secretary that the final audit has been conducted in accordance with **MP08_0194 Condition 49** (**SECTION 8.7.3**) which demonstrates that the relevant works have been completed and written evidence is provided to the Secretary that the lands have been transferred into public ownership.
Construction Phase / Infrastructure Monitoring	The Environmental Officer will be responsible for the monitoring of relevant construction activities and infrastructure during the operational phase of the development.	Environmental Officer	As detailed in **SECTION 8.6,** all infrastructure will be monitored visually on a monthly basis until the land occupied by the infrastructure is dedicated to either TSC or BCD. The Environmental Officer will also monitor the additional relevant items listed in **SECTION 8.6.**
Reporting	Annual WSF Monitoring Report to comply with **EPBC Conditions 12a and 12e.**	Independent Restoration Ecologist Approved by the Secretary/ Principal contractor/Site supervisor/Environmental Officer/ Independent Ecological Consultant	An Annual WSF Monitoring Report will be prepared which discusses the results of the following: • Water quality monitoring; • WSF occupancy rates; • Retained WSF habitat monitoring (to be completed as part of the approved Kings Forest Vegetation Management Plans); • Compensatory Planting; and • Infrastructure, Construction and Operational Management. The report will discuss the results of the monitoring against the Monitoring Performance Criteria identified in **SECTIONS 8.2.3, 8.3.4, 8.5.6 and 8.6.3** and the successful implementation of management actions (with reference to any relevant Corrective Actions). The Annual WSF Monitoring Reports will also include a reconciliation against all relevant State and Commonwealth conditions of approval, and a discussion of findings and any recommendations for corrective actions.

Management Strategy	Management Action	Responsibility	Performance Measure
			Each Annual WSF Monitoring Report will be provided to the Commonwealth DAWE, NSW DPI&E, NSW BCD and TSC and will be available on the JWA website for a period of 12 months (www.jwaec.com.au/).
	Environmental Audits report completed in accordance with **MP08_0194 Condition 49.**	The Proponent / Independent Ecological Consultant	An Environment Audit report will be completed by the independent environmental consultant within six (6) weeks of completing each audit, or as otherwise agreed by the Secretary in accordance with **SECTION 8.7.3.** The Environment Audit report will be submitted to the Secretary by the Proponent along with a response to any recommendations contained in the audit report.

10 INDICATIVE COSTINGS

TABLE 17 contains an indicative costing for the implementation of mitigation measures within each Precinct of the development. As discussed in **SECTION 7.3.2** the location of temporary fencing outside of Stage 1 (i.e. Precincts 1, 2, Part of 4 and 5) will be determined at the detailed design stage for each precinct and will be addressed in revised versions of the WSFMP**.** Similarly, the locations of permanent fencing within Precincts 12-14 will be determined at the detailed design stage and will be addressed in revised versions of the WSFMP. The indicative costings below therefore exclude these items.

It is also noted that additional costings for management actions outside the scope of the WSFMP (i.e. associated with the management of retained WSF habitat, feral animal management, bushfire management etc.) are provided in the relevant management plans.

TABLE 17
INDICATIVE COSTINGS

Precinct	Management Action/Item	Cost ($)* Establishment Phase	Cost ($)* Maintenance Phase
Precinct 1	Fauna exclusion fencing – including gates (545 m permanent @ $130/metre)	$70,792#	
	Signage	$250/sign#	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year#
	Monitoring and Reporting		$120,000/year
	Management of retained WSF habitat	Consult approved Kings Forest VMPs	
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precincts 2-5	Fauna exclusion fencing including gates (5,913 m temporary & 1,066 m temporary @ $130/metre)	$907,278#	
	Dedicated fauna underpass and furniture	$75,000#	
	Landscaping at entry to underpass	$2,500#	
	Signage	$250/sign#	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year#
	Rehabilitation of offset areas - includes seedling, fertiliser, watering and weeding until sustainable (9.52 ha @ $15,000/hectare)	$142,800	

Precinct	Management Action/Item	Cost ($)* Establishment Phase	Cost ($)* Maintenance Phase
	Maintenance of offset area (9.52 ha @ $2,500/hectare)		$23,800/year
	Environmental Awareness and Extension Program		$15,000[#]
	Monitoring and Reporting		$120,000/year
	Management of retained WSF habitat	Consult approved Kings Forest VMPs	
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precinct 6	Fauna exclusion fencing - including gates (1,912 m permanent @ $130/metre)	$248,605[#]	
	Dedicated fauna underpass and furniture	$75,000[#]	
	Landscape at entry to underpass	$2,500[#]	
	Signage	$250/sign[#]	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year[#]
	Rehabilitation of offset areas - includes seedling, fertiliser, watering and weeding until sustainable (2.25 ha @ $15,000/hectare)	$33,750	
	Maintenance of offset area (2.25 ha @ $2,500/hectare)		$5,625/year
	Monitoring and Reporting		$120,000/year
	Management of retained WSF habitat	Consult approved Kings Forest VMPs	
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precinct 7	Fauna exclusion fencing - including gates (2,026 m permanent @ $130/metre)	$263,431[#]	
	Signage	$250/sign[#]	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year[#]
	Rehabilitation of offset areas - includes seedling, fertiliser, watering and weeding until sustainable (27.83 ha @ $15,000/hectare)	$417,450	

Precinct	Management Action/Item	Cost ($)* Establishment Phase	Cost ($)* Maintenance Phase
	Maintenance of offset area (27.83 ha @ $2,500/hectare)		$69,575/year
	Monitoring and Reporting		$120,000/year
	Management of retained WSF habitat	Consult approved Kings Forest VMPs	
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precinct 8	Signage	$250/sign#	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year#
	Monitoring and Reporting		$120,000/year
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precinct 9	Fauna exclusion fencing - including gates (1,487 m permanent @ $130/metre)	$193,278#	
	Signage	$250/sign#	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year#
	Monitoring and Reporting		$120,000/year
	Management of retained WSF habitat	Consult approved Kings Forest VMPs	
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precinct 10	Fauna exclusion fencing - including gates (1,095 m permanent @ $130/metre)	$142,378#	
	Signage	$250/sign#	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year#
	Monitoring and Reporting		$120,000/year
	Management of retained WSF habitat	Consult approved Kings Forest VMPs	
	Feral animal management	Consult approved Kings Forest	

Precinct	Management Action/Item	Cost ($)* Establishment Phase	Cost ($)* Maintenance Phase
		FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precinct 11	Signage	$250/sign#	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year#
	Monitoring Reporting		$120,000/year
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	
Precincts 12-14	Fauna exclusion fencing - including gates (@ $130/metre)	TBD	
	Escape mechanisms (@ $1,250/each)	TBD	
	Signage	$250/sign#	
	Maintenance of infrastructure in the long term (accumulating per year until infrastructure dedicated or the end of the project)		$7,500/year#
	Rehabilitation of offset areas - includes seedling, fertiliser, watering and weeding until sustainable (7.75 ha @ $15,000/hectare)	$116,250	
	Maintenance of offset area (7.75 ha @ $2,500/hectare)		$19,375/year
	Monitoring and Reporting		$120,000/year
	Management of retained WSF habitat	Consult approved Kings Forest VMPs	
	Feral animal management	Consult approved Kings Forest FAMP	
	Bushfire management	Consult approved Kings Forest BMP	

Notes:

*Proposed to be funded from the proponents ongoing cash flow during the development.

#Costs as provided in the KPoM (JWA 2020n)

11 CONTINGENCY AND OFFSET STRATEGY

11.1 Introduction

The Minister granted an approval for Kings Forest, subject to conditions, on 21 May 2015 and subsequently varied that approval on 29 June 2017 and 11 June 2020. The EPBC Act Approval Condition 17 requires the preparation and submission of a WSF Contingency and Offset Strategy (WSFKCOS) that will be implemented if the created compensatory habitat does not meet the defined success criteria. Condition 12(k) of the approval decision further requires that the WSFCOS must be included in the WSFMP.

11.2 Compliance with Conditions

EPBC Act Approval Condition 17 requires that prior to commencement of construction associated with each precinct, for the Minister's written approval, the approval holder must submit a detailed WSF Contingency and Offset Strategy, that will be implemented should the created habitat not meet the defined success criteria detailed in the WSFMP. The Strategy must incorporate the requirements of Conditions 13-17. **TABLE 18** below details compliance of this WSFCOS with EPBC Act Approval Conditions 13-17. It is noted that several of the requirements of EPBC Act Approval Conditions 13-17 are addressed elsewhere in this WSFMP and therefore have not been reproduced in the WSFCOS. **TABLE 18** below refers to the relevant sections of the WSFMP as necessary.

TABLE 18
COMPLIANCE WITH EPBC ACT APPROVAL 2012/6328 CONDITIONS 13-17

Condition	Section of WSFMP
13. The approval holder must ensure the protection and conservation management of 33.63ha of existing Wallum Sedge Frog habitat and 45.09ha of created Wallum Sedge Frog habitat identified in Annexure 7 and described as follows: a) 1.8ha of existing Wallum Sedge Frog habitat and 8.82ha of created Wallum Sedge Frog habitat must be protected by a legal instrument under relevant New South Wales legislation on the title prior to commencement of bulk earthworks associated with Stage 1; b) 21.48ha of existing Wallum Sedge Frog habitat and 8.86ha of created Wallum Sedge Frog habitat must be protected by a legal instrument under relevant New South Wales legislation on the title prior to commencement of bulk earthworks associated with Stage 2; and c) 10.35ha of existing Wallum Sedge Frog habitat and 27.41ha of created Wallum Sedge Frog habitat must be	**SECTION 7.8** - **TABLES 4 - 6**, and **FIGURE 21**. **FIGURE 21** shows the location of 45.29 ha of retained WSF habitat and 47.35 ha of created WSF habitat. It is noted that the areas of WSF habitat to be retained and created on the site has increased from that originally identified on site and referred to in Condition 13. This increase is because of a combination of the following: i. ground-truthing of native vs. non-native vegetation during the preparation of this WSFMP has revealed that additional areas of suitable native vegetation had not been previously identified as existing or compensatory WSF habitat; and/or ii. corrections of mapping projection issues. **FIGURES 25 - 29** show the areas of existing habitat to be retained and the habitat creation works associated with each

Condition	Section of WSFMP
protected by a legal instrument under relevant New South Wales legislation on the title prior to commencement of bulk earthworks associated with Stages 4 and 5.	development precinct.
14. Prior to the commencement of construction in any precinct, the created Wallum Sedge Frog habitat required for the preceding commenced precinct must be substantially established.	**SECTION 7.8.5** provides that created WSF habitat will be substantially established[4] prior to the commencement of construction associated with each precinct. Prior to the issue of each Construction Certificate authorising the clearing of WSF habitat, the Proponent shall provide evidence to the Certifying Authority that the compensatory WSF habitat in the preceding stage meets the relevant establishment period completion criteria.
15. The approval holder must undertake rehabilitation in proposed Wallum Sedge Frog habitat areas referred to in Condition 13. Rehabilitation actions, performance criteria and monitoring must be in accordance with the Wallum Sedge Frog Management Plan.	**SECTION 7.8** provides the details of the proposed WSF compensatory habitat. Monitoring requirements and associated performance criteria and corrective actions are detailed in **SECTION 8.5.**
16.The instrument/s referred to in Condition 13 must: a) provide for the protection of the land referred to in Condition 13 for the duration of this approval; b) prevent any future development activities; c) ensure the active management of the land referred to in Condition 13 in accordance with the Wallum Sedge Frog Management Plan.	**SECTIONS 7.7** and **7.8** provide details of the management of retained and compensatory WSF habitat respectively. **SECTION 7.12** provides details of the transfer of land to public ownership.
17. Prior to commencement of construction associated with each precinct, the approval holder must submit for the Minister's approval a detailed Wallum Sedge Frog Contingency and Offset Strategy. The detailed Wallum Sedge Frog Contingency and Offset Strategy must address the requirements of Conditions 13-17. The approved Wallum Sedge Frog Contingency and Offset Strategy must be	**SECTION 11.3** provides details of the proposed WSF Contingency and Offset Strategy. The final Contingency and Offset Strategy will be completed **prior to commencement of construction** within each relevant Precinct if the created compensatory habitat relevant to each precinct does not meet the defined success criteria outlined in **SECTION 8.5.6**. This approach is consistent with the terms of EPBC

[4] "Substantial establishment" of the WSF habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and an independent restoration ecologist has provided a short report confirming that the plantings are established."

Condition	Section of WSFMP
implemented if the created habitat does not meet the success criteria specified in the Wallum Sedge Frog Management Plan. The Wallum Sedge Frog Contingency and Offset Strategy must include, but not limited to, details of: a) offset attributes of the proposed areas referred to in Condition 13; b) proposed arrangements for legal protection for the duration of the approval; c) management actions to be undertaken and how they will be costed; d) arrangements and responsibility for the ongoing management for the duration of the approval; e) a methodology for provision of offsets consistent with the Environmental Offset Policy should the created habitat not meet the defined success criteria; and f) how the learnings from the management and monitoring of previous precincts are incorporated into subsequent revisions of the Wallum Sedge Frog Contingency and Offset Strategy.	Approval (2011/5987) for Caloundra South (Stockland Residential Communities). Compliance with the requirements of Conditions 13-16 are addressed above. Compliance with the requirements of Conditions 17a-e are as follows: a) Refer to compliance with the requirements of Condition 13. b) Refer to compliance with the requirements of Condition 16. c) Management actions are addressed in **SECTIONS 7-9**. Indicative costings are provided in **SECTION 10**. d) Refer to **SECTION 9**. e) Refer to **SECTION 11.3.** f) Refer to **SECTION**

11.3 Contingency and Offset Measures

11.3.1 Introduction

A WSF Contingency and Offset Strategy (WSFCOS) has been prepared and will be implemented in the event that:

1. WSF monitoring completed in accordance with the methodology discussed in **SECTION 8.3** indicates that there has been a statistically significant reduction in WSF occupancy rates over the relevant development stages on the Kings Forest site over two (2) successive monitoring periods; or
2. The created compensatory habitat relevant to each precinct does not meet the defined performance criteria outlined in **SECTION 8.5.6** as determined under the monitoring regimes detailed in **SECTION 8.5** within seven (7) years.

11.3.2 WSF Occupancy Rates

If monitoring results indicate that there has been a statistically significant reduction in WSF occupancy rates within the relevant development stages on the Kings Forest site over two (2) successive monitoring periods an investigation of threatening processes will be completed. This investigation will be completed by an independent WSF specialist jointly appointed by

NSW DPI&E and Commonwealth DAWE and funded by Project 28. The independent WSF specialist will prepare a report. The report should consider the following factors:

- A thorough review of potential WSF threatening processes on the Kings Forest site and the success of the management strategies aimed at mitigating the impact of these processes on the Kings Forest site should be completed.
- Whether or not the observed decline is due to development impacts or part of a more general trend affecting WSF locally. It is considered that if the proponent remains compliant with the conditions of approval and approved management strategies relevant to WSF (i.e. this WSFMP and related environmental management plans) they should not be held responsible for any local declines in the WSF population.
- Consideration of bringing the proposed revegetation and rehabilitation effort across the whole development site forward to provide better habitat and connectivity for the WSF population.
- Consultation with all stakeholders i.e. DPI&E, BCD, TSC, relevant community groups and landowners/developers.
- Recommendations to halt (and reverse) the decline in WSF occupancy rate will be provided in the report.

This report will be assessed by Project 28, the Commonwealth DAWE, NSW DPI&E and NSW BCD. NSW DPI&E will provide Project 28 with recommendations relating to the current status of the Kings Forest WSF population and proposals to increase the occupancy rates on the Kings Forest site to assist in the formulation of a revised Contingency and Offset Strategy.

Project 28 will retain their right to appeal to the NSW Land and Environment Court if they contest any of the recommendations from NSW DPI&E.

11.3.3 Created Compensatory Habitat

If monitoring results indicate that the created compensatory habitat relevant to each precinct does not meet the defined performance criteria within seven (7) years, the contingency measures detailed in **TABLE 19** will be implemented.

TABLE 19
THREATS TO COMPENSATORY HABITAT CREATION AND CONTINGENCY MEASURES

Risk	Corrective Action	Responsibility
Poor plant survival (thresholds as discussed in **SECTION 8.4.6**).	Additional plantings and irrigation where required.	Project 28 / Bush Regeneration Company
Native groundcovers do not meet benchmark (thresholds as discussed in **SECTION 8.5.6)**	The monitoring and maintenance period must be extended until targets are met.	Project 28 / Bush Regeneration Company
Unmanaged fire	If a bushfire occurs within land owned by Project 28 an investigation will be triggered to assess damage	Project 28 / Ecologist

Risk	Corrective Action	Responsibility
	to WSF and their habitat on the relevant Kings Forest lands. The investigation will include a survey of the WSF population occurring on the Kings forest site (see **SECTION 8.3** for Methodology). Consultation will occur with RFS, TSC and BCD to determine the cause of the fire. A report will be prepared after the consultation. The report will address causes, impacts and proposed changes, if considered necessary, to Bushfire management plans.	
Weed infestation (i.e. exceeding thresholds discussed in **SECTION 8.5.6**)	Further weed control to be undertaken as necessary.	Project 28 / Bush Regeneration Company

11.4 Adaptive Management

An adaptive management approach will be applied to the management of retained and compensatory WSF habitat across the Kings Forest site. Adaptive management is an approach that involves learning from management actions and using those lessons to improve upon the overall plan. Comprehensive, long-term monitoring is a component of adaptive management as adaptive management strategies rely on the accumulation of evidence supporting decisions that demand changes in action. The principles of adaptive management have been incorporated into the administration of restoration projects within a variety of governmental authorities and programs (Thom 1997).

Compensatory habitat works will involve an integrated process of firstly monitoring, then reviewing and responding to the health and conditions of the plantings, natural regeneration and the status of the weed infestation. Alteration to the design and maintenance of works required, to ensure the objectives of the offset are achieved, are then made.

Consolidated learnings, including monitoring reports and analysis, will be submitted in a report, together with a revised WSF Contingency and Offset Strategy for subsequent project stages, to DAWE for approval, specifying how lessons have been captured and addressed. Through this adaptive management approach information gathered from the management and monitoring of offsets in previous precincts will be incorporated into subsequent precincts and WSF Contingency and Offset Strategies, thus improving the long term probability of success for the offsets on the Kings Forest site.

Before the implementation of any adaptive management strategy a brief report is to be provided to Project 28 Pty Ltd and other relevant agencies detailing the proposed management actions and the predicted outcomes. The implementation must be approved by the relevant authority prior to implementation.

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APPENDIX 1 – APPROVALS PROCESS AND STAKEHOLDER CONSULTATION

Introduction

The Commonwealth planning process requires the completion of a WSFMP, which complies with their approval conditions. The following summarises the process Project 28 have undertaken thus far in the approval process for both State and Commonwealth jurisdictions.

A summary of the process for preparing the WSFMP is detailed below:

- A Kings Forest Threatened Species Management Plan was approved as part of the Concept Plan approval in 2010.
- A Revised Threatened Species Management Plan (JWA 2012a) was approved as part of the Major Project approval in 2013.
- Commonwealth approval for the Kings Forest project was received in May 2015 which required the completion of a WSFMP.
- A final draft of the WSFMP, in accordance with the EPBC Act approval conditions (2012/6328), was completed in May 2017. This draft WSFMP was submitted to the NSW DoPE. DoPE placed the WSFMP on exhibition and received a large number of public submissions. Detailed Submissions were also received from Tweed Shire Council and NSW Office of Environment and Heritage.

Subsequently, a number of meetings have been held between Tweed Shire Council, DoPE and the Commonwealth over the 36 months preceding the completion of this plan.

Approvals Process

NSW

On the 19th January 2007, the NSW Minister for Planning authorised a Concept Plan (06_0318) for a proposed residential community at Kings Forest. The Director General's Environmental Assessment Requirements (DGEARs) were subsequently issued on the 21st August 2007. A Preferred Project Report (PPR) (JWA 2012b) (and associated management plans including a separate Threatened Species Management Plan [TSMP] for Precincts 1 & 5; Precincts 2 - 4 and 6 - 11; and Precincts 12 - 14) was prepared, after consultation with the NSW Department of Planning (DoP), addressing the DGEARs.

The Minister for Planning granted part 3A approval for the Concept plan for Kings Forest in August 2010. Modifications to the Concept Plan (and TSMP's) were then subsequently approved in the period December 2010 to present.

The Kings Forest Stage 1 Project Application No. MP 08_0194 was lodged in November 2011. The Application and Environmental Assessment Report was advertised from December 2011 to January 2012 following which 302 public submissions and 10 agency submissions were received.

The Project Application (containing the Stage 1 TSMP's) was approved with conditions on 11 August 2013.

Kings Forest Major Project Approval No. 08_0194 Modification 4 application to reconcile the inconsistencies between Commonwealth and State approvals are currently being assessed by the Department of Planning and Environment.

The area of inconsistency relates to the meaning/definition of "commencement".

Commonwealth

On the 20th March 2012, the proposed action was referred to the Commonwealth under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). On the 12th November 2012, a delegate for the Minister for the then Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) (now Department of the Environment) determined that the proposed action required approval under the EPBC Act. The basis for the decision was that the proposed action had the potential to have a significant impact on matters protected under Part 3 of the EPBC Act: listed threatened species and ecological communities (SECTIONS 18 and 18A) including the local Wallum sedge frog population.

The DSEWPC indicated that the proposed action would be assessed through Preliminary Documentation (PD). The PD was submitted in April 2013. It contained information already submitted as part of the referral as well as information acquired from experts and other relevant agencies. DSEWPC comments on the PD were received on the 12th June 2013 and further information was requested in an Analysis of Preliminary Documentation.

A further assessment was completed in order to address issues raised by the Department and the data was incorporated into the Final Preliminary Documentation, which was provided along with a Response to Submissions Report on the 24th December 2013.

Negotiations regarding approval conditions commenced in early 2014. A Supplementary Addendum report was provided to the Department on the 28th November 2014. On the 19th December 2014 the Department provided a written response to the Supplementary Addendum report. A Final Response Report was prepared by JWA and submitted on 13th March 2015 to address comments and information requests from DSEWPC.

The Department considered the proposal in accordance with Part 9 of the EPBC Act and decided to grant approval to Project 28 on the 21st May 2015. The approval specifies a number of conditions in relation to protecting WSF populations. Condition No. 12 specifically requires the preparation of a Wallum Sedge Frog Management Plan.

On 25th November 2015 DoE provided Project 28 a "Statement of Reasons for Approval under the Environment Protection and Biodiversity Conservation Act 1999". The content of this document was considered in the preparation of this WSFMP.

Consultation with DoE occurred in 2016 and early 2017. In particular, the following matters were discussed:

- The need (or otherwise) for the creation of "melon holes" for breeding habitat;
- The timing of the completion of the Contingency and Offset Strategies; and

- The performance requirements of the created habitat prior to commencement of subsequent precincts.

Stakeholder Consultation

Introduction

In accordance with the Environmental Assessment Requirements issued by the Director General for the Kings Forest Concept Plan proposal, consultation was required with relevant public authorities and the broader community. This section summarises the consultation completed by the proponent during preparation of the proposal and during the public exhibition of the Concept Plan and Preferred Project Report (PPR) (JWA 2012b) prepared for the NSW Department of Planning and Environment and Preliminary Documentation (PD) prepared for the Commonwealth Department of the Environment.

Previous Approvals and Consultations

In November 1987 Tweed Shire Council prepared the Kingscliff South Planning Report. In pursuance of this report, and following public and agency consultation, amendment No. 3 of Tweed Local Environmental Plan 1987 was gazetted on 30/09/1989. The LEP amendment zoned part of the Kings Forest site to Part 1(b) Agricultural Protection, Part 2(c) Urban Expansion, Part 6(c) Recreation Special Purposes, Part 7(a) Environmental Protection and Part 2(e) Residential Tourist. Those zones applied under Tweed LEP 2000 up until the gazettal of the State Environmental Planning Policy (Major Projects) amendment for Kings Forest on 10th November 2006.

In June 1989, Tweed Shire Council issued Development Consent No. GS488/182 for a 239 lot subdivision and 18 hole golf course and in 1992 Tweed Shire Council issued a further Development Consent No. S92/1 for a 260 lot subdivision and 18 hole golf course over Kings Forest. Whilst those developments did not proceed the consents were nevertheless granted pursuant to the statutory planning controls in force at those times."

The landowner submitted a State Significant Site Study for Kings Forest to the Minister for Planning in 2006. The study and a draft zoning plan were publicly exhibited in April and May 2006. Wide-ranging submissions were received and considered prior to gazettal of Amendment No. 10 to the Major Projects SEPP on 10th November 2006.

The proposed Concept Plan, was prepared in accordance with the zonings established by the SEPP Amendment, except for proposed minor changes to the boundaries of Environmental Protection Zones (EPZ's). The development of a golf course was integral to the State Significant Site Study and the broad road pattern accords with exhibited TSC planning proposals. Moreover, the population which the Concept Plan anticipated was of the order that has been projected by TSC for many years. Accordingly, there is little in the current proposal that has not been subject to previous public scrutiny during public exhibitions arranged by both TSC and the Department of Planning. Nevertheless, further consultation with the community ensued as described below.

Council and Agency Consultation

The following public authorities were consulted by the proponent in relation to the Concept Plan:

- Tweed Shire Council - Administrators and officers;
- Department of Environment and Climate Change (now Office of Environment and Heritage OEH) – Northern Region;
- NSW Department of Environment and Climate Change then NSW Office of Environment and Heritage (OEH) now Biodiversity and Conservation Division (BCD) – Northern Region;
- Roads and Traffic Authority (now Roads and Maritime Services); and
- Department of Education and Training.

In accordance with Condition C3 of the Concept Plan (as amended) negotiations have commenced with regard to the transfer of approximately 150 ha of land as an addition to the Cudgen Nature Reserve.

A comprehensive suite of submissions was received from the following referral agencies during the exhibition period of the Preferred Project Report (PPR) (JWA 2012b) completed for the Project Approval application in late 2012:

- Department of Planning and Infrastructure;
- Tweed Shire Council;
- NSW National Parks & Wildlife Service;
- Eco Logical Australia Pty Ltd;
- NSW Environmental Protection Agency;
- NSW Department of Primary Industries;
- NSW Roads and Maritime Services;
- NSW Rural Fire Service;
- Essential Energy;
- NSW Finance & Services (Housing & Property Group);
- NSW Trade & Investment – Mineral Resources Branch; and
- NSW Office of Water.

Community Consultation

The Major Project Application and its PPR was publicly exhibited from 22 November 2011 until 23 December 2011 for a period of thirty-two (32) days. The Department of Planning and Infrastructure received 302 submissions during the exhibition period, including 10 submissions from public authorities and 292 submissions from the general public and special interest groups. All submissions were made as objections to the proposal.

Following referral of the proposed action to the Commonwealth Department of the Environment, the Amended PD was placed on public exhibition, in accordance with Section 95A of the EPBC Act, for a period of twenty (20) business days – Monday 11th November to COB Friday 6th December. A total of 3,105 public submissions were received during this time consisting of a large proportion (3,094) of form letters and a small number (10) of individual submissions, including one (1) in support of the proposed development. A submission from Tweed Shire Council was also received.

APPENDIX 2 - COMPLIANCE WITH RELEVANT APPROVAL CONDITIONS

The Kings Forest project received NSW planning approval in 2010 (Concept Plan) and 2013 (Project Approval). Commonwealth approval under the EPBC Act was received in May 2015.

The following tables contain the relevant Consolidated Approval Conditions and also note where they are addressed in this WSFMP:

- Concept Plan 06_0318 Consolidated Approval Conditions incorporating the following:
    - Modification No. 1, approved on 22 December 2010;
    - Modification No. 2, approved on 11 August 2013;
    - Modification No. 3, approved on 16 May 2014;
    - Modification No. 4, approved on 20 November 2014;
    - Modification No. 5, approved on 10 November 2015;
    - Modification No. 8, approved on 24 May 2018;
- Project Approval 08_0194 Consolidated Approval Conditions incorporating the following:
    - Modification No. 1, approved on 16 May 2014;
    - Modification No. 2, approved on 20 November 2014;
    - Modification No. 3, approved on 20 February 2017;
    - Modification No. 6, approved on 21 December 2017;
    - Modification No. 7, approved 24 May 2018; and
- the EPBC Act Approval Conditions (2012/6328) incorporating the Approved Variations to Conditions (June 2017 and June 2020).

COMPLIANCE TABLE: CP06_0318 (MODS 1 - 8)

CP06_0318 CONDITION	SECTION OF WSFMP
B7 Implementation of Environmental Management Plans (1) The proponent is responsible for the management of all Potential Council Land and the Future OEH Land for conservation purposes and the implementation of ongoing management and maintenance activities specified in all Environmental Management Plans from the date of the commencement of the project or at another time directed by the Secretary, until such time than an agreement is reached with OEH and/or Tweed Shire Council regarding dedication of that land. Note: For the purpose of this condition, commencement is taken to mean any physical works including clearing vegetation, the use of heavy duty equipment for the purpose of breaking ground for bulk earthworks, or infrastructure for the proposed project.	**Section 7.12**
C3 Dedication of Land to OEH Prior to the release of the first subdivision certificate for the project, or as otherwise determined by the Secretary (at the request of the Proponent). The Proponent must provide evidence of an agreement for the dedication by Project 28 Pty Ltd to the OEH of the Future OEH Land being no less than approximately 150ha of land as addition to the Cudgen Nature Reserve. Such an agreement must outline the proponent's commitment to establish boundary fences and trails to the satisfaction of the OEH prior to the Future OEH Land being added to Cudgen Nature Reserve. The Proponent must ensure suitable funding for the amendment of existing reserve specific fire, pest, weed and management plans. The funding should be sufficient to ensure actions within the amended plans relevant to the new additions are able to be completed. **Future OEH Land** means the land identified in the "Plan of Proposed Areas to be Dedicated to NPWS Kings Forest Development" prepared by Landsurv Pty Ltd dated 23 August 2012, Revision C. Note: the dedicated lands may be used as an offset for biodiversity impacts in accordance with the policy applicable from time to time under which offsets for such impacts are assessed.	**SECTION 7.12** provides details of the transfer of land to public ownership.
C8 Traffic and Wildlife Protection Measures All future development applications are to demonstrate that: (1) Provision has been made to maintain the safe passage of wildlife between habitat areas through specific road design, lighting and signage requirements and, where considered appropriate, fencing to road verges, fauna underpasses and like measures; and (2) Road crossings of waterways maintain existing fish passage.	**SECTION 7.6** provides details of fauna exclusion fencing, fauna underpasses, road crossing and other infrastructure (e.g. signage, lighting).

COMPLIANCE TABLE: MP08_0194 (MODS 1 - 7)

MP08_0194 CONDITION	SECTION OF WSFMP
Management and Maintenance of Environmental Lands A13. The proponent is responsible for the management of all Potential Council Land and Future OEH Land for conservation purposes and the implementation of all establishment period and maintenance period works specified in all Environmental Management Plans from the date of the commencement of the project, or at another time directed by the Secretary, until such time that an agreement is reached with OEH and /or Tweed Shire Council regarding the dedication of that land. Note: For the purpose of this condition, commencement is taken to mean any physical works including clearing vegetation, the use of heavy duty equipment for the purpose of breaking ground for bulk earthworks, or infrastructure for the proposed project.	**SECTION 9.2** provides the definition of "commencement". **SECTION 7.12** provides details of the transfer of land to public ownership.
Environmental Offset Areas 3. Prior to commencing any Bulk Earthworks in a Precinct, or as otherwise agreed between the Proponent and the Secretary, the Proponent shall: a) engage a registered surveyor to prepare survey plan(s) and permanently mark the boundaries of the: i) the contiguous area of Potential Council Land; and ii) the contiguous area of Future OEH Land immediately adjacent to the Precinct (unless the relevant contiguous area has already been marked due to the earlier commencement of Bulk Earthworks in another Precinct). A staging plan for the survey works is be submitted to the Department prior to the commencement of the project. b) where relevant, submit amended plans of proposed subdivision to the Secretary for approval that show the relevant contiguous Potential Council Land and the relevant contiguous Future OEH Land as separate lots; c) ensure that the boundaries marked by the surveyor remain marked at all times in a permanent manner that allows operating staff, the landowner and inspecting officers to clearly identify those boundaries; and d) submit for the Secretary's approval, a form of dealing(s) to be registered on the title to the Potential Council Land and the Future OEH Land that must:	**Section 7.12**

MP08_0194 CONDITION	SECTION OF WSFMP
i. bind all future landowners; ii. provide for the management of the Potential Council Land and the Future OEH Land for conservation purposes including the implementation of relevant Environmental Management Plans, in perpetuity; iii. permit access to the Potential Council Land and the Future OEH Land by the Department, the OEH and Council at all times for the purpose of monitoring compliance with relevant covenants and the Environmental Management Plans; and iv. provide for a release of any registered dealings in circumstances where all or part of the Potential Council Land or the Future OEH Land are transferred to a public authority. e) Where the Potential Council Land or the Future OEH Land is not subject to any amended plans of subdivision, the Proponent must within 1 month of the Secretary's approval of the dealing(s) referred to in condition 3(1)(d), lodge for registration the dealing(s) on the relevant titles to the Potential Council Land or the Future OEH Land and provide to the Secretary evidence of such registration within 10 days of the dealing(s) being registered. f) Where Potential Council Land or the Future OEH land is subject to any amended plans of subdivision, the Proponent must within 3 months of the later of the Secretary's approval of the amended plans of subdivision under condition 3(b) or the Secretary's approval of dealing(s) referred to in condition 3(d), lodge for registration the dealing(s) on the relevant titles to the Potential Council Land or the Future OEH Land to the Director-General evidence of such registration within 10 days of the dealing(s) being registered. Note: For the purpose of this condition, commencement is taken to mean any physical works including clearing vegetation, the use of heavy duty equipment for the purpose of breaking ground for bulk earthworks, or infrastructure for the proposed project.	
Acid Sulfate Soil Management Plan 17. 1) Where soil testing prior to the commencement of construction identifies the presence of acid sulfate soils, a detailed **Acid Sulfate Soil Management Plan** shall be prepared by a suitably qualified person in accordance with the Acid Sulfate Soil Assessment Guidelines (Acid Sulfate Soil Management Advisory Committee, 1998). The Management plan shall be prepared in consultation with the NSW Office of Water and submitted to the Certifying Authority prior to the issue of a construction certificate for Stage 1 bulk earthworks. 2) The Plan must be consistent with the Kings Forest Stage 1 Management Plan.	**Section 7.5**
Baseline Monitoring 37. 1) Prior to the issue of the first Construction Certificate, the proponent must demonstrate to the satisfaction of the Department that sufficient baseline monitoring has commenced in accordance with the relevant Environmental Management Plans, including the following: a. Flora and Fauna Monitoring Report;	**Section 8.3**

MP08_0194 CONDITION	SECTION OF WSFMP
Environmental Management Plans	
39. 1) All Environmental Management Plans shall be revised to address management actions to be undertaken throughout the life of the project as relevant to the development precincts that the plan covers. This includes a detailed set of agreed establishment and maintenance phase performance completion criteria, ongoing monitoring and an annual maintenance schedule of works following the initial establishment period. This includes the following plans: a. Flora and Fauna Monitoring Report b. Buffer Management Plan c. Vegetation Management Plan d. Koala Plan of Management e. Feral Animal Management Plan f. Weed Management Plan g. Threatened Species Management Plan 2) Performance criteria for all management plans are reviewed to ensure they are specific to each precinct and action, measurable, achievable, relevant and timely. 3) The implementation schedule of all Environmental Management Plans shall be revised to include the following details as relevant to the precincts that the plan covers: a. Actions that are specific to the precinct for which they are addressing b. Specific map references to identify locations of works for all actions c. Total areas to be planted (m2) d. Planting density (per m2) e. Number of permanent signs to be erected and maintained f. Total areas for weed management activities (m2) g. Length of any fencing (temporary and permanent) h. Total areas for heath regeneration and revegetation (m2) i. Locations and areas (m2) of proposed threatened species habitat j. Timing and frequency of actions k. Monitoring requirements (frequency) that are specific to the action	**Section 9** contains a detailed analysis of management actions to be implemented during the pre-construction, construction and operational phases of the development (TABLES 14, 15 and 16). These tables also contain Performance Measures for each of the Management Actions. **Section 8** contains the WSF Monitoring and Reporting program.

MP08_0194 CONDITION	SECTION OF WSFMP
Vegetation Management Plans 40. 1) The Works Schedule of all Vegetation Management Plans shall be amended to include "Assisted natural regeneration" as the preferred Proposed Measure for Works Areas 2, 13 and Additional Work Areas and wherever significant natural regeneration is occurring within the EPZ and/or ecological buffer areas. This approach should be adopted in preference to revegetation or rehabilitation programs, incorporated as a guiding principle in the Statement of Commitments and relevant plans. 2) The final Vegetation Management Plans shall be prepared in consultation with Council and submitted to the Secretary for approval within 6 months of the date of determination of the application (No. 2012/2328) made under sections 130(1) and 133 of the Commonwealth Environment Protection and Biodiversity Conservation Act or prior to issue of any construction certificate, whichever occurs first.	The following updated Vegetation Management Plans have been prepared for the Kings Forest site and should be read in conjunction with this WSFMP: • Kings Forest Precincts 1 - 5 Vegetation Management Plan (JWA 2020a); • Kings Forest Precincts 6 - 11 Vegetation Management Plan (JWA 2020b); and • Kings Forest Precincts 12 - 14 Vegetation Management Plan (JWA 2020c)
Buffer Management Plans 41. 1) Figures 10 and 10A to 10L shall be revised as necessary to ensure that spatial overlap of heath revegetation, Koala food tree planting and Wallum Sedge Frog compensatory habitat is minimised. 2) Tree plantings are to be minimised in areas that are identified as naturally regenerating. 3) The final Buffer Management Plans shall be prepared in consultation with Council and submitted to the Director-General Secretary for approval within 12 months of this approval 6 months of the date of determination of the application (No. 2012/2328) made under sections 130(1) and 133 of the Commonwealth Environment Protection and Biodiversity Conservation Act or prior to issue of any construction certificate, whichever occurs first.	The following updated Buffer Management Plans have been prepared for the Kings Forest site and should be read in conjunction with this WSFMP: • Kings Forest Precincts 1 - 5 Buffer Management Plan (JWA 2020g); and • Kings Forest Precincts 6 - 14 Buffer Management Plan (JWA 2020h). FIGURE 20 of the WSFMP (**SECTION 7.8**) shows the location of the proposed compensatory WSF habitat.
Exclusion Fencing and Underpasses 64. Fauna exclusion fencing and underpasses (including any temporary fencing and underpasses) for roads traversing Environmental Protection Areas are to be constructed prior to the commencement of bulk earthworks in any of the southern and/or western development precincts.	**Section 7.6**
Acid Sulfate Soils 95. All works that involve disturbance of soils shall be carried out in accordance with the approved Acid Sulfate Management Plan, as required by Condition 17.	**Section 7.5**

MP08_0194 CONDITION	SECTION OF WSFMP
Fauna Spotter-Catcher 96. A registered Fauna spotter-catcher is to be present during all vegetation clearing works to ensure safe dispersal of fauna as required by the Environmental Management Plans.	**Section 7.2.3**

COMPLIANCE TABLE: EPBC ACT APPROVAL 2012/6328

EPBC 2012/6328 CONDITION	SECTION OF WSFMP
Protecting Wallum Sedge Frog populations	
11. The approval holder must not clear more than 44 hectares of **Wallum Sedge Frog habitat** from within the **project area. Wallum Sedge Frog habitat** on the **project area** is identified in Annexure 6 of these conditions.	**Section 6.2 TABLES 2 and 3**
12. The approval holder must submit for the Minister's approval a Wallum Sedge Frog Management Plan to monitor and manage the Wallum Sedge Frog (*Litoria olongburensis*) population at the project area including its use of the created habitat within the project area. The approval holder must not commence the action until the Wallum Sedge Frog Management Plan has been approved by the Minister in writing. The approved Wallum Sedge Frog Management Plan must be implemented. The Wallum Sedge Frog Management Plan must include, but not limited to: a. a scientifically robust methodology for monitoring Wallum Sedge Frog population and created habitat (Annexure 7) success within the project area; b. measures to restore and enhance breeding habitat for the Wallum Sedge Frog concurrent with the commencement of works within each precinct; c. measures to encourage the building of community awareness and stewardship of Wallum Sedge Frog including appropriate education programs to encourage care and protection of the species; d. costing of the management measures required and how the management measures will be funded for the duration of the approval; e. a Wallum Sedge Frog population and created habitat monitoring program with readily measurable objectives, performance indicators and scientifically robust success criteria; f. timeframes for reporting and implementation; g. corrective actions, and/or mechanisms for developing corrective actions, and the parties responsible for implementing corrective actions; h. requirements for pre-construction surveying on the subject site by a suitably qualified person immediately prior to the removal of any identified area/s of Wallum Sedge Frog habitat to record the size of the area to be destroyed/removed by the action. This information must be included as a reporting requirement of the Wallum Sedge Frog Plan; i. an outline of the measures that will be undertaken to ensure that the created habitat will be protected in perpetuity; j. criteria defining 'substantial establishment' of the created habitat for the purposes of Condition 14; and k. a contingency and offset strategy, including defined success criteria for created habitat.	**a. Section 8** **b. Section 7.8** **c. Section 7.14** **d. Section 10** **e. Section 8** **f. Section 9** **g. Sections 8, 9 and 10** **h. Section 7.2.3.2** **i. Section 7.12** **j. Section 7.8.5 and TABLE 12** **k. Section 11 provides details of the proposed Wallum Sedge Frog Contingency and Offset Strategy. The final Contingency and Offset Strategy will be completed within one year of commencement of works within each relevant Precinct if the created compensatory habitat relevant to each Precinct does not meet the defined success criteria. This approach is consistent with the terms of EPBC Approval (2011/5987) for Caloundra South (Stockland Residential Communities).**

EPBC 2012/6328 CONDITION	SECTION OF WSFMP
Retention of Wallum Sedge Frog habitat and movement corridors onsite	
13. The approval holder must ensure the protection and conservation management of 33.63ha of existing **Wallum Sedge Frog habitat** and 45.09ha of created **Wallum Sedge Frog habitat** identified in Annexure 7 and described as follows: a. 1.8ha of existing **Wallum Sedge Frog habitat** and 8.82ha of created **Wallum Sedge Frog habitat** must be protected by a legal instrument under relevant New South Wales legislation on the title prior to commencement of **bulk earthworks** associated with Stage 1; b. 21.48ha of existing **Wallum Sedge Frog habitat** and 8.86ha of created **Wallum Sedge Frog habitat** must be protected by a legal instrument under relevant New South Wales legislation on the title prior to commencement of **bulk earthworks** associated with Stage 2; and c. 10.35ha of existing **Wallum Sedge Frog habitat** and 27.41ha of created **Wallum Sedge Frog habitat** must be protected by a legal instrument under relevant New South Wales legislation on the title prior to commencement of **bulk earthworks** associated with Stages 4 and 5.	**SECTION 7.8** - **TABLES 4 - 6**, and **FIGURE 21**. **FIGURE 21** shows the location of 45.29 ha of retained WSF habitat and 47.35 ha of created WSF habitat. It is noted that the areas of WSF habitat to be retained and created on the site has increased from that originally identified on site and referred to in Condition 13. This increase is because of a combination of the following: iii. ground-truthing of native vs. non-native vegetation during the preparation of this WSFMP has revealed that additional areas of suitable native vegetation had not been previously identified as existing or compensatory WSF habitat; and/or iv. corrections of mapping projection issues. **FIGURES 25 - 29** show the areas of existing habitat to be retained and the habitat creation works associated with each development precinct.
14. Prior to the commencement of construction in any precinct, the created Wallum Sedge Frog habitat required for the preceding commenced precinct must be substantially established.	**SECTION 7.8.5** provides that created WSF habitat will be substantially established[5] prior to

[5] "Substantial establishment" of the WSF habitat plantings means "the plantings have progressed beyond the need for intensive maintenance e.g. weed control, watering etc. and are clearly established by way of persisting through a recognised growth period and an independent restoration ecologist has provided a short report confirming that the plantings are established."

EPBC 2012/6328 CONDITION	SECTION OF WSFMP
	the commencement of construction associated with each precinct. Prior to the issue of each Construction Certificate authorising the clearing of WSF habitat, the Proponent shall provide evidence to the Certifying Authority that the compensatory WSF habitat in the preceding stage meets the relevant establishment period completion criteria.
15. The approval holder must undertake rehabilitation in proposed Wallum Sedge Frog habitat areas referred to in Condition 13. Rehabilitation actions, performance criteria and monitoring must be undertaken in accordance with the **Wallum Sedge Frog Management Plan**.	**SECTION 7.8** provides the details of the proposed WSF compensatory habitat. Monitoring requirements and associated performance criteria and corrective actions are detailed in **SECTION 8.5.**
16. The instrument/s referred to in Condition 13 must: a. provide for the protection of the land referred to in Condition 13 for the duration of this approval; b. prevent any future development activities; c. ensure the active management of the land referred to in Condition 13 in accordance with the **Wallum Sedge Frog Management Plan**.	**SECTIONS 7.7** and **7.8** provide details of the management of retained and compensatory WSF habitat respectively. **SECTION 7.12** provides details of the transfer of land to public ownership.
17. Prior to **commencement of construction** associated with each **precinct**, the approval holder must submit for the Minister's approval a detailed Wallum Sedge Frog Contingency and Offset Strategy. The detailed Wallum Sedge Frog Contingency and Offset Strategy must address the requirements of Conditions 13 – 17. The approved Wallum Sedge Frog Contingency and Offset Strategy must be implemented if the created habitat does not meet the success criteria specified in the **Wallum Sedge Frog Management Plan**. The Wallum Sedge Frog Contingency and Offset Strategy must include, but not be limited to, details of: a. **offset attributes** of the proposed areas referred to in Condition 13; b. proposed arrangements for legal protection for the duration of the approval; c. management actions to be undertaken and how they will be costed; d. arrangements and responsibility for the ongoing management for the duration of the approval; e. a methodology for provision of offsets consistent with the Environmental Offset Policy should the created habitat not meet the defined success criteria; and f. how the learnings from the management and monitoring of previous precincts are incorporated into subsequent revisions of the Wallum Sedge Frog Contingency and Offset Strategy.	**SECTION 11.3** provides details of the proposed WSF Contingency and Offset Strategy. The final Contingency and Offset Strategy will be completed **prior to commencement of construction** within each relevant Precinct if the created compensatory habitat relevant to each precinct does not meet the defined success criteria outlined in **SECTION 8.5.6**. This approach is consistent with the terms of EPBC Approval (2011/5987) for Caloundra South (Stockland Residential Communities). Compliance with the requirements

EPBC 2012/6328 CONDITION	SECTION OF WSFMP
	of Conditions 13-16 are addressed above. Compliance with the requirements of Conditions 17a-e are as follows: a) Refer to compliance with the requirements of Condition 13. b) Refer to compliance with the requirements of Condition 16. c) Management actions are addressed in **SECTIONS 7-9**. Indicative costings are provided in **SECTION 10**. d) Refer to **SECTION 9**. e) Refer to **SECTION 11.3.** f) Refer to **SECTION 11.4.**
Surveys for the Koala and Wallum Sedge Frog	
18. Prior to the commencement of construction associated with each precinct, pre-clearance surveys for Koala and Wallum Sedge Frog must be conducted and any individuals safely relocated from the area to be disturbed. Pre-clearance surveys and relocation must: a. be undertaken by a suitably qualified person and in consultation with the Department; b. must not be of lower standard than described for Wallum Sedge Frogs in sections 5.4.3 and 5.4.4 of the Preliminary Documentation and for the Koala in Section 5.3 of the Preliminary Documentation. c. be undertaken no more than one day prior to commencement of bulk earth moving activities within each precinct.	**Section 7.2.3.2 and TABLE 14**
19. All survey data collected for the project must be collected and recorded so as to conform to draft or approved EPBC Act survey guidelines and/or policy statements relevant to the Koala and Wallum Sedge Frog as made available on the Department's website. When requested by the Department, the approval holder must provide to the Department all species and ecological survey data and related survey information from ecological surveys undertaken for the Koala and Wallum Sedge Frog. This survey data must be provided within 30 business days of request, or in a timeframe agreed to by the Department in writing. The Department may use the survey data for other purposes.	**Section 8.1**
21. Within three months of every 12 month anniversary of the commencement of the approved action, the approval holder must publish a report on their website addressing compliance with each of the conditions of this approval, including implementation of the Wallum Sedge Frog Management Plan and Koala Plan of Management as specified in the conditions. Documentary evidence providing proof of the date of publication must be provided to the Department at the same time as the compliance report is published.	**Section 8.7.2.1**
23. If the approval holder wishes to carry out any activity otherwise than in accordance with the Wallum Sedge Management Plan and Koala Plan of Management, as specified in the conditions, the approval holder must submit to the Department for the Minister's written approval a revised	**Section 1.8**

EPBC 2012/6328 CONDITION	SECTION OF WSFMP
version of that plan. The varied activity shall not commence until the Minister has approved the revised management plan in writing. The Minister will not approve a revised plan, unless the revised plan would result in an equivalent or improved environmental outcome. If the Minister approves the revised plan that plan must be implemented in place of the plan originally approved.	
24. If the Minister believes that it is necessary or convenient for the better protection of listed threatened species and communities to do so, the Minister may request that the approval holder make specified revisions to the management plan specified in the conditions and submit the revised plan for the Minister's written approval. The approval holder must comply with any such request. The revised approved plan must be implemented. Unless the Minister has approved the revised plan then the approval holder must continue to implement the originally approved plan, as specified in the conditions.	**TABLE 1.8**

APPENDIX 3 - ADDITIONAL KINGS FOREST MANAGEMENT PLANS AND THEIR RELATIONSHIP TO THE WSFMP

Management Plan	Relationship to the WSFMP
Kings Forest Precincts 1 - 5 Vegetation Management Plan (JWA 2020a)	This VMP provides details of rehabilitation works within retained WSF habitat and WSF compensatory habitat in EPZs and associated buffers within Precincts 1 - 5. The VMP contains the following objectives: • to assist Project 28 in managing existing native vegetation and other environmentally sensitive areas within buffers and EPZs before, during and after development; • to develop a comprehensive and integrated approach to guide the immediate and long-term management of retained and compensatory native vegetation within buffers and EPZs and to ensure its protection and enhancement; and • to ensure ongoing sustainable management of native vegetation within buffers and EPZs and that land clearing and land modification activities associated with the development are effectively remediated. These objectives show a clear relationship to the weed management plans, the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 6 - 11 Vegetation Management Plan (JWA 2020b)	This VMP provides details of rehabilitation works within retained WSF habitat and WSF compensatory habitat in EPZs and associated buffers within Precincts 6 - 11. The VMP contains the following objectives: • to assist Project 28 in managing existing native vegetation and other environmentally sensitive areas within buffers and EPZs before, during and after development; • to develop a comprehensive and integrated approach to guide the immediate and long-term management of retained and compensatory native vegetation within buffers and EPZs and to ensure its protection and enhancement; and • to ensure ongoing sustainable management of native vegetation within buffers and EPZs and that land clearing and land modification activities associated with the development are effectively remediated.

Management Plan	Relationship to the WSFMP
	These objectives show a clear relationship to the weed management plans, the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 12 - 14 Vegetation Management Plan (JWA 2020c)	This VMP provides details of rehabilitation works within retained WSF habitat and WSF compensatory habitat in EPZs and associated buffers within Precincts 12 - 14. The VMP contains the following objectives: • to assist Project 28 in managing existing native vegetation and other environmentally sensitive areas within buffers and EPZs before, during and after development; • to develop a comprehensive and integrated approach to guide the immediate and long-term management of retained and compensatory native vegetation within buffers and EPZs and to ensure its protection and enhancement; and • to ensure ongoing sustainable management of native vegetation within buffers and EPZs and that land clearing and land modification activities associated with the development are effectively remediated. These objectives show a clear relationship to the weed management plans, the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 1 - 5 Threatened Species Management Plan (JWA 2020d)	This TSMP has been prepared to address the management of other Threatened species and their habitat/s occurring in in EPZs and associated buffers within Precincts 1 - 5. The TSMP contains the following objectives: • weed control measures specific to areas containing listed threatened flora and fauna; • guidelines for the control of human and animal access to areas containing threatened species; • strategies for the embellishment of threatened species habitat through revegetation works

Management Plan	Relationship to the WSFMP
	and/or the creation of compensatory habitat areas where required. These objectives show a clear relationship to the weed management plans, the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 6 - 11 Threatened Species Management Plan (JWA 2020e)	This TSMP has been prepared to address the management of other Threatened species and their habitat/s occurring in in EPZs and associated buffers within Precincts 6 - 11. The TSMP contains the following objectives: • weed control measures specific to areas containing listed threatened flora and fauna; • guidelines for the control of human and animal access to areas containing threatened species; • strategies for the embellishment of threatened species habitat through revegetation works and/or the creation of compensatory habitat areas where required. These objectives show a clear relationship to the weed management plans, the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 12 - 14 Threatened Species Management Plan (JWA 2020f)	This TSMP has been prepared to address the management of other Threatened species and their habitat/s occurring in in EPZs and associated buffers within Precincts 12 - 14. The TSMP contains the following objectives: • weed control measures specific to areas containing listed threatened flora and fauna; • guidelines for the control of human and animal access to areas containing threatened species; • strategies for the embellishment of threatened species habitat through revegetation works and/or the creation of compensatory habitat areas where required.

Management Plan	Relationship to the WSFMP
	These objectives show a clear relationship to the weed management plans, the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 1 - 5 Buffer Management Plan (JWA 2020g)	The aim of this BMP is to provide guidelines, strategies and methods for the treatment and management of ecological buffers to Cudgen Nature Reserve and EPZs. This BMP provides details of the protection of retained WSF habitat and WSF compensatory habitat where these areas occur within ecological buffers within Precincts 1 - 5.
Kings Forest Precincts 6 - 14 Buffer Management Plan (JWA 2020h)	The aim of this BMP is to provide guidelines, strategies and methods for the treatment and management of ecological buffers to Cudgen Nature Reserve and EPZs. This BMP provides details of the protection of retained WSF habitat and WSF compensatory habitat where these areas occur within ecological buffers within Precincts 6-14.
Kings Forest Feral Animal Management Plan (JWA 2020i)	The aim of this FAMP is to develop a comprehensive and integrated approach to guide the immediate and long-term management of feral animals within buffers and EPZs associated with the development of the Kings Forest site and to ensure the protection of native fauna species, with a primary focus on threatened species. Specific objectives of this FAMP are to: • Review relevant literature on feral animal control; • Identify feral animals which have been recorded at the site; • Prioritise species considered to warrant priority management; • Examine control and/or eradication methods for 'high priority' feral animals; and • Recommend long-term control methods, including monitoring and reporting.

Management Plan	Relationship to the WSFMP
	Of particular importance for the Kings Forest WSF population is the control of Cane toads and Mosquito fish within retained WSF habitat and WSF compensatory habitat areas.
Kings Forest Flora and Fauna Monitoring Report (JWA 2020j)	The Kings Forest Flora and Fauna Monitoring Report summarises all flora and fauna monitoring requirements of the development including the WSF monitoring program.
Kings Forest Precincts 1 - 5 Weed Management Plan (JWA 2020k)	This WMP provides details of weed control works required within retained WSF habitat and WSF compensatory habitat in EPZs and associated buffers within Precincts 1 - 5. Specific objectives of this WMP are to: • Provide a weed assessment of the subject site; • Prevent the further spread of weeds resulting from the development of Precincts 1 - 5; • Designate areas requiring targeted weed control measures; • Outline specific tasks to be undertaken in each targeted weed control area; • Provide guidelines for the removal of weed species including Slash pine seedlings; • Provide guidelines for a maintenance programme; and • Outline a monitoring and reporting schedule. These objectives show a clear relationship to the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 6 - 11 Weed Management Plan (JWA 2020l)	This WMP provides details of weed control works required within retained WSF habitat and WSF compensatory habitat in EPZs and associated buffers within Precincts 6 - 11. Specific objectives of this WMP are to: • Provide a weed assessment of the subject site; • Prevent the further spread of weeds resulting from the development of Precincts 6 - 11;

Management Plan	Relationship to the WSFMP
	• Designate areas requiring targeted weed control measures; • Outline specific tasks to be undertaken in each targeted weed control area; • Provide guidelines for the removal of weed species including Slash pine seedlings; • Provide guidelines for a maintenance programme; and • Outline a monitoring and reporting schedule. These objectives show a clear relationship to the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Precincts 12-14 Weed Management Plan (JWA 2020m)	This WMP provides details of weed control works required within retained WSF habitat and WSF compensatory habitat in EPZs and associated buffers within Precincts 12-14. Specific objectives of this WMP are to: • Provide a weed assessment of the subject site; • Prevent the further spread of weeds resulting from the development of Precincts 12-14; • Designate areas requiring targeted weed control measures; • Outline specific tasks to be undertaken in each targeted weed control area; • Provide guidelines for the removal of weed species including Slash pine seedlings; • Provide guidelines for a maintenance programme; and • Outline a monitoring and reporting schedule. These objectives show a clear relationship to the vegetation management plans, the buffer management plans, the KPoM and the WSFMP.
Kings Forest Stage 1 Bushfire	A fundamental strategy of the Kings Forest Stage 1 Bushfire Management Plan (BushfireSafe 2020) is

Management Plan	Relationship to the WSFMP
Management Plan (BushfireSafe 2020)	to assess and manage fuel loads within the Kings Forest site. As discussed in **SECTION 7.13,** the risk of high intensity fires will be reduced through controlled low intensity burns or mechanical means if and where appropriate. High-intensity hazard reduction burns and wildfires that result in crown scorch or crown fires should be avoided.
Construction Environmental Management Plan (MUS 2020)	The Construction Environmental Management Plan (MUS 2020) provides details sufficient to understand and avoid, mitigate and remedy all potential environmental impacts of the project during construction and should be read in conjunction with this WSFMP.
Kings Forest Summary of Management Plans (G&S 2020a)	The Kings Forest SOMP (G&S 2020a) has been prepared to summarise all of the management requirements of the various management plans including the WSFMP.

APPENDIX 4 – REHABILITATION SPECIFICATIONS

1 REHABILITATION PHASES

Site rehabilitation works will be completed by a suitably qualified[6] Bush Regeneration company and be undertaken in six (6) phases as follows:

- **Phase 1**: Site preparation of retained WSF habitat (where necessary) and offset habitat areas.
- **Phase 2**: Initial planting (where necessary) – will commence as soon as the Bush Regeneration team is satisfied that weed species have been successfully controlled.
- **Phase 3**: Establishment and initial maintenance - it is planned that the establishment period will be of a minimum length of twelve (12) months during which time weeds will be controlled and watering will be undertaken on an 'as needs' basis.
- **Phase 4**: Supplementary planting to replace dead seedlings - will commence within two (2) months of the initial planting in each area. Replacement of seedlings/saplings that have died will continue during the approved monitoring period at a rate that will ensure a >90% survival of planted stock.
- **Phase 5**: Additional plantings - works can commence where advanced canopy growth is evident and the Bush Regeneration team determines that additional planting is necessary to satisfy the objectives of the offset strategy.
- **Phase 6**: Ongoing maintenance - will continue indefinitely on an as needed basis until performance targets have been met. If the performance targets have not been met, corrective actions will be implemented in accordance with **SECTION 8.5.6**.

2 SITE PREPARATION

Site preparation will include the following actions:

- Erection of protective fencing and signage in accordance with **SECTION 7.6**;
- Identification of retained vegetation (refer **SECTION 7.7**);
- Each retained WSF habitat area and rehabilitation (compensatory habitat) area will be allocated an individual identifying number. Each area will be separated by flat (5 cm x 1 cm) pegs painted in white at the top with the allocated identifying area number written on the white paint faced towards the relevant area;
- Primary and Secondary weed control in accordance with the following sections; and
- Sourcing and/or propagation of revegetation stock.

It should be noted that no slashing, clearing, filling or other impacts upon native vegetation within retained or offset areas should occur to achieve the WSFMP outcomes.

[6] A Bush Regeneration company that has demonstrable experience in the rehabilitation or revegetation of native vegetation communities in the Tweed region.

3 WEED CONTROL

3.1 Primary Weeding

Weed eradication will be undertaken within the retained WSF habitat (as necessary) and the proposed offset areas on a progressive basis through localised treatment of grass species via mechanical removal (hoe/rake, hand pulling and/or slashing) or with Roundup Biactive©. Woody weed species will be hand pulled or controlled using best practice weed control techniques.

All chemical users should be experienced and licensed in accordance with the relevant legislation. Utmost care must be taken when utilising chemicals to ensure that no drift occurs outside of the treatment area. Spraying should not occur on windy days or within 24 hours of predicted rainfall. Preparation before spraying, in the form of manual clearing weeds from around native plants, must be carried out.

Primary weeding should commence prior to the commencement of construction, ideally at the start of the active growing period (approximately November), and on an as needed basis.

Weed material that does not contain any fertile parts will be mulched and spread on the ground and any weeds that may have fertile parts present will be disposed of at an approved waste disposal facility such as Council landfills or transfer stations.

3.2 Secondary Weeding

Secondary weeding involves the eradication of weeds that have been overlooked or re-shoot after primary treatment. Secondary weeding will occur three (3) to four (4) months after primary weeding and no later than six (6) months.

4 NATURAL REGENERATION

Natural regeneration refers to the natural process by which plants replace or re-establish themselves. Plant species may recover through resprouting or germination from remnant soil seed banks or seed that naturally disperse from nearby site (Standards Reference Group SERA 2016).

Natural regeneration is a powerful tool that can be used to re-establish native vegetation. It ensures that the new growth is derived from genetic material (i.e. parents) that currently occupies the site and as such is adapted to local conditions. Additionally, the chance of outbreeding depression is reduced.

Natural regeneration will be encouraged within all retained vegetation and rehabilitation areas. Where natural recruitment is determined to be not currently occurring within retained vegetation and rehabilitation areas (e.g. areas devoid of native vegetation after weed control works), active revegetation through planting will be completed. Revegetation methods (if necessary) will follow those outlined below.

5 REVEGETATION WORKS

5.1 Introduction

Revegetation will commence no later than six (6) months after the primary weeding is completed. Successful completion of primary weeding will be determined by the appointed Bush regeneration team. At this time, an assessment will be made as to level of natural regeneration present within retained WSF habitat and rehabilitation areas. Any areas where the native seedling germination is considered to be low and impeding the achievement of rehabilitation objectives will require revegetation.

5.2 Propagation

Plants to be used for revegetation are to be either propagated in a nursery using material (seeds, cuttings, tissues, etc.) from species which occur onsite or obtained from a local nursery able to supply stock from local provenance. Where existing nursery stock from local provenance is not available, collection should be carried out as detailed below.

Whenever possible, seed will be removed directly from plants by shaking or cutting branches over a tarpaulin. Secateurs will be sterilised between each use. Seed will be placed in small envelopes with the collection details clearly marked. If the seed is extremely small, it will be stored in glass or plastic vials to avoid undue loss. The seed will be cleaned, its viability checked and prepared for storage. Seed that has lost viability will not be used in the revegetation works due to the dangers of genetic aberration.

The amount of seed collected will not exceed 5% per plant. Seed will not be collected from isolated populations or rare plants. The following details will be collected from each source plant:

- Location (GPS position);
- Date of collection;
- Name of collector;
- Soil type;
- Health of plant; and
- Collection method.

It is expected that during the seed collection program, a site will be visited on several occasions to ensure optimum seed ripeness. The seed collection program will be prepared in consultation with TSC and NSW NPWS prior to commencement. The program will be prepared by the bushland restoration team.

If seed collection proves difficult or impossible, other forms of propagation, such as cuttings, may be attempted.

5.3 Planting Program

Tube stock seedlings will primarily be used for the plant-out. Seedlings will be sufficiently developed so as to have a significant chance of survival. Seedlings will be at least the sixth leaf stage and/or 20cm in height. Tube stock will be sun hardened (plants should be held in full sunlight and systematically stressed to the point of wilting for at least two (2) months prior to planting).

All exclusionary fencing (where applicable) will be in place prior to the commencement of construction and before planting occurs.

Planting will occur at the optimum time of year when there is high soil moisture (between January and May), unless irrigation is available and accessible.

If required, the restoration team may make minor alterations to this revegetation strategy depending on the site requirements. The following strategy will be employed:

- Secondary weeding - Planting sites will be spot sprayed with a frog friendly glyphosate product 3 - 4 weeks prior to commencement;
- All plants will be soaked in water overnight prior to planting;
- All plants will be provided with a wetting agent such as rain-saver[7] crystals where appropriate;
- Weeds will be controlled, in the short term, through the application of suitable mulch around individual plantings and with spot applications of an appropriate herbicide.
- All plants will be protected by a tree guard or fencing if browsing becomes an issue; and
- Watering will be undertaken after the seedlings have been planted on an 'as needed' basis.

The seedings shall be planted on the same day (or as soon as practicable) as their transport from the nursery. No seedlings will be left unprotected on the site whilst awaiting planting. Planted seedlings will be marked with a piece of biodegradable tape and staked.

The planting growing medium should be soaked prior to planting and the plant cores should be buried to approx. 1-2cm deep. Only nitrogenous fertilisers will be used where appropriate to avoid the introduction of Phosphorous, Potassium and other micronutrients. Planting in areas exposed to full sun or westerly sun will be avoided in the peak summer months, where possible.

[7] Rain-saver is a polymer water crystal that has been specifically developed for plants. The polymer absorbs and holds water and nutrients at a specific tension which makes it available to plant roots but does not release to the soil. Rain-saver has proven very successful in more difficult environments (e.g. Roadside plantings on the Pacific Motorway between Brisbane and the Gold Coast and in frontal dunes at Pottsville (R. Keene *pers comm.* 2000).

5.4 Planting Density and Species Selection

A list of species to be used for planting within the proposed offset habitat areas and at underpass entrances (as appropriate) is provided in **TABLE 1.**

The following plant spacing will be adopted where applicable:

- Small trees/shrubs (where necessary) = 2 - 3 m centres; and
- Groundcovers = 1 - 1.5 m centres.

TABLE 1 - PROPOSED WSF COMPNESATORY HABITAT PLANTING DETAILS

WSF Compensatory Habitat Type	Total Area	Depth to Groundwater	Vegetation Community Type to be Recreated (PCT* / TVMS#)	Broad Structure of the Vegetation Type to be Created	Trees, Shrubs, or Groundcover Plant Species to be Planted
Compensatory breeding habitat – sedgeland & at underpass entrances (as appropriate)	9.76 ha	0m to 0.2m	PCT 1290 / TVMS 701	Sedgeland	**Ground –** *Baloskion pallens, Baumea arthrophylla, Baumea articulata, Baumea rubiginosa, Cladium procerum, Eleocharis sphacelate, Lepironia articulata, Leptocarpus tenax, Schoenus brevifolius.*
Compensatory breeding habitat – wet heath	24.26 ha	0.2m to 1m	PCT 1297 / TVMS 502	Wet heathland	**Small trees/Shrubs –** *Baeckea frutescens, Baeckea linifolia, Banksia ericifolia subsp. macrantha, Banksia oblongifolia, Banksia robur, Leptospermum juniperinum, Leptospermum liversidgei, Melaleuca nodose, Sporadanthus interruptus, Xanthorrhoea fulva* **Ground –** *Eurychorda complanata, Pteridium esculentum, Sprengelia sprengelioides*
Compensatory forage habitat – dry heath	13.34 ha	1m to >2m	PCT 663 / TVMS 501	Dry heathland	**Small trees/Shrubs –** *Allocasuarina littoralis, Banksia aemula, Boronia pinnata, Calytrix tetragona, Dillwynia retorta, Leptospermum semibaccatum, Leptospermum trinervium, Melaleuca nodosa, Monotoca scoparia, Phyllota phylicoides, Xanthorrhoea glauca, Leptospermum polygalifolium.* **Ground –** *Caustis recurvata, Coleocarya gracilis, Platysace lanceolate, Pteridium esculentum.*

*****Relevant Plant Community Type (PCT) descriptions which were accessed via the NSW Office of Environment and Heritage (OEH) database (i.e. the BioNet Vegetation Classification System).

#Refer to Tweed Vegetation Management Strategy (Kingston *et al*. 2004)

The overall maximum plant numbers to be installed in each of the proposed Compensatory WSF habitat areas within each Precinct are provided in **TABLE 2.** These numbers may be revised by the ecologist and/or bush regenerator subsequent to the initial assessment discussed in 'Site Preparation' above (e.g. extensive native regeneration may result in less planting).

TABLE 2
TOTAL NUMBER OF PLANTINGS IN EACH PRECINCT

Precinct/ EMA	WSF Compensatory Habitat - Number of Plants (*)					
	Planting Density (plants / 25 sq. metres)		Compensatory Breeding Habitat - Sedgeland (PCT 1290)	Compensatory Breeding Habitat - Wet Heath (PCT 1297)	Compensatory Forage Habitat - Dry Heath (PCT 663)	Total
Precinct 1	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 2	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 3	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 4	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 5	Shrubs	8	0	14,760	10,016	**24,776**
	Ground covers	16	11,375	29,520	20,031	**60,926**
Precinct 6	Shrubs	8	0	3,421	1,639	**5,060**
	Ground covers	16	4,285	6,842	3,277	**14,405**
Precinct 7	Shrubs	8	0	39,176	26,475	**65,651**
	Ground covers	16	46,802	78,352	52,950	**178,104**
Precinct 8	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 9	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 10	Shrubs	8	-	-	-	-
	Ground covers	16				
Precinct 11	Shrubs	8	-	-	-	-
	Ground covers	16				
Precincts 12-14	Shrubs	8	-	20,254	4,543	**24,797**
	Ground covers	16		40,508	9,086	**49,594**
TOTAL	**Shrubs**	**8**	**0**	**77,611**	**42,672**	**120,284**
	Ground covers	**16**	**62,461**	**155,223**	**85,344**	**303,029**