



APPENDIX B2

Construction Flora and Fauna Management Plan


Additional Crossing of the Clarence River at Grafton Project

SEPTEMBER 2016

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- Annexure A:** Biodiversity Monitoring Program
- Annexure B:** Protocol for managing pathogens
- Annexure C:** Pre-clearing permit
- Annexure D:** Fauna Handling and Rescue Procedure
- Annexure E:** Not used
- Annexure F:** Unexpected Threatened Flora Species / EEC Finds Procedure
- Annexure G:** Weed Management Plan
- Annexure H:** Not used.
- Annexure I:** Nest Box Management Plan
- Annexure J:** Not used.
- Annexure K:** Bat Management Plan
- Annexure L:** Three-Toed Snake Tooth Skink Construction Management Plan
- Annexure M:** Potential threatened flora and fauna species identification guide

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Glossary / Abbreviations

BoM	Bureau of Meteorology
CEMP	Construction Environmental Management Plan
CFFMP	Construction Flora and Fauna Management Plan
CoA	Condition of Approval
CSWMP	Construction Soil and Water Quality Management Plan
DECC	Department of Environment and Climate Change
DECCW	The Department of Environment, Climate Change and Water
DP&E	Department of Planning and Environment
DPI Fisheries	Department of Primary Industries Fisheries
DPI Water	Department of Primary Industries Water
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (now the Department of the Environment)
EIS	Environmental Impact Statement
EEC	Endangered Ecological Community
EPA	Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EWMS	Environmental Work Method Statements
FM Act	<i>Fisheries Management Act 1994</i>
FWCF	Freshwater Wetlands on Coastal Floodplains
GDE	Groundwater Dependent Ecosystem
KTP	Key Threatening Process
LEP	Local Environmental Plan
LGA	Local Government Area
NOW	NSW Office of Water (now DPI Water)
NPW Act	<i>National Parks and Wildlife Act 1974</i>
NW Act	<i>Noxious Weeds Act 1993</i>
OEH	Office of Environment and Heritage
Project, the	Additional Crossing of the Clarence River at Grafton Project
RMS	Roads and Maritime Services
RoTAP	Rare or Threatened Australian Plants
RTA	Roads and Traffic Authority (now RMS)
SCFF	Subtropical Coastal Floodplain Forest
SEPP	State Environmental Planning Policy
SSI	The state significant infrastructure as generally described in Schedule 1 (SSI-6103) of the Infrastructure Approval.
TSC Act	<i>Threatened Species and Conservation Act 1995</i>

TSSC	The Threatened Species Scientific Committee
UDLMP	Urban Design and Landscape Management Plan

1 Introduction

1.1 Context

This Construction Flora and Fauna Management Plan (CFFMP or the Plan) forms part of the Construction Environmental Management Plan (CEMP) for the Additional Crossing of the Clarence River at Grafton Project (the Project).

This CFFMP has been prepared to address the requirements of:

- the Infrastructure Approval (19 December 2014);
- the environmental management measures listed in the Additional Crossing of the Clarence River at Grafton Environmental Impact Statement (EIS) (ARUP, 2014) and Additional Crossing of the Clarence River at Grafton Submissions Report (RMS, 2014); and
- all applicable legislation.

1.2 Background

The *Additional Crossing of the Clarence River at Grafton EIS* (ARUP, 2014) assessed the impacts of construction and operation of the Project on flora and fauna.

As part of the EIS development, a detailed flora and fauna assessment was prepared to address the Director-General's Requirements for the Project. The flora and fauna assessments were included in the EIS as *Appendix L – Technical Paper: Flora and fauna assessment*.

The area to which this CFFMP applies comprises the Project footprint and the additional area likely to be directly or indirectly affected by the construction of the Project, defined by a 50 m buffer either side of the Project.

1.3 Environmental management document system overview

The overall Environmental Management document system for the Project is described in the Construction Environmental Management Plan (CEMP).

The CFFMP is part of Fulton Hogan's environmental management framework for the Project, as described in Section 4.1 of the CEMP. In accordance with the Instrument of Approval (CoA) D46(e), this CFFMP has been prepared by Jane Raithby-Veall Principal Ecologist, Biosis Pty Ltd in consultation with the EPA and Department of Primary Industries (DPI) Fisheries. Details of the consultation carried out as part of the preparation of this CFFMP are provided in Section 4.

Mitigation and management measures identified in this CFFMP will be incorporated into site- or activity-specific Environmental Work Method Statements (EWMS). EWMSs will be developed and signed off by environment and management representatives prior to associated works, and construction personnel will be required to undertake works in accordance with the identified mitigation and management measures.

Used together, the CEMP, strategies, procedures and EWMS form management guides that clearly identify the required environmental management actions for reference by Fulton Hogan personnel and contractors.

The review and document control processes for this CFFMP are described in Section 1.6 and Chapter 10 of the CEMP.

2 Purpose and objectives

2.1 Purpose

The purpose of this CFFMP is to describe how construction impacts on ecology will be minimised and managed.

2.2 Objectives

The key objective of the CFFMP is to ensure that impacts to flora and fauna are minimised. To achieve this objective, the following will be undertaken:

- ensure controls and procedures are implemented during construction activities to avoid, minimise or manage potential adverse impacts to flora and fauna within and adjacent to the Project corridor;
- ensure measures are implemented to address the relevant CoA outlined in Table 3-1 and the management measures detailed in the EIS and Submissions Report; and
- ensure measures are implemented to comply with all relevant legislation and other requirements as described in Section 3.1 of this Plan.

2.3 Targets

The following targets have been established for the management of flora and fauna impacts during the Project:

- ensure full compliance with the relevant legislative requirements and the Project Approvals;
- no unapproved disturbance to flora and fauna outside the proposed construction footprint and associated access tracks and site compounds;
- no increase in distribution of weeds currently existing within the Project areas;
- no new weeds introduced to the Project areas;
- no transfer of plant diseases or pathogens to or from the Project work areas;
- no net loss of significant habitat resources including hollow logs and tree nesting hollows, with materials cleared from the construction area re-used in adjacent areas where possible;
- effective rehabilitation / revegetation that ensures different successional stages of rehabilitation are achieved;
- no fauna mortality during construction;
- no spread of feral animals as a result of construction;
- no pollution or siltation of aquatic ecosystems, endangered ecological communities or threatened species habitat; and
- minimise barriers to fauna movement.

3 Environmental requirements

3.1 Relevant legislation and guidelines

3.1.1 Legislation

Legislation relevant to flora and fauna management includes:

- Environmental Planning and Assessment Act 1979 (EP&A Act);
- National Parks and Wildlife Act 1974 (NPW Act);
- NSW Threatened Species and Conservation Act 1995 (TSC Act);
- Fisheries Management Act 1994 (FM Act);
- Native Vegetation Act 2003;
- Noxious Weeds Act 1993 (NW Act);
- Pesticides Act 1999;
- Animal Research Act 1985;
- Environmental Protection and Biodiversity Conservation Act 1999 (Commonwealth) (EPBC Act);
- State Environmental Planning Policy 44 Koala Habitat Protection (SEPP 44);
- State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP14); and
- Clarence Valley Local Environmental Plan (LEP), 2011.

Relevant provisions of the above legislation are explained in the register of legal and other requirements included in Appendix A1 of the CEMP.

3.1.2 Additional approvals, licences, permits and requirements

Refer to Appendix A1 of the CEMP.

3.1.3 Guidelines

The main guidelines, specifications and policy documents relevant to this Plan include:

- RMS QA Specification D&C G36 – Environmental Protection (Management System);
- RMS QA Specification D&C G40 – Clearing and Grubbing;
- RMS QA Specification D&C R178 – Vegetation;
- RMS QA Specification D&C R179 – Landscape Planting;
- RMS Environmental Direction No.25 - Management of Tannins from Vegetation Mulch (January 2012);
- RMS Practice Note: Clearing and Fauna Management – Pacific Highway Projects (May 2012);
- RMS Biodiversity Guidelines (September 2011);
- NSW Fisheries, Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings, Fairfull and Witheridge, 2003;
- Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings – November 2003;
- NSW Department of Primary Industries, Policy and guidelines for fish habitat conservation and management, (2013 update);
- NSW National Parks & Wildlife Service. 2001. Policy for the Translocation of Threatened Fauna in NSW: Policy and Procedure Statement No. 9 Threatened Species Unit, Hurstville NSW;

- Australian Network for Plant Conservation. 2004. Guidelines for the Translocation of Threatened Plants in Australia, 2nd Edition;
- DECCW. 2008. Hygiene protocol for the control of disease in frogs; and
- Relevant recovery plans, priority action statements and best practice guidelines.

3.2 Minister's Conditions of Approval

The Conditions of Approval relevant to this CFFMP are listed in Table 3-1 below. A cross reference is also included to indicate where the condition is addressed in this CFFMP or other Project environmental management documents.

Table 3-1: Conditions of Approval relevant to the CFFMP

CoA No.	Condition Requirements	Where addressed
Biodiversity		
CoA B1	The clearing of native vegetation shall be generally in accordance with the areas specified in the documents listed in condition A2, and with the objective of reducing impacts to any endangered ecological communities (EECs), threatened species and their habitat to the greatest extent practicable.	Section 5.3.3 Table 7-2 mitigation measure ID CFFMM2 Annexure C Pre-clearing permit
CoA B2	Prior to construction, pre-clearing surveys and inspections for EECs and threatened species shall be undertaken. The surveys and inspections, and any subsequent relocation of species, shall be undertaken under the guidance of a suitably qualified ecologist and shall be in accordance with the methodology incorporated into the approved Construction Flora and Fauna Management Plan required under condition D46(e).	Table 7-2 mitigation measure ID CFFMM2 Section 5.3.3 Annexure C Pre-clearing permit Annexure D: Fauna Handling and Rescue Procedure Annexure F: Unexpected Threatened Flora Species / EEC Finds Procedure Annexure L - Three-toed Snake Tooth Skink construction management plan CEMP Appendix A6: Sensitive Area Plans
CoA B3	The Proponent shall undertake flora and fauna surveys of those parts of the Project area previously not surveyed, due to accessibility issues, prior to the commencement of construction that affects those areas. Should threatened species, communities or habitats be identified, these shall be offset and addressed in the Biodiversity Offset Statement required under condition D1.	This has been completed (by RMS) and addressed in Annexure L - Three-toed Snake Tooth Skink construction management plan
CoA B4	The Proponent shall undertake a targeted rehabilitation program post construction to restore riparian habitat to at least the pre-construction condition or better, unless otherwise agreed by DPI (Fisheries) and NOW.	The permanent <i>Revegetation Strategy</i> will be included in the UDLMP (CoA D42) and submitted separately to the CEMP. Table 7-2 mitigation measure ID CFFMM8
CoA B5	Vegetation shall be established in or adjacent to disturbed areas and include species which may provide habitat for wildlife following the completion of construction in the vicinity of the disturbed area. Revegetation is to be consistent with the Urban Design and Landscape Plan required under condition D42.	The permanent <i>Revegetation Strategy</i> will be included in the UDLMP (CoA D42) and submitted separately to the CEMP. Table 7-2 mitigation measure ID CFFMM8

CoA No.	Condition Requirements	Where addressed
CoA D1	<p>Prior to the commencement of operation of the SSI, the Proponent shall prepare a Biodiversity Offset Statement in consultation with the EPA. The Statement shall:</p> <p>a) confirm the threatened species, communities and their habitat (in hectares) cleared and their condition; and</p> <p>b) provide details of measures to offset impacts of the SSI on native vegetation, including threatened species, communities and their habitats, including the timing, responsibility, management and monitoring, and implementation of the offset measures.</p> <p>Biodiversity impacts shall be offset in accordance with the document Principles for the Use of Biodiversity Offsets in NSW (DECCW, 2008). A copy of the statement shall be submitted to the Secretary and EPA.</p>	<p>Section 7.2</p> <p><i>Biodiversity Offset Statement</i> (by RMS) - To be provided separately to the CEMP, prior to the commencement of operation.</p>
Construction Environmental Management Plan		
CoA D46(e)	<p>As part of the Construction Environment Management Plan for the SSI, the Proponent shall prepare and implement a Construction Flora and Fauna Management Plan to detail how construction impacts on ecology will be minimised and managed. The Plan shall be prepared by a suitably qualified and experienced ecologist and developed in consultation with the EPA and DPI (Fisheries), and shall include, but not necessarily be limited to:</p> <p>(i) plans for impacted and adjoining areas showing vegetation communities, important flora and fauna habitat areas, locations where threatened species, populations or endangered ecological communities have been recorded; including pre-clearing surveys to confirm the location of any threatened flora and fauna species and associated habitat features;</p> <p>(ii) a protocol for the removal and relocation of fauna during clearing, including provision for engagement of a suitably qualified and experienced ecologist to identify locations where they would be present; to oversee clearing activities and facilitate fauna rescue and re-location; and consideration of timing of vegetation clearing with consideration to the avoidance of clearing native vegetation during the breeding/nesting periods of threatened species, where feasible and reasonable;</p>	<p>This CFFMP</p> <p>Section 1.3 Section 4</p> <p>CEMP Appendix A6 Sensitive Area Plans Section 5.3.3 Section 8.3 Table 7-2 mitigation measure ID CFFMM2 Annexure C Pre-clearing permit Annexure L - Three-toed Snake Tooth Skink construction management plan</p> <p>Table 7-1 Table 7-2 mitigation measure ID CFFMM2, CFFMM4 CFFMM10, CFFMM11 Annexure C: Pre-clearing permit Annexure D: Fauna Handling and Rescue Procedure Annexure F: Unexpected Threatened Flora Species / EEC Finds Procedure Annexure L: Three-Toed Snake Tooth Skink Management Plan</p>

CoA No.	Condition Requirements	Where addressed
(iii)	<p>details of general work practices and mitigation measures to be implemented during construction and operation to minimise impacts on native terrestrial and aquatic fauna and flora (particularly threatened species and their habitats and endangered ecological communities) not proposed to be cleared as part of the SSI, including, but not necessarily limited to: fencing of sensitive areas; measures for maintaining existing habitat features (such as bush rock and tree branches etc.); seed harvesting and appropriate topsoil management; construction worker education; weed management, erosion and sediment control, including measures to at least maintain habitat values downstream; and progressive re-vegetation;</p>	<p>Table 7.1 Table 7-2 mitigation measure ID CFFMM1, CFFMM2, CFFMM8, CFFMM18. Section 8.2 Annexure C: Pre-clearing permit Annexure D: Fauna Handling and Rescue Procedure Annexure F: Unexpected Threatened Flora Species / EEC Finds Procedure Annexure G - Weed Management Plan Annexure I Nest Box Management Plan CSWQMP Annexure A – ESCPs CSWQMP Annexure F Stockpile Management Protocol The permanent <i>Revegetation Strategy</i> will be included in the UDLMP (CoA D42) and submitted separately to the CEMP.</p>
(iv)	<p>rehabilitation and revegetation details, including objectives, identification of flora species and sources, measures for the management and maintenance of rehabilitated areas, and timeframes and responsibilities for revegetation and rehabilitation;</p>	<p>Table 7.1 Table 7-2 mitigation measure ID CFFMM8, CFFMM18, CFFMM21. Annexure C: Pre-clearing permit The permanent <i>Revegetation Strategy</i> will be included in the UDLMP (CoA D42) and submitted separately to the CEMP. All levee works will be either turfed (urban areas) or seeded (rural areas) in agreement with the property owners to re-establish the existing grass cover. Levee stockpile sites will be seeded. Requirements for revegetation of the levees is captured in the levee design documentation (drawings and specifications).</p>
(v)	<p>procedures for monitoring success of regeneration and revegetation, and corrective actions should regeneration or revegetation not conform to the objectives adopted;</p>	<p>Section 8.3 The permanent <i>Revegetation Strategy</i> will be included in the UDLMP (CoA D42) and submitted separately to the CEMP.</p>
(vi)	<p>weed management measures focusing on early identification, suppression and control of invasive weeds and effective management controls;</p>	<p>Table 7-2 mitigation measure ID CFFMM14-CFFMM18.</p>

CoA No.	Condition Requirements	Where addressed
		Annexure G - Weed Management Plan
	(vii) a protocol for managing aquatic and terrestrial pest animal/invasive species and plant species, and pathogens;	Table 7-2 mitigation measure ID CFFMM21. Annexure B: Protocol for managing pathogens Annexure G - Weed Management Plan
	(viii) a procedure for dealing with unexpected endangered ecological communities and threatened species identified during construction, including cessation of work and notification of the EPA and DPI (Fisheries), determination of appropriate mitigation measures in consultation with these agencies (including relevant re-location measures) and updating of ecological monitoring and/or biodiversity offset requirements; and	Annexure F: Unexpected Threatened Flora Species / EEC Finds Procedure
	(ix) mechanisms for the monitoring, review and amendment of this plan.	Section 8.3 Section 9

Notes: ¹ Defined by the Infrastructure Approval: **Feasible** relates to engineering considerations and what is practical to build. **Reasonable** relates to the application of judgement in arriving at a decision, taking into account mitigation benefits and cost of mitigation versus benefits provided, community expectations and nature and extent of potential improvements. Where requested by the Secretary, the Proponent must provide evidence as to how feasible and reasonable measures were considered and taken into account.

4 Consultation

In accordance with CoA D46(e), this CFFMP has been developed in consultation with the:

- Environment Protection Authority (EPA), and
- Department of Primary Industries (DPI) (Fisheries).

A summary of consultation undertaken during the preparation of this CFFMP is provided in Appendix A2 of the CEMP.

4.1 Consultation Requirements under the Infrastructure Approval

CoA D1: Biodiversity Offset Statement to be developed in consultation with the EPA.

CoA B4: A targeted rehabilitation program is to be implemented post construction to restore riparian habitat to at least the pre-construction condition or better, unless otherwise agreed by DPI (Fisheries) and NOW.

CoA D46(e): The CFFMP to be developed in consultation with the EPA and DPI (Fisheries).

CoA D46(e)(viii): The CFFMP is to include a procedure for dealing with unexpected endangered ecological communities and threatened species identified during construction, including cessation of work and notification of the EPA and DPI (Fisheries), determination of appropriate mitigation measures in consultation with these agencies (including relevant re-location measures) and updating of ecological monitoring and/or biodiversity offset requirements.

4.2 Consultation Requirements under the EIS

B2 – As part of the FFMP, a revegetation management sub-plan will be developed to provide specific details for the re-establishment of native vegetation on areas disturbed by the project construction. This plan will be developed in consultation with EPA.

In accordance with Table 7-1, Environmental management measure B2 will be satisfied by way of a permanent *Revegetation Strategy* included in the UDLMP (CoA D42). The UDLMP will be prepared in consultation with the EPA, and others required by CoA D42, and submitted separately to the CEMP.

5 Existing environment

This chapter describes the existing biodiversity within the Project impact area, including species, communities and habitats, based on the information contained in Section 8 and Appendix L of the EIS.

The Project impact area comprises the Project footprint and the additional area likely to be directly or indirectly affected by the construction of the Project, defined by a 50 m buffer either side of the Project.

The location of the relevant ecological data is shown on the sensitive area maps included in Appendix A6 of the CEMP.

5.1 Vegetation Communities

The majority of the Project area, including the flood mitigation works area (levee), is represented by a highly modified landscape in poor condition with little or no native vegetation remaining. These areas have been subject to historic and ongoing urbanisation, grazing and cropping which has led to the isolated and fragmented nature of remnant vegetation.

The Project area can be broadly categorised into four vegetation communities:

- Freshwater Wetlands on Coastal Floodplains (FWCF) (listed in the TSC Act as endangered) (0.10 ha);
- Subtropical Coastal Floodplain Forest (SCFF) (listed in the TSC Act as endangered) (0.31ha);
- Native and exotic plantings (4.41 ha); and
- Weeds and exotics (31.25 ha).

The extent of the vegetation communities in the Project area are shown on Figure 5-1, Figure 5-2 and Figure 5-3. Further information on FWCF and SCFF is provided in Section 5.2.

5.1.1 Native and exotic plantings

Native and exotic plantings are dominant throughout the urbanised portion of the Project area in Grafton and South Grafton, encompassing a total area of 4.41 ha. This community comprises a high level of exotic canopy species and landscaping natives that are not native to the locality, typically found on roadside verges and nature strips where planted *Jacaranda mimosifolia* and *Ficus macrophylla* are prominent. The shrub and understorey are dominated by exotic shrubs, grasses and annuals including *Pennisetum clandestinum* and *Axonopus fissifolius*. Other commonly planted species in this community include *Eucalyptus microcorys*, *Cinnamomum camphora* and *Melaleuca leucodendron*.

This vegetation community is in poor condition due to the highly modified landscape in which it is found. Nonetheless, this community may provide potential fauna habitat for threatened and non-threatened species.

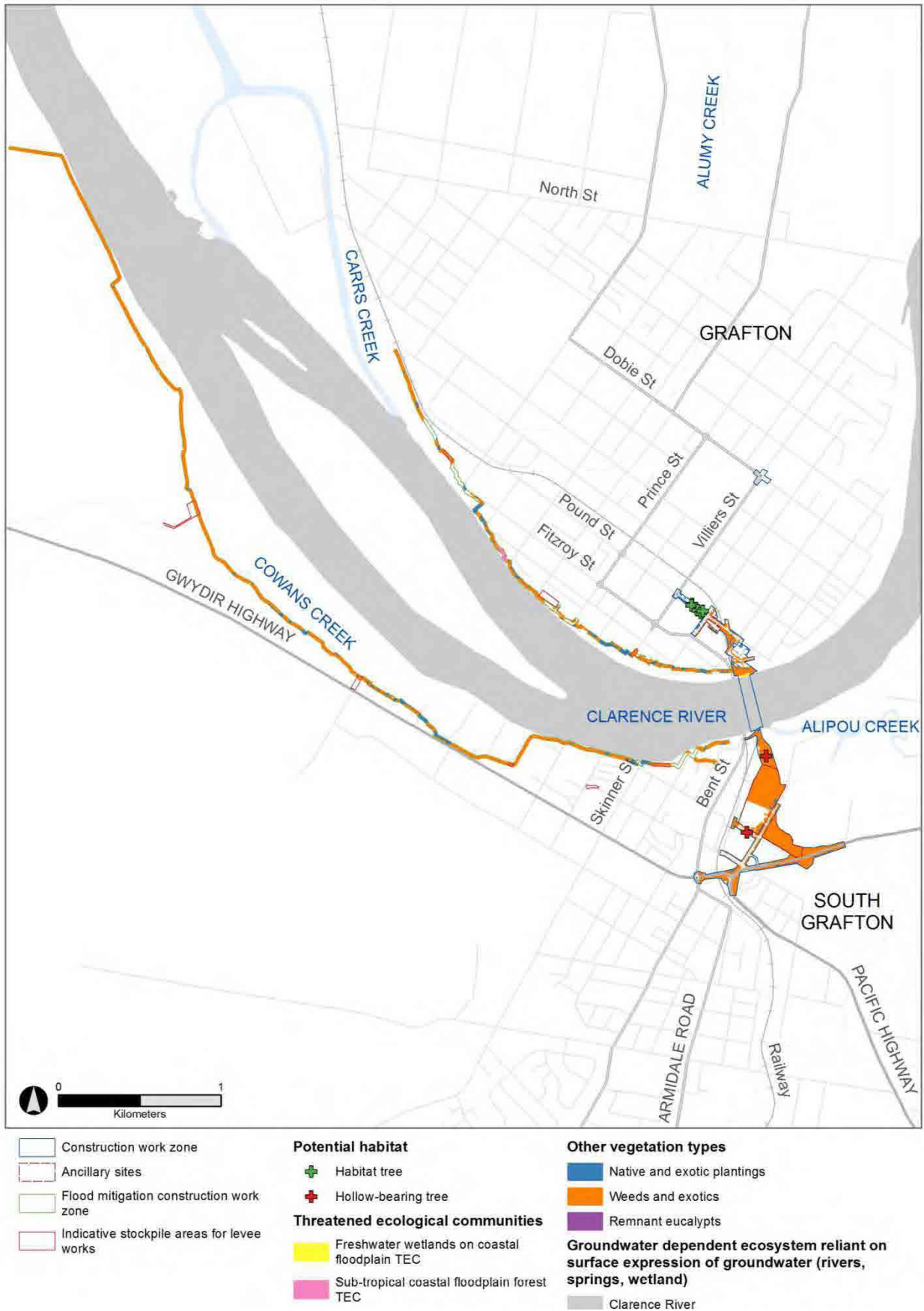


Figure 5-1: Vegetation communities in the Project area

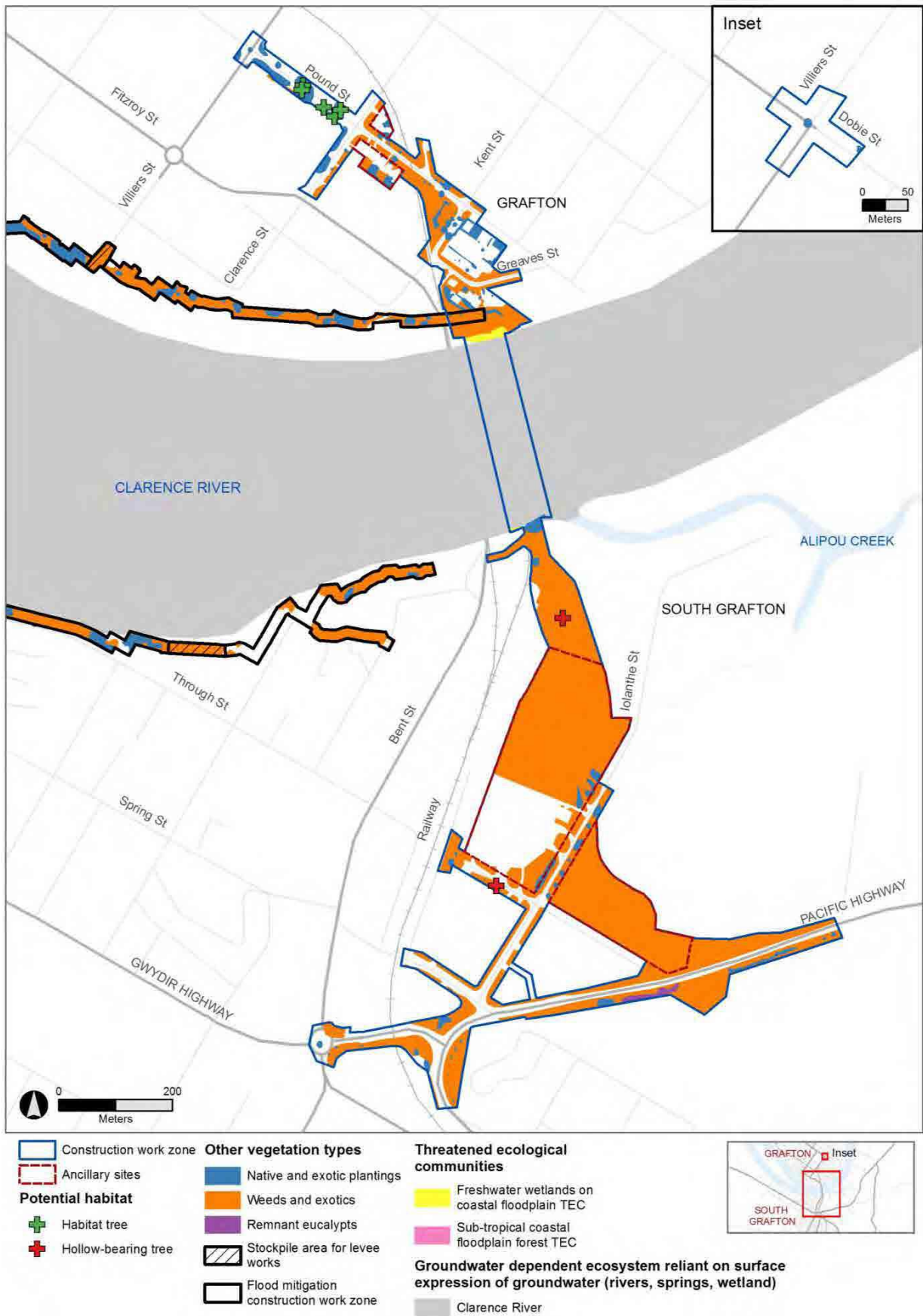


Figure 5-2: Vegetation communities in the Project area showing details within Grafton and South Grafton

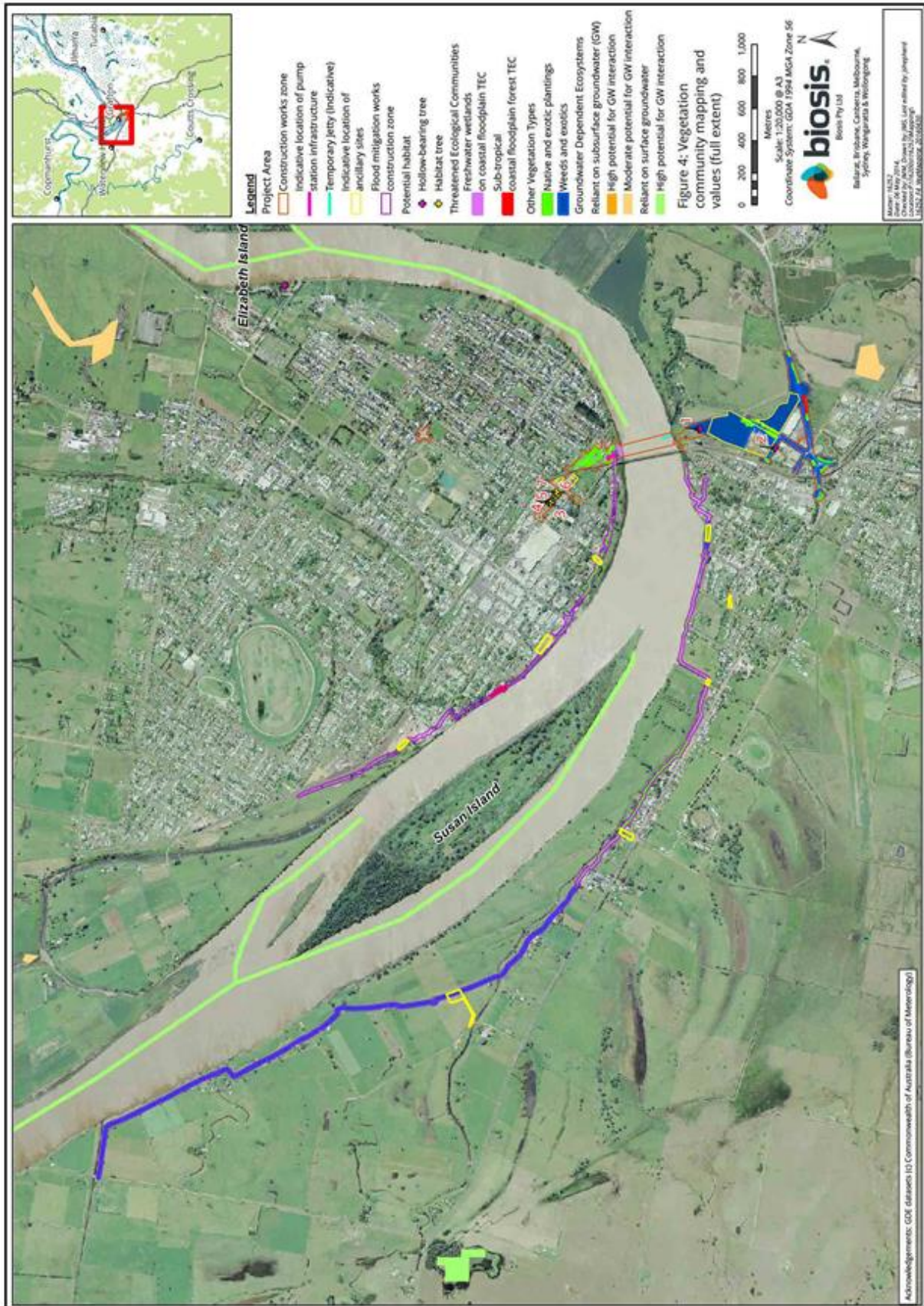


Figure 5-3: Vegetation Community Mapping (aerial photograph)

5.1.2 Weeds and exotics

Weeds and exotics dominate the Project area through Grafton and South Grafton, encompassing a total area of 31.25 ha. The species composition varies according to land use, with exotic grasses dominant within mown and grazed areas and annuals and shrubs dominant through the riparian sections adjoining the Clarence River.

This community is found in wet depressions and along the banks of the Clarence River in low lying areas with relatively poor drainage. Along the levees the community is generally dominated by exotic mown grasses and annuals such as *Pennisetum clandestinum*, *Chloris gayana* and *Bidens pilosa*. Within the urbanised area, garden escapees and landscaping plants are prevalent, with very low native diversity recorded. Common weed and exotic species include *Erythrina crista-galli*, *Ricinus communis*, *Argemone ochroleuca*, *Tradescantia fluminensis*, *Ipomoea indica*, *Vicia sativa*, *Sporobolus fertilis*, *Argemone ochroleuca*, *Lolium perenne*, *Holcus lanatus* and *Phalaris aquatica*.

This vegetation community is in poor condition based on the low number of indigenous species, high level of weed invasion and the fact that the original vegetation layers (ground, shrub, canopy etc.) are modified or missing.

5.2 Terrestrial Flora

5.2.1 Flora

A total of 217 flora species, including 127 exotic and 90 native species, have been identified across the Project area and immediate surrounds during assessments to date.. Of the 127 exotic species, thirteen are listed as noxious weeds in the Clarence Valley LGA (refer to Section 5.4).

5.2.2 Riparian Vegetation

Vegetation located along the Clarence River at Grafton is generally degraded and dominated by annuals and shrubs. Riparian vegetation also consists of isolated poor condition patches of Sub-coastal Floodplain Forest Endangered Ecological Community (EEC) and poor condition linear areas of Freshwater Wetlands on Coastal Floodplains EEC.

5.3 Threatened Ecological Communities and Flora Species

Two of the vegetation communities recorded within the Project area are consistent with EECs listed under the TSC Act:

- *Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* (FWCF); and
- *Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion* (SCFF).

Figure 5-1, Figure 5-2 and Figure 5-3 shows the location of the EECs in the Project corridor and surrounds. The composition of these EECs is described below.

5.3.1 Freshwater Wetlands on Coastal Floodplains (FWCF)

The FWCF community is present within the Project corridor and surrounds, predominantly as narrow linear disjointed patches along the banks of the Clarence River.

This community is found in predominantly inundated wet depressions and along the banks of the Clarence River in low lying areas with relatively poor drainage. Soils are often heavy alluvial deposits. Species present in the mid strata include Common Reed *Phragmites australis*, Cumbungi *Typha orientalis* and *Ricinus communis*, with groundstorey strata

including *Schoenoplectus mucronulatus*, *Cyperus eragrostis* *Bolboschoenus fluviatilis*, *Elaeocarpus obovatus*, *Persicaria hydropiper* and *Rumex brownii*. Common paddock weeds have integrated substantially into many of the areas identified.

The FWCF community in the Project area is generally in poor condition with heavy recruitment of exotic species due to surrounding land use and edge impacts. The freshwater wetlands provide marginal habitat for threatened flora including Hairy Joint Grass *Arthraxon hispidus*, however targeted searches carried out for the EIS did not identify this species.

5.3.2 Subtropical Coastal Floodplain Forest (SCFF)

This community is predominantly located on the south bank of the Clarence River, downstream of the existing bridge, with small scattered patches occurring throughout the Project area. The largest patch of SCFF (0.31 hectares) is located approximately 1,500 m upstream of the existing bridge, on the northern bank of the Clarence River.

SCFF generally occurs on exposed dry sites on hills and foot slopes, as well as dry, steep, rocky sites, often on poorly developed or skeletal soils. The canopy is predominantly native with some exotic species including garden escapees and noxious weeds in the mid storey and shrub strata. Paddock and roadside exotic grasses are dominant in the groundstorey and exotic vines and scramblers are present. The SCFF community is typically present in the form of isolated remnant canopy species with little connectivity and a lack of native shrubs, grasses and ground covers. The canopy is dominated by *Eucalyptus tereticornis*, *Casuarina cunninghamiana* and *Casuarina glauca*, with midstorey species either absent or comprising weeds such as *Cinnamomum camphora*, *Erythrina crista-galli*, *Lantana camara*, Small-leaf Privet *Ligustrum sinense* and Wild Tobacco *Solanum mauritianum*. The groundstorey comprises *Ageratum houstonianum*, *Cynodon dactylon* and *Tradescantia fluminensis*.

The SCFF community within the Project area is in poor condition and the habitat consists mainly of scattered mature *Eucalyptus tereticornis*, providing potential habitat mainly for woodland birds and microbats species. Some sparse, coarse, woody debris may provide limited habitat for reptile species. In some areas, pockets of Lantana offer a complex shrub layer understorey that may provide foraging and shelter resources for small mammals and birds.

5.3.3 Threatened Flora Species

No threatened flora species as listed under the TSC Act or the EPBC Act have been recorded in the Project area. Therefore, no specific procedures (e.g. re-location, translocation and/or management and protection measures), to deal with identified threatened flora species within the project boundary, are required at this stage.

Nevertheless, it is beneficial to identify the potential threatened flora species that may exist on the Project. The results of the habitat assessment carried out for the EIS indicate that there is a medium to high likelihood of the occurrence of one threatened flora species, Hairy-joint Grass *Arthraxon hispidus*, in the Project area. The EIS identified that FWCF may provide marginal potential habitat for Hairy-joint Grass (EIS Appendix L, p47).

To assist with identification in the field, a picture of the threatened flora species, Hairy-joint Grass is included in Annexure M.

The locations of the threatened flora species in the Project corridor are shown on Figure 5-1, Figure 5-2 and Figure 5-3, as well as on the Sensitive Area Plans included at Appendix A6 of the CEMP.

5.4 Noxious Weeds

Thirteen flora species listed as noxious weeds in the Clarence Valley LGA have been recorded in the Project corridor and surrounds. These weeds are generally located along the banks of the Clarence River and within the paddocks traversed by the levee. Table 5-1 lists the species and the noxious weed class to which they belong.

Refer to the Weed Management Plan in Annexure G for additional detail.

Table 5-1: Noxious weeds recorded in the Project area

Weeds Species	Common Name	Weed Class
<i>Ageratina adenophora</i>	Crofton weed	4
<i>Alternanthera philoxeroides</i>	Alligator weed	2
<i>Cestrum parqui</i>	Green cestrum	3
<i>Cinnamomum camphora</i>	Camphor laurel	4
<i>Cryptostegia grandiflora</i>	Rubber vine	1
<i>Eichhornia crassipes</i>	Water hyacinth	4
<i>Lantana camara</i>	Lantana	4
<i>Leptospermum petersonii</i>	Lemon-scented tea tree	4
<i>Ligustrum lucidum</i>	Broad-leaved privet	4
<i>Ligustrum sinense</i>	Small-leaved privet	4
<i>Opuntia stricta</i>	Prickly pear	4
<i>Salix fragilis</i>	Crack willow	5
<i>Sporobolus fertilis</i>	Giant Parramatta grass	4

The regulatory requirements for the management of each Weed Class are:

- Class 1 - The plant must be eradicated from the land and the land must be kept free of the plant.
- Class 2 - The plant must be eradicated from the land and the land must be kept free of the plant.
- Class 3 - The plant must be fully and continuously suppressed and destroyed.
- Class 4 - The growth and spread of the plant must be controlled according to the measures specified in a management plan published by the local control authority.
- Class 5 - The requirements in the Noxious Weeds Act 1993 for a notifiable weed must be complied with.

Crack Willow, *Salix fragilis*, is a notifiable weed under Part 3 of the *Noxious Weeds Act 1993*.

5.5 Pests and Pathogens

DPI has mapped Clarence Valley Shire as a 'red' management zone, where the myrtle rust fungus is considered to be widely distributed. Myrtle rusts are serious pathogens that affect plants belonging to the family Myrtaceae including Australian natives such as bottlebrush (*Callistemon spp.*), tea tree (*Melaleuca spp.*) and eucalypts (*Eucalyptus spp.*), which all occur in the Project area.

The presence of *Phytophthora cinnamomi* was not recorded during the surveys carried out for the EIS, however there is a risk that this pathogen could be introduced to the Project area during construction in soil on machinery or plant previously used in an infected area.

Phytophthora cinnamomi has not been widely reported in the Clarence Valley LGA, however there is a confirmed site located between Grafton and Tenterfield (DECC, 2008).

5.6 Terrestrial and Aquatic Fauna and Habitat

5.6.1 Fauna Species

Seasonal surveys conducted for the EIS in August 2010, February 2012, October 2013 and December 2013 identified 124 fauna species in the Project area and surrounds, including:

- 83 birds
- 22 mammals
- 7 reptiles
- 2 frogs
- 10 fish species.

A total of 20 threatened fauna species and 6 migratory species are known to occur or are considered to have a medium or high potential to occur in the Project area. The threatened and migratory fauna species identified during the surveys of 2010, 2012 and 2013 are listed in Table 5-2.

Table 5-2: Threatened and Migratory fauna (identified during EIS fauna surveys)

Common name	Scientific name	EPBC Act	TSC Act	Likelihood of Occurrence
Threatened Fauna Species - Birds				
Masked Owl	<i>Tyto novaehollandiae</i>	-	Vulnerable	High - Project area likely to form part of the hunting territory.
Magpie Goose	<i>Anseranas semipalmata</i>	-	Vulnerable	Medium - 80 records of this species occur within 10 km of Project area.
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	-	Endangered	Medium - Species may forage within freshwater wetlands and agricultural floodplains of the Clarence River.
Brolga	<i>Grus rubicunda</i>	-	Vulnerable	Medium - Species may forage within agricultural farmland habitats within the Project area
Comb-crested Jacana	<i>Irediparra gallinacea</i>	-	Vulnerable	Medium - One ornamental pond in South Grafton which this species may frequent.
Square-tailed Kite	<i>Lophoictinia isura</i>	-	Vulnerable	Medium - Suitable habitat in South Grafton, however no suitable nesting habitat
Osprey	<i>Pandion cristatus</i>	-	Vulnerable	Medium - This species is likely to hunt along the Clarence River.
Threatened Fauna Species - Terrestrial				
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	-	Vulnerable	High - Species recorded during anabat surveys (Biosis, 2013) Suitable habitat within Project area.
Little Bentwing-bat	<i>Miniopterus australis</i>	-	Vulnerable	High - Species recorded in surveys within Project area during 2010 and anabat surveys (Biosis, 2013).

Common name	Scientific name	EPBC Act	TSC Act	Likelihood of Occurrence
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	-	Vulnerable	High - Species recorded during surveys within Project area during 2010. Species recorded during anabat surveys (Biosis, 2013).
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	-	Vulnerable	High - Species recorded during anabat surveys (Biosis, 2013). Species may roost in Eucalyptus trees within habitat in South Grafton.
Southern Myotis	<i>Myotis macropus</i>	-	Vulnerable	High - Species was recorded during surveys via anabat (Biosis, 2013). Likely to forage along riparian vegetation of Clarence River and Alipou Creek within Project area.
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	Vulnerable	Vulnerable	High - Resident colony on Susan Island. Individuals likely to forage within Moreton bay figs within Project area
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	-	Vulnerable	High - Species recorded during current surveys via anabat (Biosis, 2013).
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	-	Vulnerable	High - Species recorded during current surveys via anabat (Biosis, 2013).
Three-toed Snake-tooth Skink	<i>Coeranoscincus reticulatus</i>	Vulnerable	Vulnerable	High – 25 records of this species occur within 10 km of Project area, 21 recorded during Lewis and BioNet 2016 Surveys.
Eastern Long-eared Bat	<i>Nyctophilus bifax</i>	-	Vulnerable	Medium - Species has been recorded approx. 9.5 km from Project area. A <i>Nyctophilus</i> sp. call was recorded during anabat surveys.
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	-	Vulnerable	Medium - Species recorded on seven occasions previously within, or within 10 km of the Project area.
Threatened Fauna Species - Fish				
Purple-spotted Gudgeon	<i>Mogurnda adspersa</i>	-	Endangered	High - Suitable habitat is available, individuals were captured during recent surveys
Silver Perch	<i>Bidyanus bidyanus</i>	Critically Endangered	Vulnerable	Moderate - Suitable habitat available within the Project area.
Migratory Fauna Species				
Cattle Egret	<i>Ardea ibis</i>			High – Confirmed
Clamorous Reed Warbler	<i>Acrocephalus stentoreus</i>			High – Confirmed
Common Tern	<i>Sterna hirundo</i>			High – Confirmed
Glossy Ibis	<i>Plegadis falcinellus</i>			High
White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>			High – Confirmed
Rainbow Bee-	<i>Merops ornatus</i>			High

Common name	Scientific name	EPBC Act	TSC Act	Likelihood of Occurrence
eater				

5.6.2 Fauna Habitat

Native vegetation occurs in a number of patches within the highly urbanised landscape. Better quality fauna habitat is found in the larger patches of native vegetation, with lower quality habitat occurring as linear roadside strips of modified vegetation. Five broad habitat types, including aquatic habitat, occur in the Project area, as summarised in Table 5-3 below.

Table 5-3: Habitat Features

Habitat Type	Terrestrial Habitat features
Freshwater Wetlands on Coastal Floodplains EEC	<ul style="list-style-type: none"> Narrow linear patches along the banks of the Clarence River and in disjunct patches. Also recorded within a number of the flood gate channels along the length of the levee. Found in inundated wet depressions and along the banks of the Clarence River in low lying areas with relatively poor drainage. Generally in poor condition due to recruitment of exotic species as a result of surrounding land use and associated edge impacts. Provides marginal habitat for threatened flora including Hairy Joint Grass <i>Arthraxon hispidus</i> and prior listed and current RoTAP, Frogbit <i>Hydrocharis dubia</i>
Subtropical coastal floodplain forest EEC	<ul style="list-style-type: none"> Predominantly located on south bank of Clarence River, downstream of existing bridge. Poor condition due to historic disturbance in the area. Consists mainly of scattered mature <i>Eucalyptus tereticornis</i>, providing potential habitat for woodland birds and microbats species. Coarse woody debris may provide limited habitat for reptile species. Pockets of Lantana may provide foraging and shelter for small mammals and birds.
Native and exotic plantings	<ul style="list-style-type: none"> Typically encompasses roadside verges and nature strips where planted <i>Jacaranda mimosifolia</i> and <i>Ficus macrophylla</i> are thriving Poor condition due to presence in highly modified landscape Poor condition habitat for native species in terms of connectivity Good quality habitat and foraging resources for a range of bird and mammal species, such as the grey-headed flying-fox, where planting comprise habitat trees (i.e. Moreton Bay Fig, <i>Jacaranda mimosifolia</i> and <i>Cinnamomum camphora</i>).
Weeds and exotics	<ul style="list-style-type: none"> Occurs throughout the Project area. Exotic grasses dominant within mown areas and annuals and shrubs dominant through the riparian sections adjoining the Clarence River. Found in wet depressions and along the banks of the Clarence River in low lying areas with relatively poor drainage. Poor condition due to low number of indigenous species, significant weed invasion, and missing or modified original vegetation layers (ground, shrub, canopy etc.). Paddock habitat provides limited resources for fauna, but supports foraging and browsing habitat for larger mammals, such as Eastern Grey kangaroo and Common wombat.
Aquatic Habitat	<ul style="list-style-type: none"> Clarence River in the vicinity of the Project area and its local tributaries are influenced by tidal waters. As a result, the aquatic ecological community is consists of combination of freshwater and estuarine/marine species. Clarence River is classified as a CLASS 1 waterway for fish habitat conservation and management (DPI, 2013). Within and adjacent to the Project alignment, Clarence River contains TYPE 2 moderately sensitive key fish habitat as it provides riverine brackish wetland habitat and has a stable vegetated substrate. Riparian vegetation along the banks of the Clarence River is heavily degraded offering limited habitat due to a lack of riparian vegetation. The tributary creeks (Alipou, Cowan's and Carr's Creeks) have been heavily modified by previous agricultural activities with limited riparian vegetation.

Habitat Type Terrestrial Habitat features

- Alipou, Cowan's and Carr's Creeks are classified as CLASS 1 waterways. They contain TYPE 2 moderately sensitive key fish habitat and provide a combination of freshwater habitats and brackish wetlands.

State Environmental Planning Policy 44 – Koala habitat protection

A habitat assessment was carried out for the EIS in accordance with the Interim Koala Referral Advice for Proponents (DSEWPaC, 2012) and State Environmental Planning Policy 44 criteria. The assessment indicated that it is unlikely that the Project area supports (or could support) a population of Koalas due to the lack of suitable connecting vegetation. The species is considered to have a low likelihood of occurrence in areas flagged as potential koala habitat within the Project area. None of the isolated, individual Forest Red Gum trees are proposed to be removed as part of the Project, therefore no potential direct impact on koalas by the Project is predicted.

Critical Habitat

There is no listed critical habitat for Koala within the Project area.

5.7 Aquatic ecology

The Clarence River at Grafton flows from west to east within the Project Area. The River rises near the Queensland border and flows south and north-east for 394 km before emptying into the Pacific Ocean at Yamba. Tidal influences extend to the town of Copmanhurst approximately 30 km upstream of Grafton. Alipou, Cowan's and Carr's Creeks are tributaries of the Clarence River at Grafton. Refer Table 5-3 above for a description of the aquatic habitat provided by these waterways.

The Clarence River experiences regular floods, with records indicating that since 1839 there has been 71 major and moderate floods, the most recent being in 2001 when the river peaked at 7.70 m (Clarence Valley City Council Website). The floods typically occur from relatively low rainfall events upstream, lasting for several days or weeks, rather than high intensity rains. Long periods of dry followed by flooding events are normal environmental conditions given the size of the catchment and rainfall for the region.

Aquatic fauna captured during the EIS surveys comprised 11 species of fish (including two introduced species), one reptile and one decapod crustacean. No aquatic flora species listed as threatened under the EPBC Act or the FM Act were recorded during the aquatic surveys. Seven threatened aquatic fauna species occur or potentially occur within the Project area. Two threatened fish species (Purple-spotted Gudgeon, *Mogurnda adspersa* and Silver Perch, *Bidyanus bidyanus* - also listed as critically endangered under the EPBC Act) listed under the FM Act have a medium to high likelihood of occurrence within the Project area.

The Seagrass Working Group has confirmed there is no seagrass (*Posidonia sp.*) in the Clarence River where the additional river crossing is to be located.

5.7.1 State Environmental Planning Policy 14 – Coastal Wetlands

The closest wetland listed under SEPP 14 is wetland number 292 located 8 km to the east of the Project area. It is part of the Upper Coldstream Wetlands, associated with Coldstream River and Pillar Valley Creek, and therefore is not expected to be impacted by the Project.

5.8 Wildlife Connectivity Corridors

The Project area is largely isolated from optimal habitats and regional corridors occurring within the Clarence Valley LGA. The surrounding landscape has historically been modified to an urban landscape of predominantly residential developments, farming lands and associated road infrastructure. As such, the Project area is not identified to be in the vicinity of any areas classified as 'significant vegetated corridors' or 'stepping stone corridors and priority restoration areas'.

The Project area is located within the interface of fresh and tidal waters within the Clarence River. This interface is a corridor for diadromous fish species - fish that migrate from freshwater to saltwater or vice versa to complete life cycles. Locally occurring freshwater fish may also utilise the Clarence River to migrate to and from spawning sites and exploit resources throughout the system.

5.9 Groundwater dependent ecosystems

The two vegetation communities and habitats that have the potential to be affected by impacts to groundwater are:

- Freshwater Wetlands on Coastal Floodplain; and
- Sub-tropical Coastal Floodplain Forest.

These communities occur on waterways and floodplains and are likely to be reliant on groundwater, particularly during drought periods.

5.9.1 Groundwater Dependent Ecosystem Map Report

The results of the Bureau of Meteorology (BoM) Groundwater Dependent Ecosystem (GDE) Atlas search undertaken as part of the EIS identified the following GDEs within the Project area:

- the Clarence River, as a GDE reliant on surface expression of groundwater (rivers, springs, wetland), identified in previous fieldwork studies; and
- vegetation, as a GDE reliant on subsurface groundwater, which is identified as having a high, moderate and low potential for groundwater interaction (refer to patch located in South Grafton).

Refer to Figure 5-1, Figure 5-2 and Figure 5-3 for locations of potential groundwater interactions.

6 Environmental aspects and impacts

6.1 Construction activities

Key aspects of the Project that could result in impacts to terrestrial and aquatic flora and fauna include:

- clearing of native vegetation and habitat;
- stockpile / compound road construction near vegetation;
- works around and within watercourses;
- removal of dead wood, in-stream woody debris and dead trees;
- noise impacts;
- general earthworks near vegetation, resulting in disturbance of soils, erosion and the mobilisation of sediment;
- establishment of concrete batching plant;
- vehicular movements; and
- open excavation works.

Refer also to the Environmental Aspects and Impacts Register included in Appendix A3 of the CEMP.

6.2 Project Ecological impacts

Potential construction impacts associated with the Project include:

- loss of vegetation and habitat;
- impacts on threatened species and their habitats;
- habitat fragmentation and loss of wildlife connectivity;
- injury and mortality of fauna;
- invasion of exotic species, weeds, pests and pathogens;
- impacts on GDEs;
- impacts due to noise, vibration and light;
- cumulative impacts.

More details on these impacts are provided in the sections below. The mitigation and management measures provided in Table 7-1 aim to minimise these potential impacts.

6.2.1 Impacts on Flora

6.2.1.1 Impacts on threatened ecological communities and riparian vegetation

The Project would result in the removal of an estimated total of 0.41 ha of threatened ecological communities, comprising:

- Subtropical Coastal Floodplain Forest EEC (approximately 0.31 ha).
- Freshwater Wetlands on Coastal Floodplains EEC (approximately 0.1 ha).

The impacted areas are considered to be of relatively low regional and local importance based on the small patch size, degraded nature of the vegetation and location within a peri-urban (i.e. non-urban areas close to cities and towns) area.

6.2.1.2 Impacts on threatened flora species

No threatened flora species were recorded within the study area, therefore no significant impacts on threatened flora species or their habitat are anticipated. The *TSC Act* assessment of significance carried out for Hairy-joint Grass in the EIS concluded that the Project would have a minimal impact on this species and its potential habitat in the locality.

In the event that Hairy-joint Grass *Arthraxon hispidus*, or any other threatened flora species, is unexpectedly encountered on the project, refer to the Unexpected Threatened Species/EEC Find Procedure in Annexure F.

6.2.1.3 Potential spread of noxious weeds

The Project is not likely to significantly increase the presence or distribution of weeds in the area. There is potential for weeds to be spread during vegetation clearance and through the movement of vehicles and machinery. Weed control works will be undertaken in accordance with the *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (RMS, 2011).

6.2.1.4 Pests and pathogens

The Project area is potentially contaminated with *Phytophthora cinnamomi*, although there is no evidence of widespread vegetation loss within the area. Infection of native plants by *P. cinnamomi* is listed as a key threatening process both in NSW and nationally. Ongoing loss of understorey species infested with *Phytophthora* can affect threatened and endangered mammal species through the loss of cover, food resources and nesting habitat.

Construction activities associated with the Project have the potential to spread disease through vegetation clearance activities and subsequent disposal, and through the movement of vehicles and machinery. Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in *Biodiversity Guidelines: Guide 7 Pathogen management* (RMS, 2011). Refer to the procedure contained in Annexure B.

6.2.2 Impacts on Fauna

6.2.2.1 Impacts on threatened and migratory fauna

Project construction has the potential to impact on threatened species through:

- death or injury of individuals;
- loss or disturbance of limiting foraging and breeding resources; and
- removal of two hollow-bearing trees and five habitat trees (the locations of these trees are shown on Figure 5-1, Figure 5-2 and Figure 5-3).

Staged clearing of the two hollow-bearing and five habitat trees will be undertaken to reduce the risk of fauna mortality associated with their removal, in accordance with the *RMS Biodiversity Guidelines* (RMS, 2011).

Seven-part tests under the *TSC Act* were carried out for threatened fauna species recorded during field surveys and fauna species considered to have a moderate to high likelihood of occurrence in the Project area. These concluded that the construction of the Project is unlikely to have a significant effect on any of these species.

EPBC Act significant impact criteria assessments carried out for Grey-headed Flying-fox, Three-toed Snake-tooth Skink and listed migratory species concluded that the Project is unlikely to have a significant impact on any of these species.

There are various permanent Cattle Egret breeding colonies around Grafton (with the closest one to the Project area on the corner of Kitchner and Price Street), however the Project would not have any direct, or significant indirect, impact on this species.

The Project would not directly impact on breeding colonies or any migratory species recorded within the Project area.

It is unlikely there would be a significant impact on the endangered Emu population recorded within 10 km of the Project area as it is unlikely the population would come so far west of their normal range.

6.2.2.2 Impacts on Koala habitat

A habitat assessment carried out for the Project area in accordance with the Interim Koala Referral Advice for Proponents (DSEWPaC, 2012) and State Threatened flora and fauna Environmental Planning Policy 44 criteria indicated that it is unlikely that the Project area supports (or could support) a population of Koalas, and the species is considered to have a low likelihood of occurrence in areas flagged as potential Koala habitat. No individual Forest Red Gum trees are proposed to be removed, so the potential direct impact of the Project on Koalas would be negligible.

6.2.2.3 Wildlife connectivity and habitat fragmentation

The Project area is isolated from the optimal habitats and regional corridors occurring within the Clarence Valley LGA. The area in the vicinity of the Project area has been substantially modified and is now an urban landscape of residential developments, farming lands and associated road infrastructure where habitat is fragmented. Therefore, the construction of the Project is not expected to result in impacts on regional fauna corridors or habitat fragmentation.

6.2.2.4 Noise, vibration and light

Construction noise, vibration and lighting from ancillary sites and construction zones have the potential to impact native fauna species. However, given the existing levels of noise, vibration and light from Grafton and South Grafton, the increase above existing levels is unlikely to be substantial enough to result in any significant impacts on native fauna species.

6.2.3 Impacts on aquatic ecology

6.2.3.1 Aquatic habitat and species

The construction of the Project is unlikely to have a significant impact on aquatic habitat and threatened species because:

- potential construction impacts on aquatic habitat will be temporary and confined to areas occupied by the bridge foundations and abutments;
- erosion and sediment control measures (refer Appendix B4 CSWQMP) will minimise potential impacts on water quality, aquatic species and their habitat;
- the proposed river-based construction activities or structures will not be barriers to the fish passage along the Clarence River;
- assessments of significance completed for Purple-spotted Gudgeon and Silver Perch concluded that the Project would have a minimal impact on these species and their potential habitat;
- No aquatic vegetation or seagrasses (*Posidonia* sp.) are expected to be present in the Clarence River at the location of the proposed bridge.

6.2.3.2 Listed coastal wetlands

The project is unlikely to impact any listed State Environmental Planning Policy 14 – Coastal Wetlands given the distance to the nearest wetland and the erosion and sediment control measures proposed during construction (refer Appendix B4 CSWQMP).

6.2.3.3 Marine species

The construction of the project is unlikely to impact marine species, due to the lack of permanent marine habitat in the estuarine reaches of the Clarence River. In the event that a marine species is identified during construction, impact to such species is unlikely because:

- potential construction impacts on aquatic habitat will be temporary and confined to areas occupied by the bridge foundations and abutments;
- erosion and sediment mitigation measures (refer Appendix B4 CSWQMP) will minimise potential impacts to water quality, aquatic species and their habitat as a result of sedimentation and erosion from construction areas and/or spillage of fuels and chemicals;
- waste mitigation measures (refer Appendix B7) will minimise the potential for injury and fatality to marine life cause by ingestion of, or entanglement in, waste debris;
- the proposed river-based construction activities or structures will not be barriers to the marine passage along the Clarence River;
- Lack of aquatic vegetation or seagrasses (*Posidonia sp.*), which form habitat for marine species, are expected to be present in the Clarence River at the location of the proposed bridge.

In addition, a *Barge Works* EWMS and *Works in Waterways* EWMS (refer Appendix B4 CSWQMP Table 7-2 mitigation measure ID CSWQMM41) will be issued to the relevant agencies for review and comment prior to commencement of bridge work in the Clarence River.

6.2.4 Groundwater dependent ecosystems

Given the likely high dependence of vegetation communities in the area on groundwater, and the proximity of construction to the Clarence River, construction of the Project has some potential to impact on GDEs. However, the risk of impact during construction is considered to be low because:

- there will be only a minor amount of cutting, and sections of cutting will be less than 2 m deep;
- construction piling will be confined to the areas occupied by the bridge foundations and piers;
- vegetation communities and habitats that have the potential to be affected by impacts on groundwater are located away from cuttings and piling operations;
- no dewatering is proposed; and
- the groundwater flow is likely to be towards the river, so the Project is unlikely to decrease groundwater levels at nearby groundwater-dependent ecosystems.

6.2.5 Key threatening processes

Table 6-1 lists the 11 key threatening processes (KTP) of relevance to the Project.

Table 6-1: Key threatening processes

Key Threatening Process	Legislation	Trigger
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Key Threatening Process	Legislation	Trigger
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	TSC Act	Medium, in stream piers would cause low level hydrological change
Bush rock removal	TSC Act	Low, minimal bush rock present
Clearing of native vegetation Land clearance	TSC Act EPBC Act	Low, 0.41 ha of poor quality EEC to be cleared
Competition and land degradation by rabbits Competition and grazing by the feral European rabbit (<i>Oryctolagus cuniculus</i>)	EPBC Act TSC Act	Low, there are currently a high number of rabbits
Infection of native plants by <i>Phytophthora cinnamomi</i> Dieback caused by the root-rot fungus (<i>Phytophthora cinnamomi</i>)	TSC Act EPBC Act	Low, further spread to be managed
Infection of amphibians with chytrid fungus resulting in chytridiomycosis Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	EPBC Act TSC Act	Low, further spread to be managed
Installation of in stream structures and other mechanisms that alter natural flow	FM Act	High, in stream piers being installed
Invasion and establishment of exotic vines and scramblers	TSC Act	Low, there are currently a high number of exotics
Invasion, establishment and spread of <i>Lantana camara</i>	TSC Act	Low, there are currently a high number of exotics
Invasion of native plant communities by African Olive <i>Olea europaea L. subsp. cuspidata</i>	TSC Act	Low, there are currently a high number of exotics
Invasion of native plant communities by exotic perennial grasses	TSC Act	Low, there are currently a high number of exotics
Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	EPBC Act TSC Act	Low, construction materials to be managed
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	EPBC Act TSC Act	Low, there are currently a high number of exotics
Loss of hollow-bearing trees	TSC Act	Low, two hollow bearing trees to be lost
Anthropogenic Climate change Human-caused climate change Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases	TSC Act FM Act EPBC Act	Low, traffic flow and volume should maintain at current levels
Novel biota and their impact on biodiversity	EPBC Act	Low, impacts to biodiversity from novel biota is of low likelihood
Predation by European red fox Predation by the European red fox (<i>Vulpes vulpes</i>)	EPBC Act TSC Act	Low, there are currently foxes present within the landscape
Removal of dead wood and dead trees	TSC Act	Low, there are not many dead wood/trees to be removed
The degradation of native riparian	FM Act	Low, 0.10 ha of poor quality FWCF to be

Key Threatening Process	Legislation	Trigger
vegetation along New South Wales water courses		removed
The removal of large woody debris from NSW rivers and streams	FM Act	Low, unlikely that this would be triggered

6.3 Pre-construction surveys

Surveys of the missing lot areas required under CoA B3 were undertaken by an ecologist on behalf RMS. An outcome of those surveys was that Three-Toed Snake Tooth Skink were found and as a consequence further surveys inside and outside the project corridor were undertaken. Following this a *Three-Toed Snake Tooth Skink Construction Management Plan* was prepared and this is attached as Annexure L.

As required under CoA B2 prior to construction, pre-clearing surveys and inspections for EECs and threatened species shall be undertaken. The surveys and inspections, and any subsequent relocation of species, shall be undertaken under the guidance of a suitably qualified ecologist and shall be in accordance with the methodology incorporated into the approved Construction Flora and Fauna Management Plan. This is outlined in Table 7-2 mitigation measure ID CFFMM2, Annexure A (Table A-1) and in the Annexure C Pre-clearing permit. The Project Ecologist then prepares a pre-clearing survey report.

7 Environmental management measures

The project has been scoped and designed to avoid or minimise impact. In particular:

- the ecological values identified during fieldwork and investigations during 2010, 2011 and 2012 were considered during the route option development and route selection stage to avoid and minimise impacts on these values;
- recommendations regarding the setback of bridge piers to minimise impacts on riparian vegetation were considered in the project design;
- the locations of construction ancillary facilities were informed by identified flora and fauna constraints and site analysis; and
- key environmental values such as terrestrial and aquatic ecology were included in the planning process.

7.1 Flora and fauna mitigation and management measures

A range of environmental requirements and control measures are identified in the various environmental documents, including the EIS, Submissions Report, Conditions of Approval and other RMS documents. Mitigation and management measures will be implemented to avoid, minimise or manage impacts to biodiversity and to improve and/or maintain biodiversity. Measures and requirements to address impacts on biodiversity are outlined in Table 7-1 and Table 7-2. These measures have been prepared in accordance with the *Biodiversity Guidelines: Protecting and Managing Biodiversity on RTA Projects* (Roads and Maritime, 2011).

7.2 Biodiversity offsets

A Biodiversity Offset Statement, as required by CoA D1, will be prepared by RMS in consultation with the OEH, prior to the commencement of operation of the Project. The Statement will:

- a) confirm the threatened species, communities and their habitat (in hectares) cleared and their condition; and
- b) provide details of measures to offset impacts of the Project on native vegetation, including threatened species, communities and their habitats, including the timing, responsibility, management and monitoring, and implementation of the offset measures.

Biodiversity impacts will be offset in accordance with the document *Principles for the Use of Biodiversity Offsets in NSW* (DECCW, 2008). A copy of the statement will be submitted to the Secretary and OEH.

Table 7-1: Environmental management measures for biodiversity impacts

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
Impact on hollow-bearing trees and foraging resources					
B1	Disturbance and clearing of native vegetation will be minimised, particularly avoiding and minimising vegetation removal wherever possible through the detailed design process. Detailed design will investigate opportunities to retain the two hollow bearing and five habitat trees identified within the Project area.	EIS Section 10 Submissions Report Section 4	Pre-construction, Construction	Contractor	Detailed design This Plan Annexure C Pre-clearing permit Table 7-2 mitigation measure ID CFFMM2, CFFMM8, CFFMM18, CFFMM20. The permanent <i>Revegetation Strategy</i> will be included in the UDLMP (CoA D42) and submitted separately to the CEMP.
Revegetation management and landscaping					
B2	<p>As part of the flora and fauna management plan, a revegetation management sub-plan will be developed to provide specific details for the re-establishment of native vegetation on areas disturbed by the Project construction.</p> <p>This plan will be developed in accordance with <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011) and the design principles identified in <i>Appendix L, Technical Paper: Flora and Fauna Assessment</i> of the EIS. It will also include details for the regeneration and rehabilitation of areas with a focus on riparian areas within the Project area with reference to Guide 3, Guide 6 and Guide 10 of the <i>Roads and Maritime Biodiversity Guidelines</i>.</p> <p>The plan will include objectives to incorporate local native species across all revegetation and landscaping efforts along the Clarence River and in the adjoining Project area. This will include species consistent with freshwater wetlands on coastal floodplain and sub-tropical coastal floodplain forest threatened ecological communities species composition, which could potentially provide foraging resources and roosting to threatened fauna species, and increase corridors and connectivity throughout the landscape.</p>	EIS Section 10 Submissions Report Section 4	Pre-construction	Contractor	The permanent <i>Revegetation Strategy</i> will be included in the UDLMP (CoA D42) and submitted separately to the CEMP.

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
This plan will be developed in consultation with OEH.					
Protection of fish habitat					
B3	During detailed design, the Project design team will comply with the <i>Policy and Guidelines for Fish Habitat Conservation and Management</i> (DPI, 2013) in relation to requirements for maintaining fish passage via the design and construction of instream structures.	EIS Section 10 Submissions Report Section 4	Pre-construction	Contractor	Detailed design
Flora and fauna management					
B4	<p>A flora and fauna management plan (FFMP) will be prepared as part of the construction environmental management plan before construction in accordance with <i>Biodiversity Guidelines – Protecting and Managing Biodiversity on RTA Projects</i> (Roads and Maritime, 2011).</p> <p>The FFMP will detail how impacts on biodiversity will be minimised and managed during construction and operation and will incorporate specific management measures identified in the EIS.</p> <p>Measures outlined in this table will be addressed within the flora and fauna management plan, including timeframes for implementation and monitoring to be developed post-EIS and Project approval.</p>	EIS Section 10 Submissions Report Section 4	Pre-construction	Contractor	<p>This Plan Section 7 mitigation measures. Section 8.3 Annexure B, Annexure C, Annexure D, Annexure F, Annexure G, Annexure I, , Annexure K, and Annexure L</p>
Vegetation clearing					
B5	<p>To minimise the impacts of vegetation clearing and habitat loss the following specific measures will be implemented:</p> <ul style="list-style-type: none"> Clearing of vegetation will be carried out in accordance with <i>Guide 1 Pre-clearing Process of Biodiversity Guidelines</i> (RTA, 2011). These guidelines cover the felling of both non-habitat and habitat trees and the rescue and relocation of fauna. The pre-clearing process will be consistent with <i>Guide 2 Exclusion zones of Biodiversity Guidelines</i> (RTA, 2011) and include: pre-clearing surveys by an experienced/qualified ecologist and mapping and delineating the boundaries of threatened flora and/or fauna species, threatened ecological communities and/or suitable habitat (hollow bearing/habitat trees). 	EIS Section 10 Submissions Report Section 4	Pre-construction	Contractor	<p>This Plan Table 7-2 mitigation measure ID CFFMM1, CFFMM2, CFFMM9, CFFMM22. Section 6.3 Section 8.2 Annexure A Biodiversity Monitoring Program Annexure C Pre-</p>

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
	<ul style="list-style-type: none"> Pre-clearance surveys to include surveys for Hairy-joint Grass during flowering period (between summer and autumn) within final impact areas. Pre-clearing surveys to be carried out for the Three-toed Snake-tooth Skink in suitable areas not yet surveyed (ancillary sites, especially in North Grafton where houses are to be demolished) before demolition and construction works during late spring and early summer in accordance with the relevant guidelines (DSEWPaC,2011; DEC, 2004 and TSSC, 2008). Construction traffic will be restricted to defined access tracks and construction works zone areas. The location of exclusion zones will be identified, with temporary fencing or flagging tape to indicate the limits of clearing (in accordance with the <i>Roads and Maritime Biodiversity Guidelines</i> (RTA, 2011)). All relevant staff will be inducted and informed of the limits of vegetation clearing and the areas of vegetation to be retained. 				clearing permit Annexure L Three-Toed Snake Tooth Skink Construction Management Plan
Weed Management					
B6	<ul style="list-style-type: none"> Weeds will be controlled in accordance with RTA (2011a) – <i>Biodiversity Guidelines Guide 6: Weed Management</i>. Declared noxious weeds will be managed in accordance with the requirements of the <i>Noxious Weeds Act 1993</i>. Weed infested topsoil will be appropriately stockpiled with sediment fencing and as soon as practical, disposed of or treated appropriately to limit potential impacts on nearby areas of native vegetation. 	EIS Section 10 Submissions Report Section 4	Construction	Contractor	Section 5.4 Table 7-2 mitigation measure ID CFFMM17 Annexure G - Weed Management Plan
Pests and pathogens					
B7	<p>The FFMP will outline a strategy for the implementation of site hygiene protocols and management measures according to <i>Biodiversity Guide 7 – Pathogen Management from Roads and Maritime</i> (2011) to reduce the risk of localised or regional introduction of Myrtle Rust, <i>Phytophthora cinnamomi</i> and the amphibian chytrid fungus as a result of the Project.</p> <p>Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011a) – <i>Biodiversity Guidelines Guide 7: Pathogen management</i>.</p>	EIS Section 10 Submissions Report Section 4	Pre-construction, Construction	Contractor	Table 7-2 mitigation measure ID CFFMM21 Annexure B: Protocol for managing pathogens

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
Impact on fauna					
B8	<p>Where practical, vegetation removal (especially of the two hollow-bearing and five habitat trees identified) will occur outside the main fauna breeding season (August to February) to avoid potential breeding disturbance to fauna, particularly avifauna (birds and bats).</p> <p>Pruning or lopping tree limbs will be conducted in preference to tree removal wherever possible.</p> <p>An appropriate tree removal procedure will be adopted. It will require the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna as detailed in <i>RMS Biodiversity Guidelines -Guide 4: Clearing of vegetation and removal of bush rock including the staged removal process</i>. (2011).</p> <p>Woody debris and habitat trees removed for the Project will be managed in accordance with <i>RMS Biodiversity Guidelines - Guide 5: Re-use of woody debris and bush rock</i> (2011).</p> <p>Fauna handling during vegetation removal will be carried out by a licensed fauna ecologist or wildlife carer, as detailed in <i>RMS Biodiversity Guidelines Guide 9: Fauna handling</i> (2011).</p>	EIS Section 10 Submissions Report Section 4	Pre-construction, Construction	Contractor	Table 7-2 mitigation measure ID CFFMM2, CFFMM10, CFFMM11 Annexure C: Pre-clearing permit Annexure D: Fauna Handling and Rescue Procedure
Threatened flora and fauna					
B9	<p>Threatened species guidelines will be developed for threatened flora and fauna likely to occur directly within the Project area and which may be impacted during construction, in order to show and educate construction workers of its appearance and outline what should be done if the species is found during construction. Relevant species will include:</p> <ul style="list-style-type: none"> • Hairy-joint grass • Three-toed Snake-tooth Skink • Grey-headed Flying-fox • Microbats. 	EIS Section 10 Submissions Report Section 4	Pre-construction	Contractor	Annexure M: Potential threatened flora and fauna species identification guide Section 8.2 Table 7-2 mitigation measure ID CFFMM4 Annexure F: Unexpected Threatened Flora Species / EEC Finds Procedure
Unexpected finds					
B10	If unexpected threatened fauna or flora species are discovered, works will stop immediately and the <i>Unexpected Threatened Species Find Procedure</i>	EIS Section 10	Pre-construction,	Contractor	Table 7-2 mitigation

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
	RTA (2011a) as well as the <i>Biodiversity Guidelines Guide 1: Pre-clearing process</i> (Roads and Maritime, 2011) will be followed. This procedure will be included in the FFMP developed for the Project.	Submissions Report Section 4	Construction		measure ID CFFMM4 Annexure C: Pre-clearing permit Annexure D: Fauna Handling and Rescue Procedure Annexure F: Unexpected Threatened Flora Species / EEC Finds Procedure
Nest box and microbat management					
B11	<p>Nest boxes and bat roost structures will be installed in accordance with the principles outlined in the <i>Roads and Maritime Guide 8 Nest Boxes</i> (2011). Details of the number and type of nest boxes will be included in the FFMP prepared for the Project, and will include the following details:</p> <ul style="list-style-type: none"> • The number and type of nest boxes required based on the number, quality and size of the hollows that will be removed. • Specifications for nest box dimensions, installation requirements, locations of nest boxes and ongoing monitoring and maintenance. • Installation timeframes, including the installation of 70% of nest boxes before the removal of any vegetation • Staged habitat removal, including removal of secondary or less preferential roosting habitat before removal of primary habitat, such as hollow-bearing trees and houses. <p>Pre-demolition inspection and exclusion measures to prevent continued use of roosts. These will be prepared to address the subject species, specific habitat, roosting habits at each location, and capture and handling procedures (if required).</p>	EIS Section 10 Submissions Report Section 4	Pre-construction, Construction	Contractor	Table 7-2 mitigation measure ID CFFM2, CFFMM6, CFFMM7 Annexure C: Pre-clearing permit Annexure I: Nest Box Management Plan
Impact on aquatic fauna					
B12	Direct disturbance of aquatic fauna and riparian zones will be minimised in accordance with <i>Roads and Maritime Biodiversity Guidelines – Guide 10 Aquatic habitat and riparian zones</i> (2011).	EIS Section 10 Submissions Report Section 4	Pre-construction, Construction	Contractor	This CFFMP Table 7-2 mitigation measure ID CFFMM1, CFFMM2 Annexure C: Pre-

ID	Measure / Requirement	Reference	When to implement	Responsibility	Where addressed
					clearing permit
Bank stability, sedimentation and erosion					
B13	<p>Erosion and sediment control measures will be implemented and maintained to:</p> <ul style="list-style-type: none"> • Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets. • Reduce water velocity and capture sediment on-site. • Minimise the amount of material transported from site to surrounding road surfaces. • Divert clean water around the site in accordance with <i>Managing Urban Stormwater: Soils and Construction Guidelines</i> (Landcom, 2004). <p>Erosion and sedimentation controls will be checked and maintained on a regular basis (including clearing of sediment from behind barriers) and records kept and provided on request.</p> <p>Erosion and sediment control measures will not be removed until the works are complete and areas are stabilised.</p> <p>Work areas will be stabilised progressively during the works.</p> <p>A progressive erosion and sediment control plan is to be prepared for the works.</p> <p>The <i>Guidelines for in stream works on waterfront land</i> (NSW DPI 2012) will be implemented when constructing and installing piers, bridge footings and undertaking river front landscape works.</p>	EIS Section 10 Submissions Report Section 4	Pre-construction, Construction	Contractor	Table 7-2 mitigation measure ID CFFMM1, CFFMM2 Annexure C: Pre- clearing permit CEMP Appendix B4 (CSWQMP)
Impact on aquatic habitat					
B14	Where feasible and reasonable any large woody debris that may be encountered during construction will be relocated.	EIS Section 10 Submissions Report Section 4	Construction	Contractor	Table 7-2 mitigation measure ID CFFMM1, CFFMM2 Annexure C: Pre- clearing permit

Table 7-2: Additional environmental management measures for biodiversity impacts

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
GENERAL				
CFFMM1	Manage flora and fauna sites identified to be retained and protected as environmentally sensitive areas. In this regard, erect exclusion fencing and signage to ensure that environmentally sensitive areas are protected in accordance with the RMS <i>Biodiversity guidelines: Guide 2 – Exclusion Zones</i> (RTA, 2011) and map these sites on the Sensitive Area Plans (Appendix A6 of the CEMP).	✓	✓	Project / Site Engineers Foreman Environmental Officer Environmental Manager
CFFMM2	Clear vegetation in accordance with a site specific <i>Clearing and Grubbing EWMS</i> . This will include the completion of pre-clearing surveys (under the guidance of the Project Ecologist) to confirm the location of any tree hollows/habitat, EECs, riparian vegetation, threatened flora and fauna species and associated habitat features. It will also cover the reuse of felled habitat trees and woody debris, adoption of a two-staged approach to clearing, and the requirement for a Pre-clearing Permit prior to clearing.	✓	✓	Foreman Environmental Manager Environmental Officer
LOSS OF UNEXPECTED EEC/ THREATENED SPECIES				
CFFMM3	In the event that an EEC/ threatened species is identified during pre-clearing surveys or during construction, incorporate any specific procedures to deal with that species (e.g. re-location, translocation and/or management and protection measures) into this CFFMP as required.	✓	✓	Environmental Manager
CFFMM4	Where an EEC or threatened species is unexpectedly identified during construction, follow the <i>Unexpected Threatened Species/ EECs Find Procedure</i> in Annexure D.	✓	✓	Foreman Environmental Officer
CFFMM5	Where an EEC/ threatened species is unexpectedly identified during pre-clearing surveys or during construction, update Sensitive Area Plans with this new information. Also provide required information to RMS to enable completion of the Biodiversity Offset Statement as required by CoA D1.	✓	✓	Environmental Manager
LOSS OF NATIVE VEGETATION/ EEC/ FAUNA HABITAT				
CFFMM6	Install bat roosting and nest boxes in accordance with the Nest Box Management Plan (Annexure L) and RMS <i>Biodiversity Guidelines: Guide 8 – Nest Boxes</i> .		✓	Foreman Environmental Officer
CFFMM7	Install 70% of nest boxes prior to removal of any vegetation.	✓	✓	Foreman Environmental Officer
CFFMM8	Complete landscaping/ permanent revegetation in accordance with the permanent <i>Revegetation Strategy</i> included in the UDLMP. <i>The objective of the Permanent Revegetation Strategy is to ensure that local native species consistent with FWCF and SCFF species composition are used, which could potentially provide foraging resources and hollows for threatened fauna species; fauna corridors and connectivity are enhanced throughout the landscape (e.g. along the Clarence River and in the adjoining project area); and riparian habitat is restored to at least the pre-construction condition or better, unless otherwise agreed by DPI (Fisheries) and NOW.</i>		✓	Foreman Environmental Manager Environmental Officer
CFFMM9	Restrict construction traffic to defined access tracks and construction works zone areas.		✓	All
TERRESTRIAL FAUNA MORTALITY/ INJURY				

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
CFFMM10	Where fauna is encountered that requires handling or rescue, follow the <i>Fauna Handling and Rescue Procedure</i> in Annexure D.		✓	Foreman Environmental Officer
CFFMM11	Where feasible and reasonable, remove vegetation (especially the two hollow-bearing and five habitat trees identified) outside the main fauna breeding season (August to February) to avoid potential breeding disturbance to fauna, particularly avifauna (birds and bats).		✓	Foreman Environmental Manager Environmental Officer
LOSS OF AQUATIC HABITAT				
CFFMM12	Retain stumps in riparian zones and aquatic habitats where practicable to reduce the potential for bank erosion. Even dead stumps and root systems may reduce erosion during construction and operation periods.		✓	Foreman Environmental Officer
CFFMM13	Subject to consultation with NOW and DPI (Fisheries), use trees removed as a consequence of the Project for fish habitat and bank stability within the creeks of the project area.		✓	Foreman Environmental Manager
INVASION OF WEEDS				
CFFMM14	Train staff in the identification and disposal of Alligator Weed.	✓	✓	Environmental Manager
CFFMM15	If Alligator Weed is identified during pre-clearing inspection, regularly inspect and clean heavy machinery before leaving the site to ensure that the species is not spread to new areas.		✓	Foreman
CFFMM16	Report positive identifications of Alligator Weed within the Project area to the Environmental Manager. The Environmental Manager will notify the RMS Representative and Clarence Valley Council.		✓	Foreman Environmental Officer Environmental Manager
CFFMM17	Stockpile in accordance with the <i>Stockpile Management Protocol</i> (refer CSWQMP) to restrict stockpiling to areas already cleared of vegetation and limit potential impacts on nearby areas of native vegetation and thus, ensure that weeds are appropriately managed.		✓	Foreman Environmental Officer
CFFMM18	Progressively revegetate batters and other disturbed areas with <i>temporary</i> cover crop species to control erosion and weed invasion during construction. Use Rye Corn during the months of April to August or Japanese Millet during the months of September to March as required by R178.		✓	Superintendent Foreman Environmental Officer
REDUCED WATER QUALITY AND LOSS OF FISH				
CFFMM19	Locate all refuelling areas at least 50 metres away from waterways.	✓	✓	Foreman Environmental Manager
CFFMM20	Progressively revegetate batters and other disturbed areas with <i>temporary</i> cover crop species to control weed invasion and erosion and thus minimise sedimentation of waterways and impacts on fish during construction. Use Rye Corn during the months of April to August or Japanese Millet during the months of September to March as required by R178.		✓	Superintendent Foreman Environmental Officer
SPREAD OF PATHOGENS				
CFFMM21	Where there is potential to introduce or spread pathogens or disease (i.e. Phytophthora, Myrtle Rust, Chytrid fungus) to the Project, follow the <i>Pathogens Management Procedure</i> in		✓	Foreman. Environmental

ID	Mitigation Measure	Timing		Responsibility
		PC ¹	C ²	
	Annexure B.			Officer
LOSS OF TTSTS				
CFFMM22	Implement all mitigation measures for the TTSTS in accordance with the <i>Three-Toed Snake Tooth Skink Construction Management Plan</i> contained in Annexure L.	✓	✓	Project / Site Engineers Foreman Environmental Officer Environmental Manager

8 Compliance management

8.1 Roles and responsibilities

The Project Team's organisational structure and overall roles and responsibilities are outlined in Section 4.2 of the CEMP. Specific responsibilities for the implementation of environmental controls are detailed in Chapter 7 of this CFFMP. The responsibilities of the Project Ecologist are detailed below.

8.1.1 Project Ecologist

The environmental responsibilities of the Project Ecologist are to:

- Review procedures for clearing and grubbing activities
- Review the design of temporary waterway crossings
- Undertake pre-clearing surveys
- Complete pre-clearing survey reports as required
- Undertake post-clearing surveys following TTSTS habitat removal and disturbance works
- Complete post-clearing survey reports following TTSTS habitat removal and disturbance works
- Undertake joint inspections with Fulton Hogan and RMS
- Oversee clearing activities
- Rescue and relocate fauna as required
- Determine appropriate relocation points for captured fauna (including GPS location) within or near the Project.
- For construction works of a shorter duration than 4 weeks, retain the TTSTS in captivity and release upon completion of those works in any given area to reduce the risk of mortality.
- Comply with the responsibilities of the Project Ecologist identified in the Three-toed Snake Tooth Skink Construction Management Plan contained in Annexure L.
- Conduct a post-clearing abundance and density count of hollow-bearing trees removed to determine the final number and type of hollows removed by the project
- Provide advice on the potential reuse of felled habitat trees and woody debris, in accordance with *Guide 5: Re-use of woody debris and bushrock* of the RMS *Biodiversity Guidelines* (RTA 2011)
- Provide technical advice on the breeding/nesting periods of threatened fauna species.

8.2 Training

All employees, contractors and utility staff working on site will undergo site induction training relating to flora and fauna management issues. The induction training will address elements related to flora and fauna management including:

- the requirements of this CFFMP;
- relevant legislation;
- No clearing is to occur outside the approved clearing limits;
- threatened species guidelines for Hairy-joint grass, Three-toed Snake-tooth Skink, Grey-headed Flying-fox and Microbats to show and educate construction workers of the appearance of these species and outline what should be done if the species is found during construction

- stockpile location and management measures;
- fauna rescue requirements;
- weed control measures;
- general flora and fauna management measures;
- ecological monitoring requirements, and
- specific responsibilities for the protection of flora and fauna.

Further details regarding staff induction and training are outlined in Chapter 5 of the CEMP.

8.3 Monitoring and inspections

General requirements and responsibilities in relation to monitoring and inspections are documented in Section 8.2 of the CEMP. Further details of biodiversity monitoring for the Project are provided in Annexure A.

Specific monitoring requirements for biodiversity include:

- CoA B46(e)(v) - procedures for monitoring success of regeneration and revegetation, and corrective actions should regeneration or revegetation not conform to the objectives adopted – refer Table 3-1;
- CoA B46(e)(viii) - a procedure for dealing with unexpected endangered ecological communities and threatened species identified during construction, including updating of ecological monitoring and/or biodiversity offset requirements - refer Annexure F Unexpected Threatened Species/EEC finds procedure; and
- CoA B46(e)(ix) - mechanisms for the monitoring, review and amendment of the CFFMP – refer Section 9.
- CoA D1 - The Biodiversity Offset Statement will provide details of measures to offset impacts of the Project on native vegetation including the monitoring of the offset measures – refer Biodiversity Offset Statement (separate document to be prepared by RMS).

8.4 Auditing

Audits (both internal and external) will be undertaken to assess the effectiveness of environmental controls, compliance with this plan, Infrastructure Approval and other relevant approvals, licenses and guidelines.

Audit requirements are detailed in Section 8.3 of the CEMP.

8.5 Reporting

Reporting requirements and responsibilities are documented in Section 8.3 and Section 8.5 of the CEMP.

There are specific reporting requirements associated with additional survey work and monitoring including:

- Results of pre-clearing surveys

9 Review and improvement

9.1 Continuous improvement

Continuous improvement of this plan will be achieved by the ongoing evaluation of environmental management performance against environmental policies, objectives and targets for the purpose of identifying opportunities for improvement.

The continuous improvement process will be designed to:

- identify areas of opportunity for improvement of environmental management and performance;
- determine the cause or causes of non-conformances and deficiencies;
- develop and implement a plan of corrective and preventative action to address any non-conformances and deficiencies;
- verify the effectiveness of the corrective and preventative actions;
- document any changes in procedures resulting from process improvement; and
- make comparisons with objectives and targets.

9.2 CFFMP update and amendment

The processes described in Chapter 8 and Chapter 9 of the CEMP may result in the need to update or revise this CFFMP. This will occur as needed.

Any revisions to the CFFMP will be in accordance with the process outlined in Section 1.6 of the CEMP and as required, be provided to RMS, ER and other relevant stakeholders for review and comment and forwarded to the Secretary of the DP&E for approval.

A copy of the updated CFFMP and changes will be distributed to all relevant stakeholders in accordance with the approved document control procedure – refer to Section 10.2 of the CEMP.

Annexure A: Biodiversity Monitoring Program

Biodiversity Monitoring Program

Regular monitoring and inspections will be undertaken during construction in accordance with Table A-1. General requirements and responsibilities in relation to monitoring and inspections are documented in Section 8.2 of the CEMP

Table A-1 Monitoring and inspections

Monitoring details	Record	Responsibility	Frequency
Inspection of exclusion fencing; exclusion signage; adherence to exclusion zones; success of temporary revegetation; and weeds (including Alligator weed) when works are being undertaken in the vicinity.	Environmental Inspection Checklist	Environmental Officer	Weekly
Pre-clearing inspection	Pre-clearing Permit Project Ecologist's pre-clearing survey report	Foreman Environmental Manager or delegate	Prior to clearing and demolition or within 24 hours of TTSTS habitat disturbance/ removal.
Threatened species/ EEC	Unexpected Threatened Species/ EEC Find Procedure	Foreman Environmental Manager or delegate	As discovered
Fauna handling and rescue	Fauna Rescue Event Record	Foreman Environmental Officer	As discovered
Visual inspection of all nest boxes (G40 Clause 2.4)	Monitoring Results Report	Environmental Officer	Twice a year, starting in 2017
Series of surveys by Project Ecologist in areas mapped as moderate, high or known TTSTS habitat as identified in Figure 2-3 of Annexure M. (specific TTSTS requirement)	Project Ecologist's survey report	Environmental Manager or delegate	Daily and at completion of construction activities that seek to disturb and remove known and potential TTSTS habitat.
Series of surveys by Project Ecologist in areas mapped as low or unlikely TTSTS habitat as identified in Figure 2-3 of Annexure M. (specific TTSTS requirement)	Project Ecologist's survey report	Environmental Manager or delegate	Only if directed by the Environmental Manager or the RMS Representative following any unexpected find.
Post-clearing inspection (specific TTSTS requirement)	Project Ecologist's post-clearing survey report	Environmental Manager or delegate	Following TTSTS habitat removal and disturbance works (e.g. post clearing and demolition)

Annexure B: Protocol for managing pathogens including *chytrid fungus*, *Phytophthora cinnamomi* and *Myrtle Rust*

CoA B46(e) (vii) a protocol for managing aquatic and terrestrial pest animal/invasive species and plant species, and pathogens;

MMB6: The FFMP will outline a strategy for the implementation of site hygiene protocols and management measures according to Biodiversity Guide 7 – Pathogen Management from Roads and Maritime (2011) to reduce the risk of localised or regional introduction of Myrtle Rust, *Phytophthora cinnamomi* and the amphibian chytrid fungus as a result of the project. Measures for preventing the introduction and/or spread of disease causing agents such as bacteria and fungi will be implemented, as detailed in RTA (2011a) – Biodiversity Guidelines Guide 7: Pathogen management.

Pathogens management procedure

1. Purpose

This procedure details practices to be implemented during construction to minimise the threat to native flora and fauna species associated with the introduction/spread of the following pathogens:

- Phytophthora (*Phytophthora cinnamomi*)
- Myrtle Rust (*Uredo rangeli*), and
- Chytrid fungus (*Batrachochytrium dendrobatidis*).

2. Scope

This procedure is applicable to all activities conducted on the Project that have the potential to disturb soil and/or water known to contain Phytophthora, Myrtle Rust or Chytrid fungus (as identified during pre-clearing survey and testing) or unintentionally import such soil or plant matter from outside the Project area.

This procedure must be read in conjunction with the Clearing and Grubbing EWMS.

Site hygiene protocols and management measures are in accordance with RMS *Biodiversity Guidelines: Guide 7 – Pathogen management* (RTA, 2011).

3. Induction and training

Where required, site personnel and subcontractors will be inducted in the control measures to prevent the introduction or spread of the identified pathogens during construction activities, in line with this procedure. Training will occur on site during the Project induction and as required in toolbox talks.

4. Procedure

To prevent the spread or introduction of pathogens during construction the Environmental Manager (EM) or Environmental Officer (EO) will ensure that the following procedure is implemented:

1. Identify and prevent pathogens

During the Pre-clearing survey, the Project Ecologist will undertake a targeted search for:

- plants displaying signs of Phytophthora cinnamomi-induced dieback
- plants displaying signs of Myrtle Rust, and
- amphibians displaying symptoms of chytrid fungus infection (where frog habitat is to be cleared).

If risks are identified in the vicinity of the project, testing from a National Association of Testing Authorities (NATA) approved laboratory may be required to confirm the presence of pathogens in the soil and/or water.

The EM/ EO is responsible for overseeing works in the Project area that are infected with pathogens.

2. Limit movement of soils infected with pathogens via vehicles and machinery

- Install signage advising of special hygiene measures.
- Limit access to the infected area using exclusion fencing.
- Stop earthworks in the infected area after extended rainfall that could make the earth saturated and potentially cause overland flow.

- Where possible, do not drive through mud or potentially infected areas.
- If a vehicle or machinery is taken into an infected area, remove all mud and dirt (including that from floor mats, tyres, wheel rims and the undersides of vehicles) and wash the vehicle/machinery with Truckwash (or equivalent) and disinfect with a cleaning product that contains benzalkonium chloride or 70 per cent methylated spirits in 30 per cent water immediately prior to leaving the area or immediately prior to accessing the Project.
- Do not use water from sediment basins, and potentially infected catchments, for vehicle wash-downs.
- Bund the area where a vehicle is to be washed using a 400mm high sandbag wall, and
- Capture and dispose of all liquids used in the washing and disinfecting process to an appropriately licenced waste facility.

3. Limit movement of soils infected with pathogens via personnel and equipment

- Clean and disinfect footwear by removing mud and dirt and then stepping into a tray of cleaning product that contains benzalkonium chloride or 70 per cent methylated spirits in 30 per cent water immediately prior to leaving the area or immediately prior to accessing the Project.
- Clean and disinfect equipment by removing mud and dirt and sponging with a cleaning solution that contains benzalkonium chloride or 70 per cent methylated spirits in 30 per cent water immediately prior to leaving the area.
- Capture and dispose of all liquids used in the washing and disinfecting process to an appropriately licenced waste facility.

4. Limit movement of soils infected with pathogens via erosion and sediment controls

- Remove and dispose of any sandbags, straw bales or other erosion and sediment controls from infected areas to an appropriately licenced waste facility. Do not reuse erosion and sediment controls outside of the infected area.
- Do not use water from sediment basins for dust control or other road construction purposes, which has originated from areas infected with pathogens. Instead, this water may be used for concrete production, subject to the prior approval of RMS.
- Remove and dispose of sediment from sediment basins infected with pathogens to an appropriately licenced waste facility.

5. Limit movement of topsoil infected with pathogens

- Stockpile, contain and reuse topsoil stripped from infected areas, within the same area of the Project.

6. Limit importation of soil and plant matter infected with pathogens

- Check and clear any vehicles or equipment brought onto the Project from areas infected with pathogens (as identified in Step 1 above).
- If signs of soil and/or plant matter are present, clean the vehicle/equipment in accordance with the procedure in Step 2/3 above, as applicable.
- When purchasing new plants or cuttings ensure they are free from myrtle rust.

5. Ongoing management and monitoring

If a pathogen is identified on the Project or in the locality, monitoring of the soil-borne plant pathogen will occur as part of the routine weekly inspections to determine the effectiveness of management controls.

Annexure C: Pre-clearing permit

CoA B1 The clearing of native vegetation shall be generally in accordance with the areas specified in the documents listed in condition A2, and with the objective of reducing impacts to any endangered ecological communities (EECs), threatened species and their habitat to the greatest extent practicable.

- Clearing of vegetation will be carried out in accordance with Guide 1 Pre-clearing Process of Biodiversity Guidelines (RTA, 2011). These guidelines cover the felling of both non-habitat and habitat trees and the rescue and relocation of fauna*
- The pre-clearing process will be consistent with Guide 2 Exclusion zones of Biodiversity Guidelines (RTA, 2011) and include: pre-clearing surveys by an experienced/qualified ecologist and mapping and delineating the boundaries of threatened flora and/or fauna species, threatened ecological communities and/or suitable habitat (hollow bearing/habitat trees)*
- Pre-clearance surveys to include surveys for Hairy-joint Grass during flowering period (between summer and autumn) within final impact areas*
- Pre-clearing surveys to be carried out for the Three-toed Snake-tooth Skink in suitable areas not yet surveyed (ancillary sites, especially in North Grafton where houses are to be demolished) before demolition and construction works during late spring and early summer in accordance with the relevant guidelines (DSEWPac,2011; DEC, 2004 and TSSC, 2008)*

Pre-clearing permit

General Instructions

1. This copy is to be retained by the relevant persons authorised to supervise work crews and/or contractors.
2. Management must retain a copy.
3. Standard work method statements apply where relevant.
4. Additional environmental controls must be implemented as listed in Part C of this permit.
5. Managers and supervisors are responsible for advising their crew members of the additional environmental controls applicable to the works as listed in Part C of this permit.

PART A. DESCRIPTION OF WORKS		To be completed by Permit Recipient
Date: / /	Project: Additional Crossing of the Clarence River at Grafton Project	
Location:		
Company/Organisation conducting the work:		
Name of Permit Recipient:		
Date Clearing is to Commence: / /		
Brief Description of Work:		
Is house demolition involved? (circle as appropriate) Yes / No		
Machinery to be used:		
Do the works involve clearance of an EEC?.		
Do the works involve clearance of a Three-toed Snake-tooth Skink (TTSTS) area? If so, what is the likelihood of TTSTS?		
Sensitive Area Plans for work area attached:		

PART B. PLANNING CHECKLIST	Yes	No	N/A	Comments include any details discussed with other parties
Are the limits of clearing identified by clearly visible markers placed at 25 m intervals on each side of the road formation and bridges as required under D&C specification G40?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Has the Hold Point under G40 Clause 2.4 (Clearing any area of work) been submitted to and released by Project Verifier?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Has the Hold Point under G36 Clause 4.8 (Commencement of vegetation clearing works) been submitted to and released by Project Verifier?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Has Project Ecologist marked all habitat trees and recorded habitat tree characteristics (e.g. GPS location, species, height, diameter, number of hollows, overall health of each hollow-bearing tree)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Have 70% of nest boxes been installed pre-clearing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Has the Project Ecologist completed pre-clearing surveys for:				
1. The Three-toed Snake-tooth Skink?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
2. Hairy-joint Grass during flowering period (between summer and autumn) within final impact areas?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
3. Habitat for roosting bats, including micro-bats (e.g. hollow-bearing trees, houses and bridge structures to be demolished)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
4. Hollow-bearing trees with active European Bee hives (G40 Clause 4.17).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
5. Presence of Freshwater Wetlands on Coastal Floodplains or Subtropical Coastal Floodplain Forest EECs?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
6. Presence of pathogens (Phytophthora, Myrtle Rust, Chytrid fungus) by carrying out a pre-clearing survey for: plants displaying signs of Phytophthora cinnamomi-induced dieback; plants displaying signs of Myrtle Rust; and amphibians displaying symptoms of chytrid fungus infection (where frog habitat is to be cleared).	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Is there a specific EWMS in place that covers these works (e.g. Clearing and Grubbing EWMS; House Demolition EWMS)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Has a pre-clearing inspection of the area been undertaken by the Environmental Officer in conjunction with Project Ecologist?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

PART B. PLANNING CHECKLIST	Yes	No	N/A	Comments include any details discussed with other parties
Have all necessary approvals and permits for the works been obtained from the following organisations (where applicable)? <input type="checkbox"/> Clarence Valley Council <input type="checkbox"/> EPA <input type="checkbox"/> Other (specify)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Have all necessary erosion and sediment controls been installed as per Progressive ESCP?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Have community notifications (letterbox drop, etc.) been completed?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Will access to private properties be maintained during the works (<i>if no, refer to the Community Communication Strategy</i>)?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Have arrangements been made for the Project Ecologist to be present as required e.g. during the clearing of hollow bearing trees.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Has the Hold Point under G40 Clause 2.4 been submitted to and released by Project Verifier?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

PART C. ADDITIONAL ENVIRONMENTAL CONTROLS (as per Project Ecologist's recommendations or other environmental assessments)		
<p>List relevant additional environmental controls here. Include all additional environmental controls and communicate these at the toolbox meeting, to the crew members, subcontractors and any other relevant parties, prior to the commencement of the works. Ensure crews and subcontractors know the locations of the exclusion zones as shown on the Sensitive Area Plans.</p>		
Activity	Environmental Controls	Reference (i.e. Ecologist's report, consultation with RMS, community or other)

PART D. APPROVAL
<p>PERMIT HOLDER</p> <p>I understand and accept all conditions stated in this permit and any associated permits. I will ensure that all conditions are strictly adhered to by myself and colleagues.</p> <p>Name of Permit Holder.....Signature: Date: Time:.....</p>
<p>ENVIRONMENTAL OFFICER</p> <p>Approval is granted for the work listed above by the Environmental Officer. All conditions of this permit and any associated permits have been fully explained to the permit holder.</p> <p>Name of approver.....Signature: Date: Time:</p>
<p>PROJECT ECOLOGIST</p> <p>Name of Project Ecologist.....Signature: Date: Time:</p>

Annexure D: Fauna Handling and Rescue Procedure

MMB9

- *Where practical, vegetation removal (especially of the two hollow-bearing and five habitat trees identified) will occur outside the main fauna breeding season (August to February) to avoid potential breeding disturbance to fauna, particularly avifauna (birds and bats).*
- *An appropriate tree removal procedure will be adopted. It will require the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna as detailed in RMS Biodiversity Guidelines -Guide 4: Clearing of vegetation and removal of bush rock including the staged removal process (2011).*
- *Fauna handling during vegetation removal will be carried out by a licensed fauna ecologist or wildlife carer, as detailed in RMS Biodiversity Guidelines Guide 9: Fauna handling (2011).*

Three-Toed Snake Tooth Skink Construction Management Plan (May 2016)

- *Section 3.3.1 Engaging a Suitability Qualified and Experienced Ecologist The construction contractor must engage a suitably qualified and experienced ecologist with at least 10 years field experience with reptiles. This must include demonstrated first-hand experience with the subject species or some other cryptic threatened reptile, and importantly, the person conducting the onsite duties must possess this experience and not the entity or the company. Contingency for any support role must also possess the same level of experience and must receive endorsement from the RMS and if applicable the Project's Environmental Representative. No provision is made for updates or changes to this component of the plan.*

Fauna Handling and Rescue Procedure

D1 Purpose

This procedure explains the actions to be undertaken in the event fauna (including injured, shocked, juvenile or other animal) that require handling or rescue are discovered on the Project site during vegetation and soil clearance and ongoing construction activities.

D2 Scope

This procedure is applicable to all native and introduced species that are found on the Project site.

This procedure is consistent with *Guide 9: Fauna handling of the RMS Biodiversity Guidelines* (RTA 2011) and the *Three-Toed Snake Tooth Skink Construction Management Plan* (May 2016) (TTSTS CMP).

D3 Clearing Procedure

Where practical, vegetation removal (especially of the two hollow-bearing and five habitat trees identified) will occur outside the main fauna breeding season (August to February) to avoid potential breeding disturbance to fauna, particularly avifauna (birds and bats). Refer also to Pre-Clearing Permit (Annexure C of this CFFMP).

The Project Ecologist will undertake the following steps:

1. Prior to undertaking clearing at any location or time, a pre-clearing assessment must be undertaken by the Project Ecologist to identify the presence or evidence of the presence of fauna (including fresh scats, scratches and remains of prey), including threatened species such as the TTSTS. The pre-clearing assessment for the TTSTS must be undertaken in accordance with the TTSTS CMP. Prescribed survey techniques to be used by the Project Ecologist are detailed in Section 3.6 of the TTSTS CMP.
2. The pre-clearing assessment must also include the identification and assessment of habitat trees affected by the clearing activities, including details on the checks by the Project ecologist on trees for fauna, nests and the like. The assessment must include processes and actions to protect or rescue the identified fauna including koalas, the Three-Toed Snake Tooth Skink, bat colonies and roosts, glider dens and frogs and address all elements of the implementation, outcomes and effectiveness of the proposed fauna rescue procedure (refer Section D4 below).
3. All hollow-bearing trees, potential hollow-bearing trees and all other fauna containing habitat trees, including trees with nests, dreys and termitaria likely to be occupied by fauna, must be marked at least 7 days prior to the commencement of clearing in a manner which clearly identifies and demarcates the trees.
4. **Stage 1 -Under-scrubbing and non-habitat tree removal.** Non-habitat trees must be removed at least 48 hours before habitat trees are removed, unless otherwise agreed with the EPA.
5. **Stage 2 - Habitat tree removal.** Habitat trees must be carefully felled at least 48 hours after Stage 1 unless otherwise agreed with the EPA, to allow fauna an opportunity to move from habitat trees and allow time to concentrate rescue efforts on the trees that are most likely to be inhabited. All habitat trees must be felled under the supervision of the Project ecologist. Felled trees must be left for a short period of time, determined by the Project ecologist, on the ground to give any fauna trapped in the trees an opportunity to escape.

All fauna captured will be relocated into areas of suitable habitat adjacent to the Project site in accordance with the Rescue Procedure detailed in Section D4 below. The species, number, sex, age, class and general health of each individual is to be recorded for later reporting in accordance with the Rescue Procedure detailed in Section D4 below.

D4 Rescue Procedure

If wildlife is discovered on the Project Site during site construction activities, including clearing (refer Section D3 above) that may harm, or has resulted in harm, to the animal or pose a risk to site personnel, the following steps will be taken:

1. Stop all work in the vicinity of the fauna and immediately notify Project Superintendent who will notify the Environmental Manager and Project Ecologist.
2. Preferably allow fauna to leave the area without intervention.
3. Use a licensed fauna ecologist or wildlife carer with specific animal handling experience to carry out any fauna handling.
4. Where necessary, to minimise stress to native fauna and/or remove the risk of further injury before a licensed fauna handler arrives onsite, the Environmental Officer will implement the Handling Procedure detailed in D5 below.
5. If the animal cannot be handled (i.e. venomous reptiles):
 - (a) exclude all personnel from the vicinity with fencing and/or signage; and
 - (b) record the exact location of the animal and provide to the Project Ecologist or appropriate rescue agency.
6. Call the appropriate rescue agency immediately and follow any advice provided by the agency. Once the rescue agency arrives at the site, they are responsible for the animal. Any decisions regarding the care of the animal will be made by the rescue agency. The contact details for the relevant fauna rescue services and local veterinary services contact details are provided in Table D-1.

Table D-1 Fauna Rescue Contact Details

Agency / business	Contact Number
Project Ecologist	
Wildlife Rescue Clarence Valley	02 6643 4055
RSPCA Dowsett Drive, Coffs Harbour NSW 2450	02 6651 3311
Veterinary Services	

The contact details for the Project Ecologist will be kept at a convenient location on the Project site and be available to the Contractor's personnel at all locations where clearing is being undertaken, to enable quick contact and access to the Project Ecologist.

In the event the rescue service and/or local veterinary service cannot be contacted, the injured animal will be delivered to the relevant agency as soon as practically possible.

In the event the rescue service and/or local veterinary service cannot be contacted, if required, the most appropriate euthanasia will be administered by the Project Ecologist (i.e. cervical dislocation for small vertebrates, ice slurry for introduced fish). This is to occur in accordance with applicable guidelines and legislative requirements.

7. If the fauna species is identified as a threatened species that is not a species identified in the CFFMP, the Environmental Manager must:
 - (a) immediately cease all work likely to affect the threatened species;
 - (b) inform the RMS Representative;
 - (c) contact the following stakeholders, in the order provided, to determine the appropriate corrective actions and additional safeguards to be undertaken:
 - Project Ecologist

- EPA
 - Environmental Representative
8. others as instructed by the RMS Representative or EPA. Relocation of fauna captured during construction works, including clearing and associated works, will be undertaken by the Project Ecologist or wildlife rescuer. If the animal is not injured or stressed, it should be released to an area that is not to be disturbed by the Project construction works, in accordance with the following:
 - (a) sites identified as suitable release points by the Project Ecologist or wildlife rescuer;
 - (b) release site will contain similar habitat and occur as close to the original capture location as possible;
 - (c) if the species is nocturnal, release will be carried out at dusk;
 - (d) release would generally not be undertaken during periods of heavy rainfall; and
 - (e) non-native fauna will not be translocated and will be euthanised.
 9. If the animal has been placed into care due to injury, age (i.e. young) or stress, upon its rehabilitation it will be released in an area that is not to be disturbed by the Project construction works, at the discretion of the Project Ecologist or wildlife rescuer.
 10. Following consultation with all relevant stakeholders, the Project Ecologist/Environmental Manager will implement any corrective actions and additional safeguards.
 11. Following confirmation by the Project Ecologist/Environmental Manager that all appropriate safeguards have been implemented, construction works can recommence.
 12. Project Ecologist/Environmental Manager to record find/translocation in the RMS Environmental Incident Report or Weekly Environmental Inspection Checklist. All relevant characteristics of the fauna find should be recorded to the extent practicable (i.e. visual signs of behaviour; habitat; health signs; sex, time date, weather etc.), and capture and relocation data.

D5 Handling Procedure

The Handling Procedure will be implemented to minimise stress to native fauna and/or remove the risk of further injury. The Project Ecologist will:

1. Captured TTSTS requirements are addressed in section 3.7 of the TTSTS MP.
2. Cover larger animals with a towel or blanket and place in a cardboard box and/or hessian bag;
3. Place smaller animals in a cotton bag, tied at the top;
4. Keep terrestrial fauna quiet, warm, ventilated and in a dark location away from noisy construction activities;
5. Relocate aquatic fauna in accordance with the following steps:
 - a. Ensure all aquatic fauna relocation works are supervised by a suitably qualified aquatic ecologist.
 - b. Prior to the commencement of pumping, advice should be sought from the aquatic ecologist on pumping methods and the extent of drawdown.
 - c. The water level should be pumped down to a level that will allow the safe and effective implementation of capture methods, such as seine nets, dip nets and electrofishing.
 - d. A fine mesh screen with not >5mm mesh must be installed on the inlet of the pump or a fish basket used to remove the risk of native aquatic fauna being transferred through pump. A maximum depth of 500mm is typically required before fish salvage can commence but site-specific advice will be required from the aquatic ecologist.
 - e. Aquatic ecologist is to establish the presence of native and introduced aquatic fauna and plan relocation. Access to adjoining properties may be required for relocation, particularly

when dewatering dams. The aquatic ecologist will ensure that native aquatic fauna species are released into suitable habitat as close to the original location as possible.

- f. Native fish will be placed in tubs full of water sourced from the salvage site where they will be housed for brief periods before being transferred to the release site. Pest fish will be euthanased using an ice slurry.
 - g. Following completion of relocation, a final check shall be undertaken to find any remaining fish, or dying/dead fish.
 - h. All euthanized and dead fish will be transported to a licensed landfill facility for disposal.
 - i. Records will be kept on habitat type, method of water extraction, species, number of individuals and reproductive status of fish encountered.
 - j. Aquatic ecologist will prepare a report on the relocation, detail the source of the fish, the number and species of fish released and euthanased.
6. Transport frogs without water or debris in recognition of the risk of transporting disease and the minimal transport time.
 7. Animals such as venomous reptiles and raptors require particular handling and will only be handled by appropriately qualified personnel, i.e. Project Ecologist or wildlife rescuer.
 8. If handling bats, the handler must be vaccinated against the Australian Bat Lyssavirus (ABL), which is a form of rabies.
 9. Any frog handling will be undertaken in accordance with the *Hygiene Protocol for the Control of Disease in Frogs* (DECC 2008). This protocol recommends onsite hygiene precautions be undertaken to minimise the transfer of disease between and within wild frog populations. Measures recommended include:
 - a. thorough cleaning/disinfecting of footwear and equipment when moving from one site to another;
 - b. spraying/flushing vehicle tyres with a disinfecting solution where necessary in high risk areas;
 - c. cleaning/disinfecting hands between collecting samples/frogs (gloves, not bare hands, will be used to handle frogs); and
 - d. limiting one frog or tadpole to a bag. Bags will not be reused.

Annexure E: Not used

Annexure F: Unexpected Threatened Flora Species / EEC Finds Procedure

[CoA D46e)(x) – a procedure for dealing with **unexpected** EEC/threatened species identified during construction including:

- cessation of work and notification of the DP&E, OEH, and DPI (Fisheries),
- determination of appropriate mitigation measures in consultation with these agencies (including relevant re-location measures), and
- update of ecological monitoring and/ or biodiversity offset requirements;]

MMB10 - If unexpected threatened fauna or flora species are discovered, works will stop immediately and the Unexpected Threatened Species Find Procedure RTA (2011a) as well as the Biodiversity Guidelines Guide 1: Pre-clearing process (Roads and Maritime, 2011) will be followed. This procedure will be included in the FFMP developed for the project.

Unexpected Threatened Flora Species / EEC Finds Procedure

1. Purpose

This procedure details the actions to be taken when a threatened species / EEC is unexpectedly encountered during excavation / construction activities.

2. Induction / Training

Where required, personnel will be inducted on the identification of potential threatened species / EEC occurring on site and the relevant actions for them with regards to this procedure during the Project Induction, Site Inductions and regular Toolbox Talks.

3. Scope

This procedure is applicable to all activities conducted by personnel that have the potential to come into contact with threatened flora species. Where threatened fauna is unexpectedly encountered, refer to the **Fauna Handling and Rescue Procedure**.



Refer to Figure F-1 for Unexpected Threatened Flora Species / EEC Find Procedure flow chart.

4. Procedure

1. Threatened flora species / EEC unexpectedly encountered during excavation/construction activities

If a threatened flora species / EEC is unexpectedly encountered during excavation / construction activities:

- STOP ALL WORK in the vicinity of the find.

Immediately notify the Environmental Manager (EM), or Environmental Officer (EO) who will notify the Project Ecologist, RMS and the EPA/OEH.

2. Assessment of Impact

An assessment is to be undertaken by the EM and the Project Ecologist to determine the likely impact to the threatened flora species / EEC and appropriate management options developed in consultation with RMS.

If a significant impact is likely to occur, consultation will be undertaken with the EPA/OEH and / or DPI as appropriate.

3. Approvals

Obtain any relevant licences, permits or approvals required if the species / EEC is likely to be significantly impacted.

4. Resumption of Works

Works will recommence once necessary advice has been sought and approval obtained if required.

Include threatened flora species / EEC in subsequent Project Inductions and Toolbox Talks.

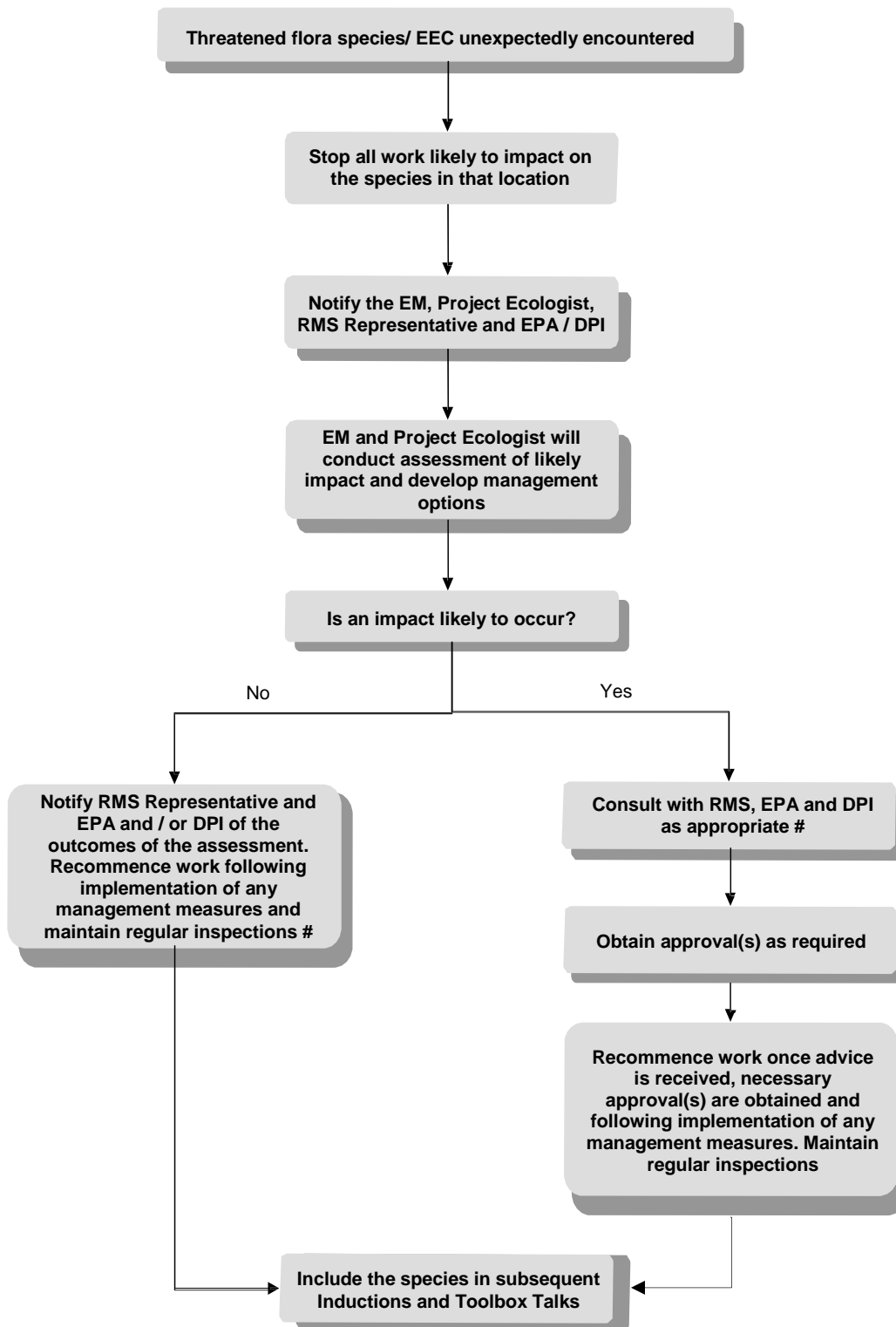


Figure F-1 Unexpected Threatened Flora Species / EEC Find Procedure Flow Chart

Annexure G: Weed Management Plan

Weed Management Plan

6. Purpose

The purpose of this Weed Management Plan (WMP) is to detail how Fulton Hogan will manage and control weeds throughout pre-construction, construction and for a period of the maintenance phase of the Project to minimise the threat to remnant vegetation, native flora and fauna habitats and waterways within the local area.

This WMP does not detail weed management of permanently landscaped areas as this will be included in the UDLMP.

7. Scope

Weed management will be implemented to control weed infestation on the Project and to limit the introduction and/or spread of weed species during construction activities.

Noxious and environmental weeds in the existing road corridor, construction areas and ancillary facility areas will be controlled in accordance with *RMS Biodiversity Guidelines: Guide 6 - Weed management* and *Guide 10 - Aquatic habitats and riparian zones* (RTA, 2011). Weed control, generally, will have a strong focus on:

- restricting the area of native vegetation disturbed during construction works by application of *RMS Biodiversity Guidelines: Guide 2 Exclusion zones* (RTA 2011).
- restricting stockpiling to areas already cleared of vegetation.
- controlling drainage that may contain weed propagules.
- weed hygiene protocols including inspecting and cleaning light and heavy plant and equipment; inspecting materials brought to site, especially topsoil, turf and mulch to ensure that these are weed-free.
- removing weeds prior to clearing (where practicable), in order to reduce the potential for any future weed infestation.
- revegetating disturbed sites with locally indigenous plant species to stabilise the soil and provide native vegetation cover as a method of ongoing weed control.

This WMP must be read in conjunction with the Project-specific Clearing and Grubbing Environmental Work Method Statement.

8. Induction and training

All site personnel and subcontractors will be inducted in the existence of noxious weeds on the Project, including the identification and disposal of Alligator weed (*Alternanthera philoxeroides*); and management procedures for weeds. This training will occur on site during the Project induction and as required in toolbox talks.

The training material on Alligator weed will be in accordance with the *RMS Biodiversity Guidelines: Guide 10 – Aquatic habitats and Riparian Zones* (RTA 2011).

Where work is scheduled in an area that contains weeds, personnel will be advised of this in toolbox talks. The controls that are required to be implemented to minimise weed spread (i.e. weed hygiene protocols) will be implemented prior to clearing and grubbing or ground disturbance.

All site personnel will be made aware of the limits of clearing and the importance of threatened species and populations and any vegetation of significant value.




9. Weeds overview





Weeds are often classed in broad groups depending on their characteristics and impacts. The main groups of weeds are: noxious weeds, Weeds of National Significance (WoNS), National Environmental Alert List weeds, environmental weeds and agricultural weeds. The focus of this procedure is on the first four weed groups. These are discussed below, followed by the weed control procedure.





10. Noxious weeds



Thirteen flora species, declared as noxious under Section 7 of the *Noxious Weeds Act 1993* by the Minister for Primary Industries in the Clarence Valley LGA have been recorded in the Project corridor and surrounds. Table G-1 provides a list of these, the weed class to which they belong, a picture, and the DPI website where additional up-to-date information can be found on control and management methods. Further reference can be made to *Noxious and environmental weed control handbook: A guide to weed control in non-crop, aquatic and bushland situations*, 5th Edition. (DPI 2011) for the following and any additional noxious weed species.

Table G-1: Noxious weeds recorded in the project corridor and surrounds

Weeds Species	Weed Class ⁴	Picture	Control and management details
Crofton weed (<i>Ageratina adenophora</i>) ¹	4		Mechanical removal or herbicide application –foliar spray
Alligator weed (<i>Alternanthera philoxeroides</i>)	2		Mechanical removal or herbicide application –foliar spray
Green cestrum (<i>Cestrum parqui</i>)	3		Herbicide application –foliar spray

Weeds Species	Weed Class ⁴	Picture	Control and management details
Camphor laurel (<i>Cinnamomum camphora</i>)	4		Mechanical removal or herbicide application –foliar spray
Rubber vine (<i>Cryptostegia grandiflora</i>)	1		Mechanical removal or herbicide application –foliar spray
Water hyacinth (<i>Eichhornia crassipes</i>)	4		Mechanical removal or herbicide application –foliar spray
Lantana (<i>Lantana camara</i>)	4	 <p data-bbox="512 1771 903 1827">Flower clusters in leaf forks (source: http://keyserver.lucidcentral.org)</p>	Mechanical removal or herbicide application –foliar spray

Weeds Species	Weed Class ⁴	Picture	Control and management details
Lemon-scented tea tree (<i>Leptospermum petersonii</i>) ²	4		Mechanical removal or herbicide application –foliar spray
Broad-leaved privet (<i>Ligustrum lucidum</i>)	4		Mechanical removal or herbicide application –foliar spray
Small-leaved privet (<i>Ligustrum sinense</i>)	4		Mechanical removal or herbicide application –foliar spray
Prickly pear (<i>Opuntia stricta</i>)	4		Mechanical removal or herbicide application –foliar spray

Weeds Species	Weed Class ⁴	Picture	Control and management details
Crack willow (<i>Salix fragilis</i>)	5 ³		Mechanical removal or herbicide application –foliar spray
Giant Parramatta grass (<i>Sporobolus fertilis</i>) ¹	4		Mechanical removal or herbicide application –foliar spray

¹ Crofton weed, *Ageratina adenophora* and Giant Parramatta grass, *Sporobolus fertilis* appear to have been incorrectly identified as noxious weeds in the EIS. In accordance with the Noxious Weeds (Weed Control) Order 2014 published in the NSW Government Gazette, these weeds are not declared to be noxious weeds in the Clarence Valley LGA.

² In accordance with the Noxious Weeds (Weed Control) Order 2014, Lemon-scented tea tree is not declared to be a noxious weed in the Clarence Valley LGA.

³ In accordance with the Noxious Weeds (Weed Control) Order 2014, Willows are declared to be Class 4 noxious weeds in the Clarence Valley LGA (not Class 5 as identified in the EIS).

⁴ Refer to Table 7-1 for example control requirements.

Alligator weed

Alligator weed (*Alternanthera philoxeroides*) was recorded in the project area. It is a Class 2 noxious weed in the Clarence Valley LGA, and is listed as a WON. It poses a significant environmental and economic threat and is highly invasive. As such, the Project must be kept free of alligator weed and it must be eradicated when identified.

All site personnel and subcontractors will be inducted in the identification and disposal of alligator weed. Positive identifications of alligator weed within the construction area will be reported to the RMS Representative and Clarence Valley Council.

11. Environmental weeds

Environmental weeds are plants that invade native ecosystems and adversely affect the survival of indigenous flora and fauna (Source: <http://www.daff.qld.gov.au>). Environmental weeds can be foreign plants accidentally or intentionally introduced into Australia, or they can be native plants that have become weedy due to inappropriate management or because they are outside of their normal range (Source: <http://www.daff.qld.gov.au>).

Environmental weeds may have significant economic and social impacts, as well as environmental impacts, including:

- reduction of biodiversity
- cost of control
- loss of ecotourism opportunities
- impacts on recreational activities
- impacts on landscape
- degradation of water quality
- increased risk of fire.

Several environmental weeds are present throughout the project area, some including those listed in Table G-2.

Table G-2: Environmental weeds

Environmental weeds	Environmental weeds
Cobbler's Pegs (<i>Bidens pilosa</i>)	Curled Dock (<i>Rumex crispus</i>)
Spear Thistle (<i>Cirsium vulgare</i>)	Creeping Christian (<i>Tradescantia fluminensis</i>)
Paddy's Lucerne (<i>Sida rhombifolia</i>)	Camphor Laurel (<i>Cinnamomum camphora</i>)
Kikuya Grass (<i>Pennisetum clandestinum</i>)	Wild Tobacco Bush (<i>Solanum mauritianum</i>)

12. Weed control procedure

To control weed infestations pre and during construction the Environmental Manager or Environmental Officer will ensure that the following procedure is implemented:

1. Weed inspection

The Environmental Manager/EO will undertake an inspection with the Project Ecologist to inspect the area for weeds:

- prior to clearing and grubbing (i.e. as part of the Pre-clearing survey)
- when a potential weed infestation has been identified, and
- before spring (around August) to identify weeds before they go to flower and seed.

Infestations of noxious weeds and WoNS will be mapped with GPS by the Project Ecologist during the inspection. The Project Ecologist will close note the specie(s) degree of infestation and capture an image of the weed for monitoring purposes.

2. Exclusion zones

The Project Ecologist will identify areas of weed infestation and exclusion zones will be established around these areas (as required) to prevent the distribution of weeds.

3. Weed treatment methodology

The Project Ecologist will advise the appropriate weed control methods, and timing for each area of works.

4. Pesticide Application Record

The Environmental Manger/EO will follow the Fulton Hogan Pesticide Use Procedure and ensure that a Pesticide Application Record is completed and public notifications made in accordance with relevant legislation and G36, where pesticides are to be used in areas that could be accessed by members of the public.

Only pesticides registered for use near water may be used near any waterways.

5. Follow-up inspection

The Environmental Manger/EO will ensure that a follow-up inspection is undertaken of identified weed infestation sites to verify the success of treatment.

Where weeds cannot be effectively destroyed prior to topsoil stripping, weed-contaminated topsoil will be isolated and either encapsulated by deep burying (refer R178), or disposed of at an approved offsite licensed facility as directed by the Environment Manager/EO.

6. Vehicle, plant and equipment movement plan

Site specific vehicle, plant and equipment movement plans will be prepared for each worksite that contains noxious weeds. The plans will be incorporated into Progressive Erosion and Sediment Control Plans and include identification of vehicles, plant, equipment, turning and parking areas.

To prevent the spread of weeds throughout the construction site and surrounding areas, the movement of weed-contaminated plant and equipment will be monitored by Foreman.

The Foreman will ensure that all plant and machinery entering the site is inspected and free of weeds applying standard weed hygiene protocols.

Plant and equipment will be checked and cleaned before leaving a worksite that contains noxious weeds.

Records of all construction plant screening checks will be recorded on the Mobile Plant Inspection Checklist and monitored by the Foreman.

7. Weed disposal

Where noxious weed areas are disturbed by the construction activities, weeds and topsoil potentially containing weed propagules will be removed and disposed of as required by the *Noxious Weeds Act 1993* at Grafton Regional Landfill.

Any weeds physically removed (particularly those bearing seeds) will be disposed of appropriately at a licensed facility in accordance with the *Noxious Weeds Act 1993*.

13. Ongoing management and monitoring

Monitoring of weed infestations will occur as part of the routine weekly inspections to determine the effectiveness of management controls. The presence of any weeds and the necessary management actions will be noted on the Environmental Inspection Checklist (Appendix A8 of the CEMP).

Annexure H: Not used.

Annexure I: Nest Box Management Plan



Additional Crossing of the Clarence River at Grafton Nest Box Management Plan

FINAL REPORT

Prepared for Fulton Hogan

16 August 2016

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1 Introduction

1.1 Project background

Biosis Pty Ltd has been commissioned by Fulton Hogan to review and prepare management plans for the Additional Crossing of the Clarence River at Grafton (the Project). This Nest Box Management Plan (NBMP) forms Annexure I to the Construction Flora and Fauna Management Plan (CFFMP), which forms part of the Construction Environmental Management Plan (CEMP) for the construction of the Project.

The Project area is located in the city of Grafton in northern NSW, approximately 600 km north-east of the Sydney CBD (Figure 1). The Project area encompasses 49.70 hectares of private and public land and the adjacent road reserves.

The Project area is located within the:

- NSW North Coast Bioregion.
- Northern Rivers Catchment Management Area (CMA).
- Clarence Local Government Area (LGA).
- Clarence River Basin, of which the Clarence River Estuary is listed as a nationally important wetland in the Directory of Important Wetlands in Australia (Environment Australia 2001) including the Susan Island Nature Reserve, gazetted May 1989 under NSW *National Parks and Wildlife Act 1974*.

The Clarence River dissects the central portion of the Project area flowing from west to east with an average width of approximately 200 metres.

The Project involves the construction of a new bridge parallel to the existing bridge across the Clarence River at Grafton (Figure 1).

The main components of the Grafton Bridge project are:

- Construction of a new bridge over the Clarence River approximately 70 metres downstream (east) of the existing road and rail bridge, comprising two traffic lanes.
- Construction of a new road to link the new bridge with Iolanthe Street in South Grafton.
- Construction of a new road to link the new bridge with Pound Street in Grafton.
- An approach viaduct, about 64 metres long, on the South Grafton side of the Clarence River and 29 metres long on the Grafton side.
- Upgrades to the road network in South Grafton to connect the new bridge to the existing road network.
- Upgrades to the road network in Grafton to connect the new bridge to the existing road network.
- Replacement of the existing three span concrete arch rail viaduct which crosses Pound Street in Grafton with a single span steel truss bridge.
- Construction of a pedestrian and cycle path to provide connectivity between Grafton, South Grafton and the new bridge.
- Provision of two signalised pedestrian crossings in South Grafton to improve safety for pedestrians crossing Iolanthe Street and Gwydir Highway.

- Construction of new pedestrian links to connect the new bridge with the existing bridge.
- Provision of designated car park spaces in Pound Street and Clarence Street, including some off street parking, to maintain a similar number of existing car park spaces currently available in those two streets.
- Flood mitigation works, which include raising the height of sections of the existing levee upstream from the new bridge in Grafton and South Grafton.
- Construction of a stormwater detention basin and pump station in Grafton to manage local flooding.
- Public utilities adjustment.
- Ancillary facilities required for the construction of the project, including some or all of the following: site compounds, concrete batching plant, pre-cast facilities, and stockpile areas for materials and temporary storage of spoil and mulch.

The Project was approved by the Minister for Planning in 19 December 2014.

This NBMP has been prepared to address the requirements of the Ministers Conditions of Approval (CoA) dated 19 December 2014, the Revised Environmental Management Measures (REMM) contained in the *Additional Crossing of the Clarence River at Grafton: Submissions Report* (RMS 2014), the *Additional Crossing of the Clarence River at Grafton: Appendix L – Technical Paper: Flora and fauna assessment* (Biosis 2014) and all applicable legislation.

This NBMP has been prepared and reviewed by qualified and licenced zoologists and botanists (Amy Rowles, Alejandro Barreto, Nathan Garvey, Callan Wharfe and Jane Raithby-Veall) of Biosis.

1.2 Scope of works

The NBMP has been developed to conform to Guide 8: Nest Boxes of the *Biodiversity Guidelines* (RTA 2011). Work undertaken in the development of this NBMP includes:

- Review of the Project *Additional Crossing of the Clarence River at Grafton: Appendix L – Technical Paper: Flora and fauna assessment* (Biosis 2014) and associated documentation.
- Hollow-bearing trees surveys to capture quantity and characteristics of hollows present within the Project area.
- Collation of recorded information and development of the NBMP.

The construction footprint for this NBMP is shown in Figure 1.

1.3 Objectives of the NBMP

The aim of the NBMP is to catalogue tree hollows within the construction footprint and to outline specific measures to be undertaken to mitigate the impacts of vegetation clearing on hollow-dependent fauna, with a specific emphasis upon threatened fauna.

To achieve this aim, as specified by Guide 8: Nest Boxes of the *Biodiversity Guidelines* (RTA 2011) and fulfil commitment B11 in the Revised Environmental Management Measures (REMMs) of the *Additional Crossing of the Clarence River at Grafton: Submissions Report* (RMS 2014), the NBMP will:

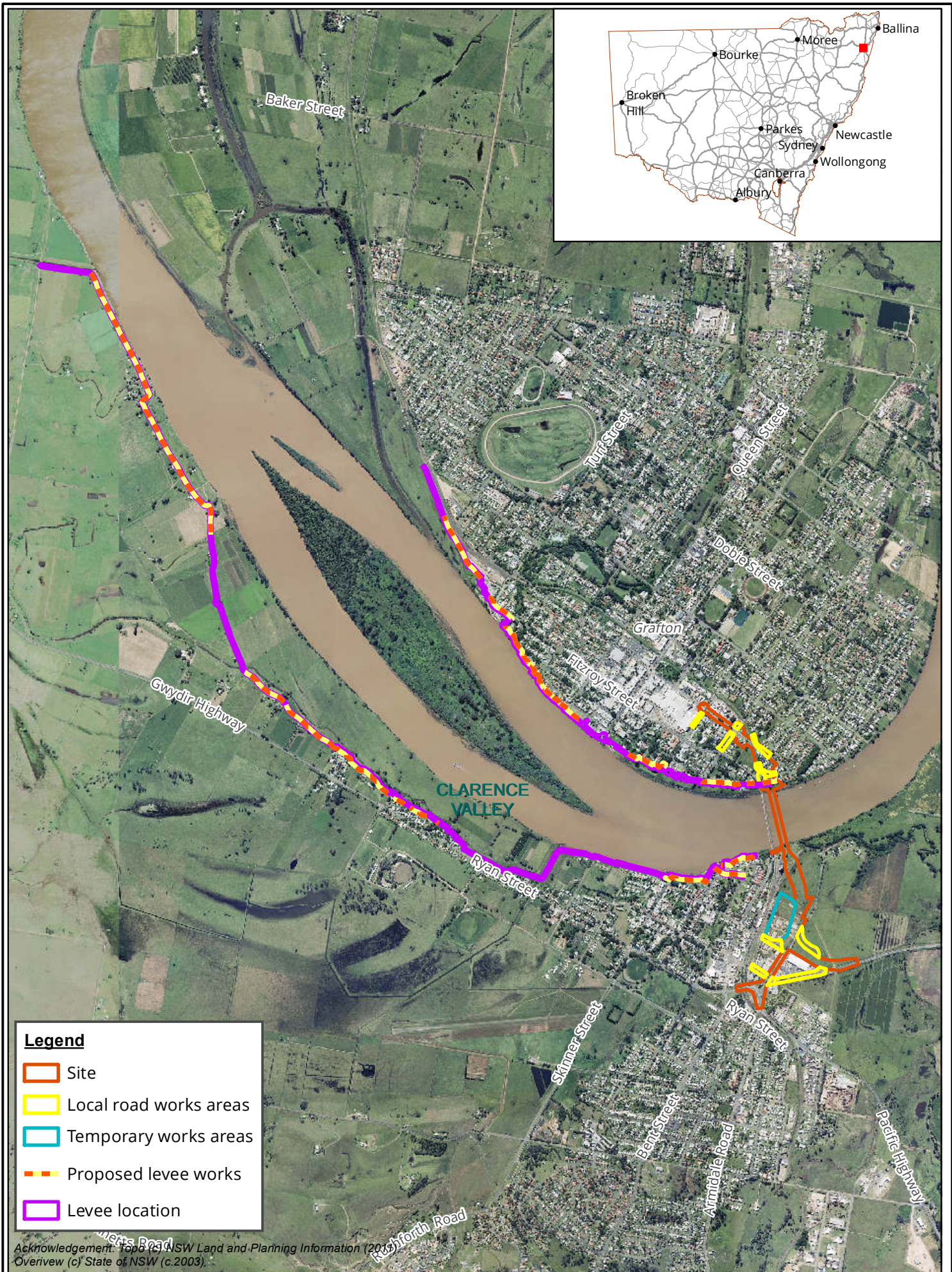
- Outline the target hollow-dependent fauna species.

- Outline the tree hollow preferences of hollow-dependent fauna known or likely to utilise existing hollows within the construction footprint.
- Detail the number, size and type of hollows to be removed (based on preliminary surveys).
- Outline the number and type of nest boxes to be installed, based on the information above.
- Refine the final number and type of nest boxes to be installed based on findings following vegetation removal.
- Provide details for the location, maintenance and monitoring of nest boxes to be installed.

1.4 Limitations

Identification of tree hollows presents a number of sampling difficulties. When observations are made from ground-level, the number of hollows seen in standing trees may differ from the actual number present, as hollows may be obscured by branches, entrances may be facing upwards or too small to see, and some apparent entrances may be blind. This is supported by a study by Mackowski (1987) which found that most hollows, particularly branch hollows, become increasingly difficult to count the larger the diameter of the tree. Variables other than tree diameter, such as tree height and visibility of the tree crown, can also influence the detectability of hollows to the observer.

Furthermore, not all hollows observed from ground-based observations will be suitable for fauna, so data collected in this way must be corrected from direct measurements obtained from hollows or treated as an index only (Gibbons & Lindenmayer 2002).



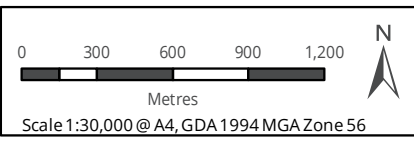
Legend

- Site
- Local road works areas
- Temporary works areas
- Proposed levee works
- Levee location

Acknowledgement: Topographic NSW Land and Planning Information (2015)
 Overview (c) State of NSW (c.2003).

Figure 1: Location of the Approved Construction Footprint, NSW

Matter: 22681
 Date: 25 July 2016,
 Checked by: NMG, Drawn by: JMS, Last edited by: jshepherd
 Location: P:\22600s\22681\Mapping\



2 Background

It is widely recognised that tree hollows as a habitat resource have been depleted in modified landscapes. This is being exacerbated by urban development which is expanding in many parts of eastern Australia (Goldingay 2011). A consequence of development and the ensuing decline in hollow resources is the listing of the loss of hollow-bearing trees as a Key Threatening Process (KTP) under Schedule 3 of the *Threatened Species Conservation Act 1995* (TSC Act) (TSSC 2007). In NSW, terrestrial vertebrate species that are known to be reliant on tree hollows for shelter and/or nesting include at least 46 mammals, 81 birds, 31 reptiles and 16 frogs (Gibbons & Lindenmayer 1997, Gibbons & Lindenmayer 2002). Of these, 40 species are listed as threatened under the TSC Act.

Many hollow-dependent fauna readily take to using artificially constructed hollows, most commonly in the form of a nest box attached to a tree (Beyer & Goldingay 2006). Nest boxes have been used as research tools for detecting species, and for studies of the ecology of hollow-dependent species (Harley 2006, Menkhorst 1984, Soderquist 1996). Nest boxes may also be effective substitutes for natural hollows where hollow-dependent species are excluded or reduced in abundance by a lack of naturally occurring hollows (Beyer & Goldingay 2006, Harper et al. 2005, Menkhorst 1984).

The use of tree hollows by fauna may depend on a number of factors including hollow characteristics (diameter, height and depth), the number of hollows in a tree, tree health, size, location, density and the resulting thermoregulatory capabilities of the hollows themselves (Gibbons & Lindenmayer 2002).

3 Methodology

3.1 Hollow-bearing tree surveys

Hollow-bearing tree surveys were undertaken by Biosis in 2013 and the results of these surveys are outlined in the Flora and Fauna Assessment (Biosis 2014). Additional hollow-bearing tree surveys were undertaken on 19-10 July 2016. This data is provided in Appendix 1 and forms the basis of the current NBMP for the Project.

The methodology for recording hollow-bearing trees is outlined below and is in accordance with *Methodology for Development of Nest Box Management Plan* (RMS 2015).

3.1.1 Hollow inventory

Tree hollows were only recorded if:

- The entrance could be seen from the ground.
- The hollow appeared to have depth.
- The hollow was at least 1 metre above the ground (basal hollows were only recorded if they continued up into the tree above 1 metre).

3.1.2 Hollow-bearing tree characteristics

For each individual hollow-bearing tree, the following data was collected:

- GPS waypoint of each hollow-bearing tree (GPS accuracy to +/- 5 metres).
- Habitat ID.
- Scientific Name and Common Name.
- Condition (dead / poor/ medium/ high).
- Height of the tree.
- Diameter at Breast Height (DBH).
- Hollow count.
- Estimated dimensions of each hollow entrance.
- Any observed signs of fauna occupancy (i.e. scats or regurgitated pellets at the base of hollow-bearing trees).
- Potential fauna suitability of each hollow (based on hollow characteristics, tree position in landscape and surrounding habitat).
- Photograph of each tree hollow.
- Observer.
- Capture date.

3.2 Hollow-dependent fauna

The Flora and Fauna Assessment (Biosis 2014) provide a list of threatened hollow-dependent fauna that are known to, or have potential to, occur within Project boundaries. The Flora and Fauna Assessment (Biosis 2014) also lists other more common fauna species that were recorded in the study area, some of which are also dependent on tree hollows. These results have been used to determine the nest box requirements for the Project.

4 Existing conditions

4.1 Habitat for hollow-dependent fauna

The Project area is predominantly cleared of native vegetation with current land uses including public open space, rail infrastructure, industrial and residential areas and agricultural land including areas used for cattle grazing and cropping. Outside of urbanised Grafton, and particularly along the extent of the levees, land use is agricultural and extensive past clearing of native vegetation and intensive grazing by cattle is evident.

The vegetation types throughout the study area are broadly categorised into four communities:

- *Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions* endangered ecological community (EEC) (0.10 hectares).
- *Subtropical coastal floodplain forest of the NSW North Coast bioregion* EEC (Subtropical Coastal Floodplain Forest) (0.31 hectares).
- Native and exotic plantings (4.41 hectares).
- Weeds and exotics (31.25 hectares).

Subtropical Coastal Floodplain Forest habitat consists mainly of scattered mature Forest Red Gum *Eucalyptus tereticornis*. These trees provide a significant portion of the nesting, perch sites and tree hollow habitat for woodland birds, microbats and birds of prey in the locality, due to the sparse nature of the vegetation in the community.

Due to the highly modified nature of the urban environment, the native and exotic plantings community, is considered to provide poor condition landscape connectivity habitat for native fauna species. However, a number of native plantings within the Project area (i.e. Moreton Bay Fig *Ficus macrophylla*) provide good quality habitat and foraging resources for a range of bird and mammal species, including small crevices and fissures for microbats.

4.2 Hollow-bearing tree inventory

A total of eight hollow-bearing trees were recorded within the works area, with a further eight hollow-bearing trees recorded adjacent to the construction footprint (Appendix 1). The distribution of hollow-bearing trees within the construction footprint is shown in Figure 2.

A catalogue of tree hollows is provided in Table 1.

Table 1 Hollow bearing/habitat trees within the works area (Figure 2)

Tree number	Species	Feature	Description	Location (Figure 2)
1	River She-oak <i>Casuarina cunninghamiana</i>	Hollows in branches and fissures	Multiple hollows suitable for small microbats.	Site
3-7	Moreton Bay Fig <i>Ficus macrophylla</i>	Foraging resources and numerous fissures	These five mature Moreton Bay Figs provide significant habitat for avifauna (i.e. bird and bat species), in terms of:	Site

			<ul style="list-style-type: none"> • Microbat roosting habitat within fissures and crevices • Foraging resources for Grey-headed Flying-fox <i>Pteropus poliocephalus</i>. 	
8	Moreton Bay Fig <i>Ficus macrophylla</i>	Foraging resources and numerous fissures	<p>These mature Moreton Bay Fig provide significant habitat for avifauna (i.e. bird and bat species), in terms of:</p> <ul style="list-style-type: none"> • Microbat roosting habitat within fissures and crevices • Foraging resources for Grey-headed Flying-fox <i>Pteropus poliocephalus</i>. 	Levee system
14	Camphor Laurel <i>Cinnamomum camphora</i>	Hollows in branches and fissures	Two small hollows potentially suitable for microbat roosts..	Levee system

Recent examination of a Forest Red Gum *Eucalyptus tereticornis* (habitat tree number HT2) during hollow-bearing tree surveys determined that the small hollows observed during the initial survey (Biosis 2014) were not present. The hollows previously observed were the result of insect activity and recent regrowth of bark had reduced their size and habitat suitability. Therefore, this tree was not included in Table 1.

4.3 Hollow-dependent fauna

In NSW, terrestrial vertebrate species that are reliant on tree hollows for shelter and nests include at least 46 mammals, 81 birds, 31 reptiles and 16 frogs (Gibbons and Lindenmayer 1997, 2002). Of these, eight hollow-dependent species, listed as threatened under the TSC act or Commonwealth *Environmental protection and Biodiversity Conservation Act 1999* (EPBC Act), including the Masked Owl *Tyto novaehollandiae* and six microbat species have either been identified within the Project area, or are considered likely to occur. The Flora and Fauna Assessment (Biosis 2014) also recorded a number of other common, and non-threatened, hollow-dependent fauna species, including eight microbat species and six hollow nesting birds.

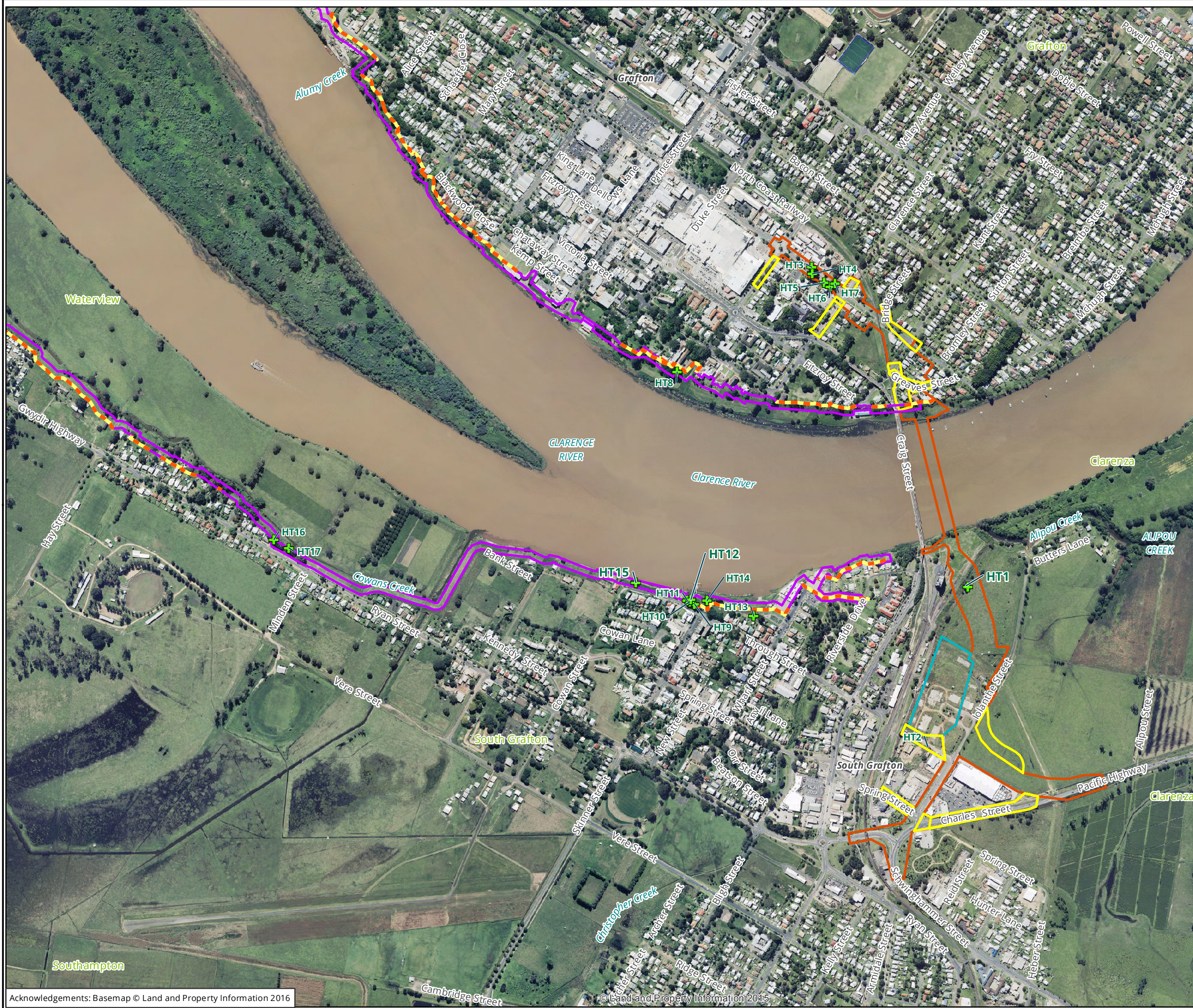
The hollows, crevices and fissures to be removed as part of the Project have been assessed as mostly small in size and mainly suitable for use by microbats. Hollows were considered too small in size to support the Masked Owl. Smaller gliders are known to utilise small hollows as well; however, these species are considered unlikely to occur due to the disturbed nature of the site and the fragmented nature of the remnant habitat.

Table 2 lists the species that were recorded in the Project area as well as threatened species identified as having potential to occur within the study area with potential to utilise hollows within the construction footprint.

Table 2 Hollow-dependent fauna species potentially affected by loss of the hollow bearing trees within the construction footprint

Common name	Scientific name	Conservation status	
		EPBC Act	TSC Act
Central-eastern Broad-nosed Bat (undescribed)	<i>Scotorepens sp. undescribed</i>	-	-
Eastern Broad-nosed Bat	<i>Scotorepens orion</i>	-	-
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	-	V
Eastern Free-tailed Bat	<i>Mormopterus ridei</i>	-	-
Eastern Long-eared Bat	<i>Nyctophilus bifax</i>	-	V
Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>	-	-
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	-	-
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	-	V
Hoary Wattled-bat	<i>Chalinolobus nigrogriseus</i>	-	V
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	-	-
Little Forest Bat	<i>Vespadelus vulturnus</i>	-	-
Southern Forest Bat	<i>Vespadelus regulus</i>	-	-
Southern Myotis	<i>Myotis macropus</i>	-	V
White-striped Freetail Bat	<i>Austronomus australis</i>	-	-
Yellow-bellied Sheath-tail bat	<i>Saccolaimus flaviventris</i>	-	V

Note: V – Vulnerable under the TSC Act



- Legend**
- Site
 - Local road works areas
 - Temporary works areas
 - Proposed levee works
 - Levee location
 - + Hollow-bearing trees

Figure 2: Location of hollow-bearing trees within and adjacent to the construction footprint

0 100 200 300 400 500
 Metres
 Scale: 1:10,387 @ A3
 Coordinate System: GDA 1994 MGA Zone 56



Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

5 Nest box plan

This NBMP has been developed to provide shelter and breeding resources for both common and threatened hollow-dependent fauna known or predicted to occur with the Project area. In the case of the Project such species are limited to microbats. Provision of these habitat resources will result in indirect benefits to biodiversity in the locality. Insectivorous microbats (both common and threatened species) perform an important role in controlling the abundance of invertebrates (especially flying insects such as mosquitos).

Installation of nest boxes is to be guided by a suitably qualified and experience Project Ecologist.

5.1 Proposed number of nest boxes required

The density and quantity of each nest box type should reflect the proportion of tree hollow types being removed, the proportion of tree hollow types to be retained in adjacent habitat, the availability of adjacent food resources and the assemblage of hollow-dependant fauna known or likely to occur in the project locality (RTA 2011). A ratio of 1:1 (hollows to nest boxes) is recommended in order to meet the specific objectives and needs for the target species and location (RTA 2011).

A total of 0.31 hectares of vegetated land, consisting of Subtropical Coastal Floodplain Forest, will be removed as a part of the Project. This includes only forested land, and excludes areas of freshwater wetlands native & exotic plantings and weeds & exotics. A total of eight hollow-bearing trees supporting a minimum of 32 hollows have been identified within the clearing footprint (Appendix 1).

Using this data, the number of nest boxes required to be installed to provide supplementary breeding habitat and shelter for hollow-dependant fauna where hollows have been removed is 32.

Habitat tree HT1 could not be accessed during recent surveys and the number of hollows in this tree confirmed.

5.2 Locations for nest box installation

Where practical, nest boxes should be installed on suitable trees in habitat adjacent to the construction footprint. Placement of nest boxes in areas adjacent to the construction footprint could increase the potential for these boxes to provide habitat for hollow-dependent fauna potentially displaced during vegetation clearing for the Project. However, suitable next box locations should be determined in consultation with the Project Ecologist.

Where installation of nest boxes adjacent to the construction footprint is not feasible, nest box locations should be chosen as close as possible to Project area and in broadly similar habitats and vegetation types to those to be impacted.

Where possible, areas chosen for nest box installation should have secure land tenure to ensure that boxes installed as offsets for the loss of biodiversity values as part of the current project are not lost to future development.

5.3 Nest box design

5.3.1 Nest box dimensions

As all hollows identified within the Project area are suitable for microbats only, only nest boxes suitable for microbats will be installed. The design features recommended for microbat nest boxes, in line with Franks & Franks (2006; as outlined in RTA 2011) are outlined in Table 3 below:

Table 3 Recommended nest box dimensions and design features

Entrance diameter (mm)	Internal dimensions (mm)	Depth / height of chamber (mm)	Height above ground (m)	Additional comments
30 (hole) 20 (slot)	n/a	400	3 – 5	Bottom opening. Shadecloth or denim to be hung internally.

5.3.2 Other design factors

The recommended dimensions of nest boxes for the target species of microbats have been provided in Table 3. While recognising the different nest box dimensions, the constructed nest boxes should also take a number of additional species-specific design considerations into account. For example, the thermoregulatory capabilities of the nest boxes should be considered, particularly for bats as this is considered to significantly influence roost use (Gibbons & Lindenmayer 2002). Several companies (e.g. Hollow Log Homes Pty Ltd and Nesting Boxes Australia) develop boxes targeted to specific fauna species. It is recommended that species-specific boxes be purchased with the dimensions in the table used as a guide only.

Furthermore, the design of the positioning and fastening mechanism should be sturdy and stable, and preferably resulting with the box having a slight forward lean to assist with drainage, whilst allowing for growth in the host tree. The preferred option for bracketing outlined in RMS (2011) is the Habisure system (Hollow Log Homes Pty Ltd). This system has the added advantage of allowing at least 1 metre of growth in the diameter of the host tree before adjustment is required, the mechanism is non-invasive to the tree and provides the required security.

5.3.3 Reducing competitive interactions

A number of pest species, both native and exotic, are known to utilise both natural hollows and nest boxes, potentially displacing microbat species. Pest species considered most likely to invade nest boxes, and therefore most relevant to this NBMP are outlined in Table 4, along with recommended measures to reduce nest box occupation by these unwanted species. During monitoring of the boxes, the ecologist will select the most appropriate measure/s for removal/deterrence of pest fauna. This may require the use of professional pest control personnel (e.g. for removal of bee hive or European Wasps), and/or the installation of a replacement box.

Table 4 Recommended measures to reduce invasion by introduced/pest species.

Potential invading species	Measures to prevent or discourage use
Ants	Talcum powder applied to the entrance and edges of the nest box to deter ants. Talcum powder sprinkled inside of the box incites ants to leave, and lanolin grease around the edges of the box prevents them from returning.

Potential invading species	Measures to prevent or discourage use
	Ring of grease around trunk of smooth-barked eucalypts encourages colony to leave the box.
	Open bottom prevents ant infestations in bat boxes.
Wasps	2 cm roost spacing discourages wasp infestations in bat boxes.
European Honeybee	Insecticide strip placed inside box kills bee colonies; however, this practice is hazardous.
	Lining the ceiling of nest box with carpet prior to installation may thwart attachment of wax comb to ceiling.
	A small box volume reduces incidents of hive building.
	Greasing the underside of the lid and top of the walls with marine grease or lanolin prevents bees from attaching honeycomb.
	2 cm roost spacing discourages bee infestations in bat boxes.

5.4 Nest box installation

The minimum number of 32 nest boxes required for the Project will be installed prior to the proposed clearing works. It is recommended that approximately 70 per cent of nest boxes be installed before the start of any clearing to provide alternative shelter for hollow-dependant fauna displaced during clearing.

The remainder of nest boxes would be installed once the actual abundance and density of tree hollows removed has been confirmed, and before completion of the project (RTA 2011). Alternative timing of nest box installation should be determined in consultation with the Project Ecologist.

Occupancy rates of tree hollows during the clearing supervision may also contribute to the final number and type of nest boxes being installed. The Project Ecologist will be responsible for determining whether adjustment to nest box numbers or types is required, based upon the hollows recorded during clearing supervision, and any fauna species utilising them.

A suitably qualified ecologist will provide advice on re-use of woody debris to ensure consistency with Guide 5: Re-use of woody debris and bushrock of the *Biodiversity Guidelines* (RTA 2011). The Project Ecologist should provide advice to ensure that there are no negative impacts on the receiving environment.

5.5 Nest box position

As a general rule, nest boxes should be installed on suitable sound trees (diameter breast height > 400 millimetre) close to, or on the main trunk. Where using the Habisure mounting system, boxes are ideally supported by a strong lower branch to prevent the boxes from slipping down the tree trunk. This requirement may be a limiting factor with regards to placement of nest boxes in suitable trees.

The following factors should also be taken into account by the Project Ecologist when considering the fine scale locations of nest boxes.

- The fine-scale position of the nest box on the host tree should be considered, specifically in the context of predominant weather patterns and light and noise disturbances arising from the Project and the urban landscape. It is proposed that nest boxes be installed with their entrances facing away from the lights of the traffic and from a north-west to south-easterly position on the tree trunk to

provide additional shelter from the rain and wind (i.e. dominant rain is from the south-east). However, alternative positions (entrance facing the trees, other vectors, etc.) will be considered if branches or any other access issues prevent the recommended alignment.

- It is recommended that nest boxes be placed high off the ground (i.e. at least 2 m) to protect the occupants from predation and low enough to allow for safe monitoring and maintenance. In the case of microbat boxes it is recommended that the boxes are placed 3 to 10 metres off the ground. Nest boxes should be installed by a specialist installation contractor with appropriate tree climbing certification (i.e. Arborist Tree Climbing Certificate and Work Safely at Heights certification). Monitoring and maintenance will also need to be undertaken by appropriately height-certified personnel (preferably ecologists) as required.

6 Nest box monitoring and maintenance

A monitoring and maintenance strategy has been developed to evaluate the effectiveness of the nest boxes. As such, it will be important to assign each nest box a number and ensure its location is recorded using a GPS.

6.1 Timing and frequency

It is proposed that an initial inspection of all installed nest boxes would take place post-installation to determine they have been installed in accordance with this plan. This inspection would be undertaken by the Project Ecologist and a brief report prepared to show that relevant conditions have been addressed.

Monitoring and maintenance will commence one year after nest boxes are installed. Bi-annual monitoring is recommended, to commence in the year following installation. A brief monitoring report will be provided after the completion of each monitoring survey. This report should outline the results of the monitoring and recommendations for maintenance or replacement.

The timing of monitoring and maintenance activities is outlined in Table 5. Further detail is provided below.

Table 5 Timing of NBMP actions

Management action	Timing				Responsibility	Documentation requirements
	Year 0	Monitoring – Year 1	Monitoring – Year 2	Monitoring – Year 3		
Prepare Nest Box Management Plan	✓				Biosis Pty Ltd	Construction Flora and Fauna Management Plan (CFFMP)
Construction of nest boxes	✓				Fulton Hogan	n/a
Install nest boxes	✓				Fulton Hogan	CFFMP and NBMP
Post-installation inspection	✓				Project Ecologist	Nest box post-installation report
Spring monitoring		✓	✓	✓	Project Ecologist	Bi-annual reporting provided to Fulton Hogan. May be audited by EPA (OEH).
Autumn monitoring		✓	✓	✓	Project Ecologist	As above
Maintenance of nest boxes		✓	✓	✓	Fulton Hogan	n/a

6.2 Nest box monitoring

The CFFMP specifies that monitoring of installed nest boxes will be undertaken as recommended in the NBMP. Twice a year monitoring will be required to determine the usage of nest boxes by the target species

and inform any maintenance requirements. Timing and frequency of nest box monitoring is provided in Table 5.

During each annual monitoring event, a visual inspection of each nest box will be conducted. The use of a camera on an extension pole is the preferred method because it minimises disturbance to resident animals and minimises safety issues. Other methods include using burrow scopes and an extension ladder to access the nest box (least preferred method) or via watching for bats exiting the nest box at dusk. If using a burrow scope, the entrance to the nest box should be blocked prior to inspection. Microbat nest boxes must not be opened as this can disturb bats.

The following data will be collected during each monitoring event:

- Inspection date and time.
- Weather conditions (i.e. rain, wind, cloud cover, ambient temperature).
- Nest box number and location.
- If the nest box is occupied, including:
 - Species.
 - Number of individuals.
 - Sex and age of individuals (if possible).
 - Breeding data (if possible).
- Signs of usage, (e.g. scats, feathers, fur etc.) and whether the species be identified or assigned to a group (i.e. bats, birds).
- Presence of a pest species (e.g. European Bees, ants, termites).
- Any deterioration of the nest box.
- Any maintenance required.
- Photographic records

It is assumed that nest boxes will be effectively utilised within the four year monitoring period. As bats do not make a nest, and faecal evidence falls out of the slot design boxes, it is difficult to know if bats are using the boxes unless there are individuals present at the time of monitoring.

During monitoring some maintenance considerations/actions could be undertaken.

6.3 Nest box maintenance

Nest box maintenance will be undertaken in accordance with the Guide 8: Nest Boxes of the *Biodiversity Guidelines* (RTA 2011). It is recommended that nest box maintenance should occur following the recommendations of the monitoring schedule (refer to Table 5). This allows for the monitoring activities to inform the level of maintenance that is required. Factors to be considered as part of the maintenance schedule include the following.

- The need to remove exotic pest species such as European Bees.
- Replacement of fallen, damaged or degraded nest boxes. The geographic co-ordinates of damaged boxes would need to be reported.
- Repositioning, re-erection or relocation of dysfunctional nest boxes.

- Checking that each box is not holding water or leaking.
- Removing excess nesting material, which may impede access over time.

6.4 Performance indicators and corrective actions

The performance of the nest box program will be assessed against the following parameters.

- Use of nest boxes by the species they were designed for.
- Low rates of exotic fauna using nest boxes.
- Low maintenance requirements.

Performance indicators and appropriate corrective actions are outlined below in Table 6.

Table 6 Nest box performance monitoring and corrective action plan.

Performance indicator	Corrective actions	Responsibility
Nest boxes are being used by a wide range of native fauna, including target species.	Review the location, type and number of nest boxes used. Install additional boxes or relocate boxes if deemed necessary.	Fulton Hogan is responsible for engaging suitably qualified ecologists to undertake the monitoring and suitably qualified contractors to undertake the maintenance
Greater than 20% occupation by exotic or invasive fauna.	Review/ change nest box design and/or placement on tree to exclude undesirable species where possible, treat if applicable or relocate those nest boxes to a suitable location determined in consultation with the Project Ecologist.	
A total of >5% of nest boxes requiring maintenance over a 4 year span	Identify causes of nest box failure, and maintain as required.	

Limitations will need to be considered in this regard. Only a few microbat species are known to readily use nest boxes, limiting the success of this method for mitigating impacts for microbats. Monitoring twice a year provides a very narrow window into the use of these boxes. Microbats are known to change roosts regularly and may not be present at the time of survey, despite using the boxes at other times.

6.5 Review of monitoring

This monitoring plan will be reviewed following completion of each annual monitoring period to review ongoing requirements for and scope of monitoring.

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Appendices

Appendix 1 Hollow-bearing tree inventory

Table A.1 Hollow-bearing tree data within and adjacent to the site

Tree number	Easting	Northing	Location	Habitat ID	Scientific name	Common name	Condition	Height (m)	Diameter at breast height (cm)	Hollow count	Estimated dimension of hollow entrance	Signs of fauna occupancy	Fauna suitability	Observer	Date
1	494573	6714373	Site	HT1	<i>Casuarina cunninghamiana</i>	River she-oak	High	10	50	TBC	TBC	None	Yes	JKD	2014
3	494115	6715312	Site	HT3	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	30.5	293	5	<50mm	None	Yes	AJR	19/07/2016
4	494117	6715293	Site	HT4	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	31	274	11	<149mm	None	Yes	AJR	19/07/2016
5	494152	6715267	Site	HT5	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	20	179	7	<149mm	None	Yes	AJR	19/07/2016
6	494169	6715254	Site	HT6	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	18.5	168	4	<50mm	None	Yes	AJR	19/07/2016
7	494183	6715265	Site	HT7	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	19.5	161	1	<50mm	None	Yes	AJR	19/07/2016
8	493718	6715005	Levee system	HT8	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	40	204	2	<50mm	None	Yes	AJR	19/07/2016
9	493770	6714321	Levee system - outside works area	HT9	<i>Cinnamomum camphora</i>	Camphor laurel	High	23	115	2	<50mm	None	Yes	AJR	19/07/2016
10	493756	6714328	Levee system - outside works area	HT10	<i>Cinnamomum camphora</i>	Camphor laurel	Medium	20	88	5	<149mm	None	Yes	AJR	19/07/2016
11	493749	6714332	Levee system - outside works area	HT11	<i>Cinnamomum camphora</i>	Camphor laurel	High	20	145	5	<149mm	None	Yes	AJR	19/07/2016
12	493759	6714335	Levee system - outside works area	HT12	<i>Cinnamomum camphora</i>	Camphor laurel	High	20	147	2	<149mm	None	Yes	AJR	19/07/2016
13	493944	6714286	Outside works area	HT13	<i>Harpullia pendula</i>	Tulipwood	High	12.5	60	1	<50mm	None	Yes	AJR	19/07/2016
14	493808	6714333	Levee system	HT14	<i>Cinnamomum camphora</i>	Camphor laurel	High	22	213	2	<50mm	None	Yes	AJR	19/07/2016
15	493597	6714384	Levee system - outside works area	HT15	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	18.5	156	1	<149mm	None	Yes	AJR	19/07/2016
16	492534	6714511	Levee system - outside works area	HT16	<i>Ficus macrophylla</i>	Moreton Bay Fig	High	20	200	1	<149mm	None	Yes	AJR	19/07/2016
17	492577	6714487	Levee system - outside works area	HT17	<i>Eucalyptus tereticornis</i>	Forest Red Gum	High		110	2	<149mm	None	Yes	AJR	19/07/2016

Annexure J: Not used.

Annexure K: Bat Management Plan



Additional Crossing of the Clarence River at Grafton Bat Management Plan

FINAL REPORT

Prepared for Fulton Hogan

17 August 2016

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1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by Fulton Hogan to review and prepare management plans for the Additional Crossing of the Clarence River at Grafton (the Project). This Bat Management Plan (BMP) forms Annexure K to the Construction Flora and Fauna Management Plan (CFFMP), which forms part of the Construction Environmental Management Plan (CEMP) for the construction of the Project.

The Project involves the construction of a new bridge parallel to the existing bridge across the Clarence River, located in the city of Grafton in northern NSW, approximately 600 kilometres north-east of the Sydney CBD (Figure 1).

The main components of the Project are:

- Construction of a new bridge over the Clarence River approximately 70 metres downstream (east) of the existing road and rail bridge, comprising two traffic lanes.
- Construction of a new road to link the new bridge with Iolanthe Street in South Grafton.
- Construction of a new road to link the new bridge with Pound Street in Grafton.
- An approach viaduct, about 64 metres long, on the South Grafton side of the Clarence River and 29 metres long on the Grafton side.
- Upgrades to the road network in South Grafton to connect the new bridge to the existing road network.
- Upgrades to the road network in Grafton to connect the new bridge to the existing road network.
- Replacement of the existing three span concrete arch rail viaduct which crosses Pound Street in Grafton with a single span steel truss bridge.
- Construction of a pedestrian and cycle path to provide connectivity between Grafton, South Grafton and the new bridge.
- Provision of two signalised pedestrian crossings in South Grafton to improve safety for pedestrians crossing Iolanthe Street and Gwydir Highway.
- Construction of new pedestrian links to connect the new bridge with the existing bridge.
- Provision of designated car park spaces in Pound Street and Clarence Street, including some off street parking, to maintain a similar number of existing car park spaces currently available in those two streets.
- Flood mitigation works, which include raising the height of sections of the existing levee upstream from the new bridge in Grafton and South Grafton.
- Construction of a stormwater detention basin and pump station in Grafton to manage local flooding.
- Public utilities adjustment.
- Ancillary facilities required for the construction of the project, including some or all of the following: site compounds, concrete batching plant, pre-cast facilities, and stockpile areas for materials and temporary storage of spoil and mulch.

The Project was approved by the Minister for Planning in 19 December 2014.

This BMP has been prepared to address the requirements of the Ministers Conditions of Approval (CoA) dated 19 December 2014, the Revised Environmental Management Measures (REMM) contained in the *Additional Crossing of the Clarence River at Grafton: Submissions Report* (RMS 2014), the *Additional Crossing of the Clarence River at Grafton: Appendix L – Technical Paper: Flora and fauna assessment* (Biosis 2014) and all applicable legislation.

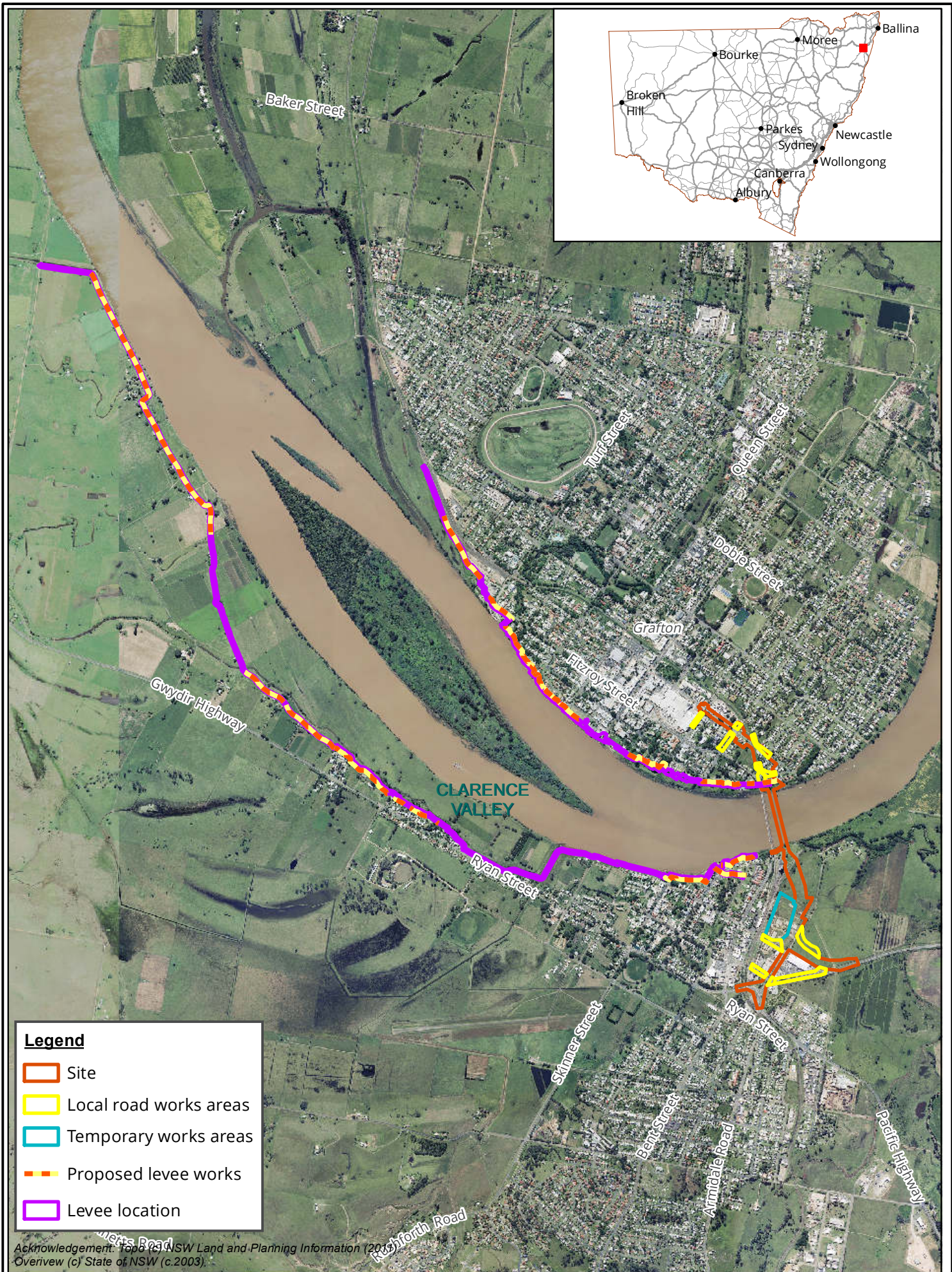
The BMP outlines specific mitigation measures prescribed in documents listed above and the CFFMP. The mitigation measures were developed with the aim to reduce impacts on microbats and the Grey-headed Flying-fox *Pteropus poliocephalus* associated with the Project to the greatest extent practicable. This plan has been developed in consultation with the Environment Protection Authority (EPA) Pacific Highway Upgrade Team and the NSW Roads and Maritime Services (Roads and Maritime), as part of the CFFMP consultation process. It is noted that the EPA Pacific Highway Upgrade Team is responsible for delivering both environment protection and biodiversity management services to the Project.

This BMP has been prepared and reviewed by qualified and licenced zoologists (Amy Rowles, Nathan Garvey and Jane Raithby-Veall) of Biosis.

1.2 Objectives of the management plan

The objectives of the Bat Management Plan are to:

- Identify habitat for threatened and non-threatened bats within the Approved Construction Footprint.
- Summarise the potential impacts on bats resulting from the Project.
- Recommend appropriate management strategies to avoid, mitigate or compensate for Project impacts on bats and/or bat habitat.




Legend

-  Site
-  Local road works areas
-  Temporary works areas
-  Proposed levee works
-  Levee location

Acknowledgement: Topographic NSW Land and Planning Information (2015)
 Overview (c) State of NSW (c.2003).

Figure 1: Location of the Approved Construction Footprint, NSW

Matter: 22681
 Date: 25 July 2016,
 Checked by: NMG, Drawn by: JMS, Last edited by: jshepherd
 Location: P:\22600s\22681\Mapping\

0 300 600 900 1,200

 Metres
 Scale 1:30,000 @ A4, GDA1994 MGA Zone 56



2 Existing conditions

2.1 Literature and database review

In order to provide a context for the Project area, information about bats recorded from within 5 kilometres of the Project (the 'locality') was obtained from the following public databases and documents was reviewed:

- NSW BioNet: The database for the Atlas of NSW Wildlife © The State of New South Wales, Office of Environment and Heritage (OEH), for threatened flora, fauna populations and ecological communities (biota) protected by the *Threatened Species Conservation Act 1995* (TSC Act), accessed 29 June 2016.
- Protected Matters Search Tool of the Australian Government Department of the Environment (DoE) for matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), accessed 29 June 2016.
- Additional Crossing of the Clarence River at Grafton: Appendix L – Technical Paper: Flora and fauna assessment (Biosis 2014).
- Flora and Fauna Management Sub Plan: Additional Crossing of the Clarence River at Grafton (RMS 2016).

Desktop assessment indicates that 21 bat species have previously been recorded are predicted to occur in the locality of the Project, including ten threatened species. Table 1 lists the bat species that were returned during database searches.

Table 1 Bat species returned during database searches

Common Name	Scientific Name	Conservation status	
		EPBC Act	TSC Act
Black Flying-fox	<i>Pteropus alecto</i>	-	-
Central-eastern Broad-nosed Bat (undescribed)	<i>Scotorepens sp. undescribed</i>	-	-
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	-	V
Eastern Broad-nosed Bat	<i>Scotorepens orion</i>	-	-
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	-	V
Eastern Freetail-bat	<i>Mormopterus norfolkensis</i>	-	V
Eastern Free-tailed Bat	<i>Mormopterus ridei</i>	-	-
Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>	-	-
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	-	-
Greater Broad-nosed Bat	<i>Scoteanax rueppillii</i>	-	V
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	-	V
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	V	V
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	-	-

Common Name	Scientific Name	Conservation status	
		EPBC Act	TSC Act
Little Bentwing-bat	<i>Miniopterus australis</i>	-	V
Little Forest Bat	<i>Vespadelus vulturnus</i>	-	-
Little Red Flying-fox	<i>Pteropus scapulatus</i>	-	-
Southern Forest Bat	<i>Vespadelus regulus</i>	-	-
Southern Myotis	<i>Myotis macropus</i>	-	V
White-striped Freetail-bat	<i>Austronomus australis</i>	-	-
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	-	V

2.2 Survey methods

Biosis staff conducted site investigations and surveys of the Project area at various intervals between August 2010 and December 2013 to support the Environmental Impact Statement (EIS). The investigation included an assessment of habitat present for bats (Biosis 2014).

Targeted microbat surveys were undertaken using a combination of passive Anabat surveys, active Echometer transects, harp trapping and passive observations for flying-foxes.

Passive Anabat surveys were conducted at four locations between 9 and 11 August 2010 (four Anabats within the Project area for one night each) and at three locations between 2 and 3 October 2013 (three Anabats within the Project area for two nights each). Detectors were placed in areas of potential habitat, such as at the base of the existing bridge, likely flyways in scarce remnant woodland patches and near water within the Project area.

An active Echometer transect was undertaken during the 2–3 October 2013 field survey. This involved one ecologist walking along Bent, Fitzroy and Villiers streets in Grafton.

Harp trapping was undertaken during the 2–3 October 2013 field survey effort. Two harp traps were set for two consecutive nights at a site in South Grafton at the one area which represented the only suitable flyways within a remnant woodland patch. Harp trapping was undertaken to target species that are considered difficult to identify through Anabat analysis, or could not be accurately identified further than genus (i.e. *Nyctophilus* spp.).

Passive observations of flying foxes were performed at dusk between 9–11 August 2010, 7–8 February 2012 and 2–3 October 2013. This involved two ecologists observing the flight path of flying-foxes from Susan Island, and collecting abundance data. These observational surveys targeted the threatened Grey-headed Flying-fox.

2.3 Bat habitat features within the Project area

The following potential bat habitat features exist within the Project area:

- The existing bridge across the Clarence River is likely to provide roosting opportunities for several microbats, particularly the Southern Myotis, the Eastern Bentwing-bat and Little Bentwing-bat.
- Potential microbat roost habitat in the existing three span concrete arch rail viaduct which crosses Pound Street in Grafton.

- Suitable artificial roost habitat for the cave-dwelling microbats exists in existing residential dwellings located within the proposed construction compound.
- Road culverts within the Project area may provide artificial roost habitat for the cave-dwelling microbats.
- Five Moreton Bay Figs *Ficus macrophylla* provide good quality habitat and foraging resources for the Grey-headed Flying-fox. Small crevices and fissures in these Figs also provide roosting habitat for microbats (see Table 2).
- Roosting habitat for microbats was identified in an additional two trees; one hollow-bearing Eucalyptus species and one hollow-bearing River She-oak (see Table 2).

A total of eight hollow-bearing trees and would be removed as part of the Project. The number of hollows is difficult to ascertain in the Moreton Bay Fig trees, although it is estimated to be a significantly higher number than in Eucalyptus and River She-Oak based on the growth and mature nature of these trees. Further detail on the habitat features in these trees is provided in Table 2.

Table 2 Hollow-bearing / habitat trees to be removed

Tree number	Species	Feature	Description	Location
1	River She-oak <i>Casuarina cunninghamiana</i>	Hollows in branches and fissures	Multiple hollows suitable for small microbats.	Site
3-7	Moreton Bay Fig <i>Ficus macrophylla</i>	Foraging resources and numerous fissures	These five mature Moreton Bay Figs provide significant habitat for avifauna (i.e. bird and bat species), in terms of: <ul style="list-style-type: none"> • Microbat roosting habitat within fissures and crevices • Foraging resources for Grey-headed Flying-fox <i>Pteropus poliocephalus</i>. 	Site
8	Moreton Bay Fig <i>Ficus macrophylla</i>	Foraging resources and numerous fissures	This mature Moreton Bay Fig provides significant habitat for avifauna (i.e. bird and bat species), in terms of: <ul style="list-style-type: none"> • Microbat roosting habitat within fissures and crevices • Foraging resources for Grey-headed Flying-fox. 	Levee system
14	Camphor Laurel <i>Cinnamomum camphora</i>	Hollows in branches and fissures	Two small hollows potentially suitable for microbat roosts.	Levee system

Recent examination of a Forest Red Gum *Eucalyptus tereticornis* (habitat tree number HT2) during hollow-bearing tree surveys determined that the small hollows observed during survey undertaken for the Environmental Impact Assessment (Biosis 2014) were no longer present. The hollows previously observed

were the result of insect activity and recent regrowth of bark had reduced their size and habitat suitability. Therefore, this tree was not included in Table 2.

2.4 Bat species recorded in the Project study area

Eight threatened bat species were recorded in the Project study area and an additional two threatened bat species were considered to have a medium likelihood of occurrence within the Project study area during field surveys informing the Environmental Impact Assessment (Biosis 2014). Nine non-threatened bat species were recorded within the Project study area (Biosis 2014).

Table 3 lists the species that were recorded in the Project study area as well as threatened species identified as having potential to occur within the Project area.

Table 3 Bat species recorded in the locality of the Project

Common Name	Scientific Name	EPBC Act	TSC Act	Comments in relevant documents
Threatened Bats				
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	-	V	Recorded in the Project study area (Biosis 2014)
Little Bentwing-bat	<i>Miniopterus australis</i>	-	V	Recorded in the Project study area (Biosis 2014)
Eastern Bentwing-bat	<i>Miniopterus schreibersii oceanensis</i>	-	V	Recorded in the Project study area (Biosis 2014)
East Coast Freetail-bat	<i>Mormopterus norfolkensis</i>	-	V	Recorded in the Project study area (Biosis 2014)
Southern Myotis	<i>Myotis macropus</i>	-	V	Recorded in the Project study area (Biosis 2014)
Eastern Long-eared Bat	<i>Nyctophilus bifax</i>	-	V	Previously recorded in the locality (Bionet 2016). Considered a medium likelihood of occurrence (Biosis 2014).
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	Recorded in the Project study area (Biosis 2014)
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	-	V	Previously recorded in the locality (Bionet 2016). Considered a medium likelihood of occurrence (Biosis 2014).
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	-	V	Recorded in the Project study area (Biosis 2014)
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	-	V	Recorded in the Project study area (Biosis 2014)
Non-threatened Bats				
White-striped Freetail-bat	<i>Austronomus australis</i>	-	-	Recorded in the Project study area (Biosis 2014)

Common Name	Scientific Name	EPBC Act	TSC Act	Comments in relevant documents
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	-	-	Recorded in the Project study area (Biosis 2014)
Eastern Free-tailed Bat	<i>Mormopterus ridei</i>	-	-	Recorded in the Project study area (Biosis 2014)
Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>	-	-	<i>Nyctophilus</i> sp. recorded in the Project study area (Biosis 2014)
Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>	-	-	<i>Nyctophilus</i> sp. recorded in the Project study area (Biosis 2014)
Eastern Broad-nosed Bat	<i>Scotorepens orion</i>	-	-	<i>Scotorepens</i> sp. recorded in the Project study area (Biosis 2014)
Central-eastern Broad-nosed Bat (undescribed)	<i>Scotorepens</i> sp. <i>undescribed</i>	-	-	Recorded in the Project study area (Biosis 2014)
Southern Forest Bat	<i>Vespadelus regulus</i>	-	-	Recorded in the Project study area (Biosis 2014)
Little Forest Bat	<i>Vespadelus vulturinus</i>	-	-	Recorded in the Project study area (Biosis 2014)

3 Impacts and management strategies

3.1 Impacts

Table 4 below outlines the potential impacts resulting from the Project to each of the bat habitat features present within the Project area.

Table 4 Project impacts on bat habitat features

Bat habitat feature	Proposed impact
Eight hollow-bearing and habitat trees to be removed	The removal of hollow-bearing and habitat trees within the Project area, including; a River She-oak, a Camphor Laurel and six large Moreton Bay Fig trees, trees considered likely to provide potential roosting and foraging resources for bat species.
Demolition of residential dwellings and associated structures	The demolition of residential dwellings within the indicative ancillary sites providing potential roosting resources for threatened microbats.
Demolition of concrete viaduct and road culverts	The demolition of these structures may result in loss of habitat as well as injury or death to any present microbats during the time of demolition.

3.2 Management strategies

The *Additional Crossing of the Clarence River at Grafton: Submissions Report* (Roads and Maritime Services 2014), recommends a number of Revised Environmental Management Measures (REMMs) relevant to bats. These are outlined in Table 5.

Table 5 REMMs relevant to bats

No.	Environmental management measure	Timing/Mechanism
B1	Disturbance and clearing of native vegetation will be minimised, particularly avoiding and minimising vegetation removal wherever possible through the detailed design process. Detailed design will investigate opportunities to retain the two hollow-bearing and five habitat trees identified within the Project area. A Vegetation Management Plan will be developed as part of the flora and fauna management sub plan to revegetate with species suitable for the creation of hollows and foraging resources. Strategies to compensate for the loss of hollow-bearing/habitat trees will focus on revegetation and rehabilitation activities along riparian and adjoining areas.	Detailed Design UDLMP – Permanent Revegetation Strategy
B2	As part of the flora and fauna management sub plan, a Vegetation Management Plan will be developed to provide specific details for the re-establishment of native vegetation on areas disturbed by the Project construction. This plan will be developed in accordance with Roads and Maritime Biodiversity Guidelines (RTA, 2011) and the design principles identified in Appendix L, Technical Paper: Flora and Fauna Assessment of the EIS. It will also include details for the regeneration and rehabilitation of areas with a focus on riparian areas within the	Detailed Design UDLMP – Permanent Revegetation Strategy

No.	Environmental management measure	Timing/Mechanism
	<p>Project area with reference to Guide 3, Guide 6 and Guide 10 of the Roads and Maritime Biodiversity Guidelines.</p> <p>The plan will include objectives to incorporate local native species across all revegetation and landscaping efforts along the Clarence River and in the adjoining Project area. This will include species consistent with freshwater wetlands on coastal floodplain and sub-tropical coastal floodplain forest endangered ecological communities species composition, which could potentially provide foraging resources and roosting to threatened fauna species, and increase corridors and connectivity throughout the landscape. This plan will be developed in consultation with EPA.</p>	
B4	<p>A flora and fauna management sub plan (FFMSP) will be prepared as part of the construction environmental management plan before construction in accordance with Biodiversity Guidelines – Protecting and Managing Biodiversity on RTA Projects (Roads and Maritime, 2011).</p> <p>The FFMSP will detail how impacts on biodiversity will be minimised and managed during construction and operation and will incorporate specific management measures identified in the EIS.</p> <p>Measures outlined in this table will be addressed within the flora and fauna management plan, including timeframes for implementation and monitoring to be developed post-EIS and Project approval.</p>	Pre-construction CFFMP
B5	<p>To minimise the impacts of vegetation clearing and habitat loss the following specific measures will be implemented:</p> <ul style="list-style-type: none"> • Clearing of vegetation will be carried out in accordance with Guide 1 Pre-clearing Process of Biodiversity Guidelines (RTA, 2011). These guidelines cover the felling of both non-habitat and habitat trees and the rescue and relocation of fauna. • The pre-clearing process will be consistent with Guide 2 Exclusion zones of Biodiversity Guidelines (RTA, 2011) and include: pre-clearing surveys by an experienced/qualified ecologist and mapping and delineating the boundaries of threatened flora and/or fauna species, endangered ecological communities and/or suitable habitat (hollow-bearing/habitat trees). • Construction traffic will be restricted to defined access tracks and construction works zone areas. • The location of exclusion zones will be identified, with temporary fencing or flagging tape to indicate the limits of clearing (in accordance with the Roads and Maritime Biodiversity Guidelines (RTA, 2011)). • All relevant staff will be inducted and informed of the limits of vegetation clearing and the areas of vegetation to be retained. 	Construction CFFMP
B8	<p>Where practical, vegetation removal (especially of the two hollow-bearing and five habitat trees identified) will occur outside the main fauna breeding season (August to February) to avoid potential breeding disturbance to fauna, particularly avifauna (birds and bats).</p> <p>Pruning or lopping tree limbs will be conducted in preference to tree removal wherever possible.</p>	Pre-construction CFFMP

No.	Environmental management measure	Timing/Mechanism
	<p>An appropriate tree removal procedure will be adopted. It will require the presence of a qualified ecologist or wildlife expert experienced in the rescue of fauna as detailed in RMS Biodiversity Guidelines -Guide 4: Clearing of vegetation and removal of bush rock including the staged removal process (2011).</p> <p>Woody debris and habitat trees removed for the Project will be managed in accordance with RMS Biodiversity Guidelines - Guide 5: Re-use of woody debris and bush rock (2011).</p> <p>Fauna handling during vegetation removal will be carried out by a licensed fauna ecologist or wildlife carer, as detailed in RMS Biodiversity Guidelines Guide 9: Fauna handling (2011).</p>	
B9	<p>Threatened species guidelines will be developed for threatened flora and fauna likely to occur directly within the Project area and which may be impacted during construction, in order to show and educate construction workers of its appearance and outline what should be done if the species is found during construction. Relevant species will include:</p> <ul style="list-style-type: none"> • Grey-headed Flying-fox. • Microbats. 	Pre-construction CFFMP – Annexure M
B10	<p>If unexpected threatened fauna or flora species are discovered, works will stop immediately and the Unexpected Threatened Species Find Procedure RTA (2011a) as well as the Biodiversity Guidelines Guide 1: Pre-clearing process (Roads and Maritime, 2011) will be followed. This procedure will be included in the CFFMP developed for the Project.</p>	Pre-construction and Construction CFFMP
B11	<p>Nest boxes and bat roost structures will be installed in accordance with the principles outlined in the Roads and Maritime Guide 8 Nest Boxes (2011). Details of the number and type of nest boxes will be included in the CFFMP prepared for the Project, and will include the following details:</p> <ul style="list-style-type: none"> • The number and type of nest boxes required based on the number, quality and size of the hollows that will be removed • Specifications for nest box dimensions, installation requirements, locations of nest boxes and ongoing monitoring and maintenance • Installation timeframes, including the installation of 70% of nest boxes before the removal of any vegetation • Staged habitat removal, including removal of secondary or less preferential roosting habitat before removal of primary habitat, such as hollow-bearing trees and houses. • Pre-demolition inspection and exclusion measures to prevent continued use of roosts. These will be prepared to address the subject species, specific habitat, roosting habits at each location, and capture and handling procedures (if required). 	Pre-construction Nest Box Management Plan – Annexure I in the CFFMP)

Drawing on the recommendations from the Flora and Fauna Assessment (Biosis 2014), the REMMs, the CFFMP and the CoAs the following management strategies are provided for each of the bat habitat features present within the Approved Construction Footprint.

3.2.1 Demolition of buildings

The demolition of residential dwellings within the indicative ancillary sites that may provide potential roosting resources for threatened microbats. Table 6 outlines appropriate management strategies for this habitat.

Table 6 Recommended management strategies for building and structure removal

Management strategy	Recommendation
Surveys	Diurnal pre-clearing inspection of buildings/structures should be conducted prior to demolition. This is anticipated to occur in September.
Exclusion measures	If microbats are present, or suitable roosting habitat is identified, exclusion measures should be considered in consultation with an ecologist. These should be put in place during September pre-clearing surveys where possible.
Protocols	If microbats are present or the structure could not be thoroughly investigated, but deemed to provide suitable habitat the following should apply: <ul style="list-style-type: none"> For buildings with a roof cavity, all roofing materials should be carefully removed to effectively open up these buildings and let in light. These buildings should be left standing with roof removed for at least one night prior to demolition to allow roosting microbats to vacate. It is recommended that an ecologist should be present during demolition of disused buildings that provide microbat roosting habitat within the Project area to ensure that no microbats are harmed. Works should cease if fauna are located within buildings during demolition, until an ecologist can verify that works can re-commence. Refer to the Fauna Handling and Rescue Procedure contained in the CFFMP for the steps to be taken if bats require handling or rescue.
Timing	A diurnal pre-clearing inspection of buildings/structures should be conducted prior to demolition. This is anticipated to occur in September.
Artificial roost habitat	None recommended
Monitoring	None recommended

3.2.2 Demolition of concrete viaduct and culverts

The demolition of the concrete viaduct and any road culverts that may provide roosting resources for threatened microbats. Table 6 outlines appropriate management strategies for this habitat.

Table 7 Recommended management strategies for removal of concrete viaduct and culverts

Management strategy	Recommendation
Surveys	<p>Diurnal pre-clearing inspection of the concrete viaduct and any road culverts that may provide roosting habitat will be conducted prior to any impacts occurring. Diurnal pre-clearing inspections will include:</p> <ul style="list-style-type: none"> • Inspection by an ecologist experienced in microbat species identification and management. • Inspection of all possible roosting locations (e.g. joins in the drain) using a light and / or small USB inspection camera. • The locations of any roost sites will be recorded as a distance from culvert entrance, with species observed identified (if possible) and approximate numbers noted. • Undertake a standard monitoring event using ultrasonic bat detectors to determine activity levels. Standard monitoring event to include: <ul style="list-style-type: none"> - Bat detectors will be set at exit points from culverts and in the vicinity of the viaduct. - Bat detectors will be set to record from 30 minutes prior to sunset until two hours after sunset. • Bat detectors will be collected, bat calls identified and reported.
Exclusion measures	<p>If microbats are present, or suitable roosting habitat is identified, exclusion measures should be considered in consultation with an ecologist experienced in microbat species identification and management. These should be put in place during September pre-clearing surveys where possible.</p>
Protocols	<p>If microbats are present and unable to be excluded or the structure could not be thoroughly investigated, but deemed to provide suitable habitat the following should apply:</p> <ul style="list-style-type: none"> • It is recommended that an ecologist be present during demolition of the structures that provide microbat roosting habitat within the Project area to ensure that no microbats are harmed. • Works should cease if fauna are located within structures during demolition, until an ecologist can verify that works can re-commence. Refer to the Fauna Handling and Rescue Procedure contained in the CFFMP for the steps to be taken if bats require handling or rescue.
Timing	<p>A diurnal pre-clearing inspection of the concrete viaduct and any road culverts that may provide roosting habitat should be conducted prior to demolition. This is anticipated to occur in September.</p>
Artificial roost habitat	None recommended
Monitoring	None recommended

3.2.3 Hollow-bearing trees and microbat foraging habitat

Recommended management strategies for clearance of hollow-bearing trees and microbat forage habitat (habitat values) in order to minimise injury and mortality to tree-roosting microbats during vegetation clearing activities is outlined in Table 8. Additionally, removal of hollow-bearing trees is addressed in the Nest Box Management Plan (NBMP) for the Project, with the installation of nest boxes being recommended to offset the loss of tree hollows.

Table 8 Recommended management strategies for clearance of hollow-bearing trees and forage habitat

Management strategy	Recommendation
Surveys	Pre-clearing inspection should be undertaken prior to clearing.
Exclusion measures	If microbats are present, exclusion measures should be considered in consultation with an ecologist experienced in microbat species identification and management.
Protocols	Clearing protocols are specified in the CFFMP and will be undertaken in accordance with Guide 1 Pre-clearing Process of Biodiversity Guidelines (RTA 2011) and pre-clearing process will be consistent with Guide 2 Exclusion zones of Biodiversity Guidelines (RTA 2011). Protocols for managing hollow-dependent fauna are specified in the CFFMP.
Timing	A pre-clearing inspection of hollow-bearing trees should be conducted prior to clearing.
Artificial roost habitat	Nest boxes will be installed (as per the NBMP) to offset impacts on hollow-roosting microbats and other fauna species dependent on this resources.
Monitoring	Monitoring of nest boxes will be outlined in the NBMP for the Project.

4 Conclusion

The Flora and Fauna Assessment (Biosis 2014) has identified the potential for Project impacts on bat species, including a number of threatened microbats and the Grey-headed Flying-fox which are known or predicted to occur. The following microbat habitat features are located within the Project area:

- Buildings and man-made structures.
- Hollow-bearing trees.
- Native vegetation providing forage habitat for microbats and Flying-foxes.

Desktop assessment, literature review and field investigations conducted by Biosis in 2010-2013, confirmed the values of microbat habitat present within the Project area. Targeted microbat surveys resulted in 17 species being recorded in the broader Project study area, eight of which are listed threatened species. These species included both tree-dwelling and cave and man-made structure dwelling microbats and the Grey-headed Flying-fox.

Construction for the Project will require complete removal of a range of buildings and structures and eight hollow-bearing trees. To mitigate these impacts on bats the following management strategies are recommended:

- Complete demolition of buildings, viaduct and culverts as per management strategies outlined in Section 3.2. These include pre-clearing inspection prior to demolition, exclusion where possible and having an ecologist present during demolition to minimise impacts on bat species where bats are known to occur or suitable habitat is present.
- Staged habitat removal and pre-clearing surveys and clearing supervision of the eight hollow-bearing trees as recommended in the CFFMP for the Project.
- Provide nest boxes (as per the Project Nest Box Management Plan) to offset the loss of roost habitat for hollow-dependent microbats.

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**Annexure L: Three-Toed Snake Tooth Skink
Construction Management Plan**



ADDITIONAL CROSSING OF THE CLARENCE RIVER
AT GRAFTON: THREE-TOED SNAKE TOOTH SKINK
(*Saiphos reticulatus*) CONSTRUCTION MANAGEMENT PLAN

May 2016



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Abbreviations & Glossary of Terms

Abbreviation	Description
APO	Affected Property Owner
CEMP	Construction Environmental Management Plan
CVC	Clarence Valley Council
DPI	Department of Primary Industries
DoE	Department of Environment
EA	Environmental Adviser
EIS	Environmental Impact Statement
EM	Environmental Manager
EPA	Environmental Protection Authority
ER	Environmental Representative
FFMP	Flora and Fauna Management Plan
GIS	Geographic Information Systems
LES	Lewis Ecological Surveys Pty Ltd
LLS	Local Land Services (formerly LHPA)
NES	National Environmental Significance
PoM	Plan of Management
RMS	Roads and Maritime
SSI	State Significant Infrastructure
OEH	Office of Environment and Heritage
Threatened	Species listed on either the NSW Threatened Species Conservation Act (1995) and/or Commonwealth Environmental Protection and Biodiversity Conservation Act (1999).
TTSTS	Three-toed Snake Tooth Skink (<i>Saiphos reticulatus</i>)
Endangered	Species listed as endangered under schedule two of the NSW <i>Threatened Species Conservation Act</i> (1995) and Commonwealth <i>Environmental Protection and Biodiversity Conservation Act</i> (1999).
Vulnerable	Species listed as vulnerable under schedule two of the NSW <i>Threatened Species Conservation Act</i> (1995) and Commonwealth <i>Environmental Protection and Biodiversity Conservation Act</i> (1999).

1.0 INTRODUCTION

1.1 Purpose and Scope

Roads and Maritime Services (Roads and Maritime) has obtained approval for the construction of a new bridge over the Clarence River at Grafton on the NSW North Coast. The project involves the construction of a road bridge across the Clarence River, approximately 70 metres downstream of the existing road and rail bridge and upgrading parts of the road network in Grafton and South Grafton to connect the new bridge to the existing road network (see Section 1.3). This will also require the replacement of the rail viaduct where it crosses Pound Street in Grafton and the provisioning of a pedestrian and cycle path and signalised pedestrian crossings. More details are provided in Section 1-3 or alternatively, <http://www.rms.nsw.gov.au/projects/northern-nsw/grafton-clarence-river-crossing/environmental-impact>.

The Project is needed to address short-term and long-term transport needs within Grafton and South Grafton. The primary drivers of the Project are to:

- Relieve current and future traffic congestion across the existing bridge;
- Provide greater accessibility (measured in terms of travel time and reliability) for the journey to work, other private travel, freight and commercial activities; and
- Enhance road safety for all road users over the length of the Project.

The Projects approval was granted under Part 5.1 of the *Environmental Planning and Assessment Act* (1979) on the 19th December 2014. This approval was based on the Environmental Impact Statement (EIS) and was designated the status of State Significant Infrastructure (SSI) with a number of conditions, one of these being Ministers Condition of Approval (MCoA) Biodiversity B3 *“The Proponent shall undertake flora and fauna surveys of those parts of the project area previously not surveyed, due to accessibility issues, prior to the commencement of construction that affects those areas.....”*. Consequently, the Roads and Maritime engaged Lewis Ecological Surveys (Contract Identifier – 13.2544.0917-0018) on the 11th December 2015 to implement a biodiversity gap survey focusing initially on desktop surveys (Stage 1 works) and if required, field surveys (Stage 2 works) at those previously unsurveyed locations due to access constraints.

Field surveys conducted as part of stage 2 works in February 2016 resulted in the capture of two Three-toed Snake Tooth Skinks (*Saiphos reticulatus*, hereafter TTSTS) with another unconfirmed sighting from a nearby property (Lewis 2016). All records were concentrated to an area on the northern bank of the Clarence River between ch.1370-1500 in an area locally referred to as Dovedale. This provided confirmation to the Roads and Maritime that a TTSTS population occurred within an area of proposed construction works and in order to manage this new threatened species finding, the following management plan has been prepared to minimise impacts during construction.

1.2 Construction Environmental Management Plan – Framework

The Construction Environmental Management Plan (CEMP) framework is outlined below in Figure 1-1.

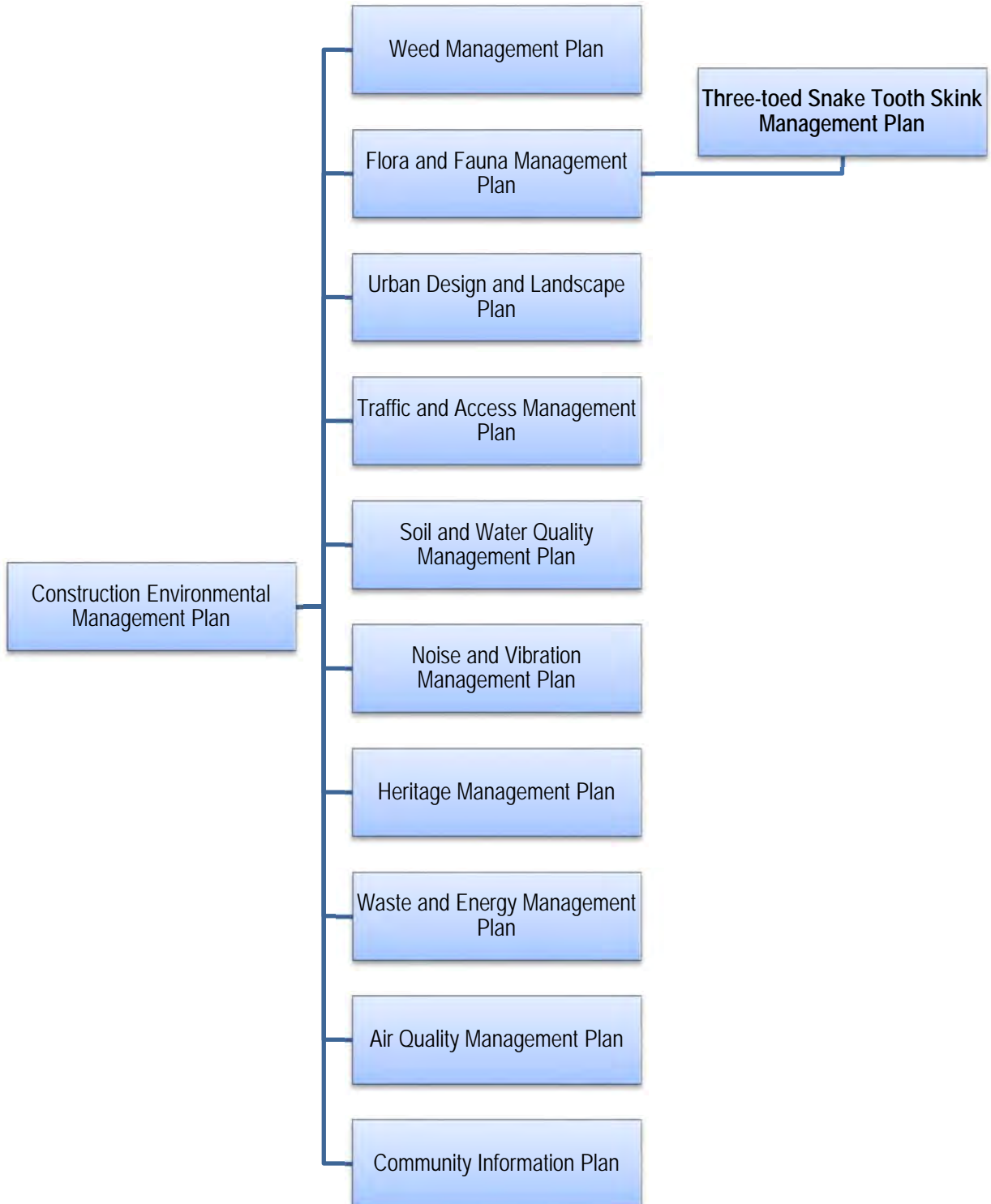


Figure 1-1. Construction Environmental Management Plan framework.

1.3 Construction Scope

The Project involves:

- Construction of a new bridge over the Clarence River about 70 metres downstream of the existing road and rail bridge (which is to be retained);
- Upgrades to parts of the road network in Grafton and South Grafton to connect the new bridge to the existing road network, including:
 - Widening Iolanthe Street to four lanes;
 - Widening the Gwydir Highway to four lanes between Bent Street and the Pacific Highway;
 - Realigning the existing Pacific Highway to join Iolanthe Street near Through Street;
 - Providing a new roundabout at the intersection of the Pacific Highway and Gwydir Highway;
 - Providing a new roundabout at the intersection of Through Street and Iolanthe Street;
 - Limiting Spring Street and the Old Pacific Highway to left in and left out only where they meet Iolanthe Street;
 - Realigning Butters Lane;
 - Widening Pound Street to four lanes between Villiers Street and the approach to the new bridge;
 - Providing traffic signals at the intersection at Pound Street and Clarence Street;
 - Closing Kent Street where it is crossed by the bridge approach road;
 - Realigning and lowering Greaves Street beneath the new bridge;
 - Realigning Bridge Street to join directly to the southern part of Pound Street (east of the new bridge approach). There would be no direct connection between Pound Street south and the new bridge approach;
 - Widening Clarence Street to provide formal car park spaces; and
 - Minor modifications to the existing Dobie Street and Villiers Street roundabout.
- The existing rail viaduct section across Pound Street would be replaced with a new bridge structure to provide sufficient vertical clearance for the upgrade of Pound Street;
- Construction of a pedestrian and cycle path and signalised pedestrian crossings for access to and across the new bridge and throughout Grafton and South Grafton;
- Flood mitigation works, which includes raising the height of sections of the existing levee upstream of the existing bridge in Grafton and South Grafton; and
- Ancillary works such as public utility adjustments, construction compounds and stockpile areas and water management measures.

1.4 Site Overview

1.4.1 Location and Environment

The Project is located at Grafton in the Clarence Valley local government area, on the NSW North Coast approximately 610 kilometres north of Sydney. Grafton is located on the northern and southern banks of the Clarence River, about 37 kilometres inland from the coast and experiences a humid subtropical climate with significantly more rainfall and higher temperatures in summer than in winter.

Grafton is a major regional centre within the North Coast Region and is a focal point for regional road, river and other transport networks. It is also the focus of higher order services to the Clarence Valley subregion such as a major hospital, regional airport, state government offices, sports and entertainment venues, retail shopping centres and livestock selling centre among other services.

The majority of the Project area is represented by a highly modified landscape in poor condition with little or no native vegetation remaining (Biosis 2011; Biosis 2012). These areas have been subject to historic and ongoing urbanisation, grazing and cropping which has led to the isolated and fragmented nature of remnant vegetation. The Project area totals 49.70 hectares (ha), of which 36.07 ha comprises vegetation and the remaining hard stand, buildings and infrastructure. The vegetation includes 31.25 ha of weeds and exotics, 4.41 ha of native and exotic plantings and 0.41 ha of poor condition threatened ecological communities (Biosis 2014). This vegetation is generally in low condition in a cleared and highly modified urban and rural environment.

The Clarence River and adjacent tributaries are classified as CLASS 1 waterways, which within and adjacent to the alignment contains TYPE 2 moderately sensitive key fish habitat as it provides riverine brackish wetland habitats, and has a stable vegetated substrate. The Clarence River Estuary is listed as a nationally important wetland in the Directory of Important Wetlands in Australia (Biosis 2014).

1.5 Project conditions and management measures applicable to TTSTS

The most relevant Project conditions and how the management actions proposed in this management plan relate to each condition is summarised in Table 1-1.

Table 1-1. Compliance summary of all conditions of approval and statements of commitments.

Source	Condition	Details of Compliance
Additional Crossing of the Clarence at Grafton (Approved 19/12/2014)		
NSW Minister for Planning	B1. The clearing of native vegetation shall be generally in accordance with the areas specified in the documents listed in condition A2, and with the objective of reducing impacts to any endangered ecological communities (EECs), threatened species and their habitat to the greatest extent practicable	Section 3.4
	B2. Prior to construction, pre-clearing surveys and inspections for EECs and threatened species shall be undertaken. The surveys and inspections, and any subsequent relocation of species, shall be undertaken under the guidance of a suitably qualified ecologist and shall be in accordance with the methodology incorporated into the approved Construction Flora and Fauna Management Plan required under condition D46(e)	Section 3.6
	B3. The Proponent shall undertake flora and fauna surveys of those parts of the project area previously not surveyed, due to accessibility issues, prior to the commencement of construction that affects those areas. Should threatened species, communities or habitats be identified, these shall be offset and addressed in the Biodiversity Offset Statement required under condition D1.	This has been completed and report issued (Lewis 2016).
	B4. The Proponent shall undertake a targeted rehabilitation program post construction to restore riparian habitat to at least the pre-construction condition or better, unless otherwise agreed by DPI (Fisheries) and NOW	Section 3.8
	B5. Vegetation shall be established in or adjacent to disturbed areas and include species which may provide habitat for wildlife following the completion of construction in the vicinity of the disturbed area. Revegetation is to be consistent with the Urban Design and Landscape Plan required under condition D42.	Section 3.8
	D1. Prior to the commencement of operation of the SSI, the Proponent shall prepare a Biodiversity Offset Statement in consultation with the OEH. The Statement shall:	Biodiversity Offset Strategy (separate document)

Source	Condition	Details of Compliance
	<p>(a) Confirm the threatened species, communities and their habitat (in hectares) cleared and their condition; and</p> <p>(b) Provide details of measures to offset impacts of the SSI on native vegetation, including threatened species, communities and their habitats, including the timing, responsibility, management and monitoring, and implementation of the offset measures.</p> <p>Biodiversity impacts shall be offset in accordance with the document Principals for the Use of Biodiversity Offsets in NSW (DECCW 2008). A copy of the statement shall be submitted to the secretary and OEH.</p>	
	<p>D42. The Proponent shall prepare and implement an Urban Design and Landscape Management Plan prior to the commencement of permanent built works and/or landscaping, unless otherwise agreed by the Secretary, to present an integrated landscape and design for the SSI. The Plan shall be prepared in accordance with the Roads and Maritime Services urban design and visual guidelines, and the design principals and revegetation guidelines outlined in the EIS. The Plan shall be prepared by an appropriately qualified expert in consultation with the OEH, including the Heritage Division, Council and community, and submitted to the Secretary for approval. The Plan shall include, but not necessarily be limited to –</p> <p>(a) Identification of design principals and standards based on –</p> <ul style="list-style-type: none"> i. Local environmental values; ii. Heritage values; iii. Urban design context; iv. Sustainable design and maintenance; v. Community amenity and privacy; vi. Relevant design standards and guidelines including “Crime Prevention Through Environmental Design Principals”; and vii. The Urban design objectives outlined in the EIS Technical Paper Urban Design and Landscape Concept Report; <p>(b) Details on the location of existing vegetation and proposed landscaping (including use of indigenous and endemic species where possible). Details of the species to be replanted/revegetated shall be provided in a Revegetation Strategy, including their appropriateness to the area and habitat for threatened species;</p>	Section 3.8

Source	Condition	Details of Compliance
	<p>(c) A description of locations along the corridor directly and indirectly impacted by the construction of the SSI (e.g. temporary ancillary facilities, access tracks etc.) and details of the strategies to progressively rehabilitate regenerate and/or revegetate the locations with the objective of promoting biodiversity outcomes and visual integration;</p> <p>(d) appropriate roadside plantings and landscaping in the vicinity of heritage items and ensure no additional heritage impacts;</p> <p>(e) appropriate landscape treatments on flood levees to ensure the structural integrity of the levees is not compromised;</p> <p>(f) strategies for progressive landscaping of environmental controls (such as erosion and sedimentation controls, drainage controls);</p> <p>(g) responsibilities for maintaining landscaping treatments and areas of regeneration and revegetation;</p> <p>(h) location and design treatments for any associated footpaths and cyclist elements, and other features such as seating, fencing, materials and signs;</p> <p>(n) evidence of consultation with OEH, Council and community on the proposed urban design and landscape measures prior to finalisation of the Plan.</p>	
	<p>D46. As part of the Construction Environmental Management Plan for the SSI, the Proponent shall prepare and implement:</p> <p>(e) a Construction Flora and Fauna Management Plan to detail how construction impacts on ecology will be minimised and managed. The Plan shall be prepared by a suitably qualified and experienced ecologist and developed in consultation with the OEH and DPI (Fisheries), and shall include, but not necessarily be limited to:</p> <p>(i) plans for impacted and adjoining areas showing vegetation communities, important flora and fauna habitat areas, locations where threatened species, populations or endangered ecological communities have been recorded; including pre-clearing surveys to confirm the location of any threatened flora and fauna species and associated habitat features;</p> <p>(ii) a protocol for the removal and relocation of fauna during clearing, including provision for engagement of a suitably qualified and experienced ecologist to</p>	Section 3.1 – 3.8

Source	Condition	Details of Compliance
	<p>identify locations where they would be present; to oversee clearing activities and facilitate fauna rescue and relocation; and consideration of timing of vegetation clearing during the breeding/nesting periods of threatened species, where feasible and reasonable;</p> <p>Details or general work practices and mitigation measures to be implemented during construction and operation to minimise impacts on native terrestrial and aquatic fauna and flora (particularly threatened species and their habitats and endangered ecological communities) not proposed to be cleared as part of the SSI, including, but not necessarily limited to: fencing of sensitive areas; measures for maintaining existing habitat features (such as bush rock and tree branches etc.); seed harvesting and appropriate topsoil management; construction worker education; weed management, erosion and sediment control, including measures to at least maintain habitat values downstream; and progressive re-vegetation;</p> <p>(iv) rehabilitation and revegetation details, including objectives, identification of flora species and sources, measures for the management and maintenance of rehabilitated areas, and timeframes and responsibilities for revegetation and rehabilitation;</p> <p>(v) procedures for monitoring success of regeneration and revegetation, and corrective actions should regeneration or revegetation no conform to be objectives adopted;</p> <p>(viii) a procedure for dealing with unexpected endangered ecological communities and threatened species identified during construction, including cessation of work and notification of the OEH and DPI (Fisheries), determination of appropriate mitigation measures in consultation with these agencies (including relevant relocation measures) and updating of ecological monitoring and/or biodiversity offset requirements; and</p> <p>(ix) mechanisms for the monitoring, review and amendment of this plan.</p>	

1.6 Roles and Responsibilities

The key roles associated with this TTSTS Management Plan include:

- Project Manager;
- Construction Manager;
- Environmental Manager;
- Project Ecologist; and
- Environmental Representative.

Their roles have been summarised in Table 1-2 and as a team they are responsible for the successful implementation of this plan. Roads and Maritime will work closely with the construction Contractor in managing this plan and managing compliance with this plan, incident investigation and learning.

Table 1-2. Summary of roles and responsibilities for key personnel associated with this Three-toed Snake Tooth Skink Management Plan.

Role	Responsibility	Organisation
Project Manager	<p>Ensure that all personnel including sub-contractors complete an induction prior to mobilising for work.</p> <p>Provide necessary resources / facilities for the protection of the Three-toed Snake Tooth Skink and its associated habitat as directed by the Environmental Manager.</p> <p>Ensure that all environmental incidents involving habitat disturbance, relocation or death are reported appropriately to the nominated RMS representative.</p> <p>Ensure that corrective actions including Three-toed Snake Tooth Skink management, communicated by the Environmental Manager are closed out within the stipulated timeframe.</p>	Construction Contractor
Construction Manager	<p>Confirm as part of inductions/pre-start and toolbox meetings that all personnel are familiar with the requirements for management of Three-toed Snake Tooth Skink protection.</p> <p>Confirm with and report to the Environmental Manager, any suspected non-compliance by subcontractors or any contractor employees and site visitors over protection methods as per the Project CEMP and specifically, this TTSTS Management Plan.</p> <p>Follow instructions from Environmental Manager and Environmental Adviser in relation to the requirements for the management of habitat removal/relocation, open excavations, house demolition/removal and TTSTS relocation.</p>	Construction Contractor

Role	Responsibility	Organisation
Environmental Manager	<p>Undertake the investigation of any TTSTS environmental incidents involving unplanned habitat disturbance, relocation failure or accidental death and incident reporting requirements in consultation with RMS</p> <p>Provide senior support to the Environmental Adviser(s) and site staff to ensure environmental works are carried out in accordance with the TTSTS Management Plan.</p> <p>Ensure tool box talks cover procedures associated with TTSTS including its identification.</p> <p>Consult as necessary, with RMS Representative and Project Environmental Representative on matters relating to the TTSTS.</p> <p>Control access into TTSTS Relocation Sites</p>	Construction Contractor
Environmental Adviser	<p>Assist in the delivery of Project specific inductions, environmental awareness training sessions, pre-starts and toolbox meetings.</p> <p>Ensure all employees and sub-contractors are aware of the protocols relating to habitat removal/relocation, open excavations and TTSTS relocation in accordance with this TTSTS Management Plan.</p> <p>Submit incident reports when required for due diligence and communicate with the EM and client's Environmental Representative as necessary.</p>	Construction Contractor
Project Ecologist	<p>Be present during the removal or disturbance of all known or potential TTSTS habitat</p> <p>Determine appropriate relocation points for captured TTSTS in accordance with the TTSTS MP</p> <p>Assist both the Environmental Manager and Environmental Adviser.</p> <p>Prepare a summary report following the completion of habitat removal and disturbance works.</p>	Construction Contractor
Environmental Representative	<p>Monitor the implementation of this TTSTS Management Plan</p> <p>Approve or reject minor amendments of the Construction Environmental Management Plan</p> <p>Approve or reject out of hours works in accordance with MCoA D4 for matters relating to TTSTS surveys and implementation of this management plan</p>	Roads and Maritime

2.0 THREE-TOED SNAKE TOOTH SKINK (*SAIPHOS RETICULATUS*)

2-1 Taxonomy

Scientific name: *Saiphos reticulatus* (formerly *Coeranoscincus reticulatus*)

Common name: Three-toed Snake-tooth Skink

This genus was split from *Anomalopus* by Wells and Wellington (1984) and first recognised by Greer and Cogger (1985). Consequently, it has only been formally or scientifically recognised for 32 years.



Plate 2-1. Adult Three-toed Snake Tooth Skink captured from the Project study area (Grafton).

2-2 Description

The Three-toed Snake-tooth Skink has reduced limbs, each with three digits (Cogger 2000). Snout-vent length (SVL) is reported as 180 mm (Cogger 2000), 195 mm (Wilson 2005; Wilson & Swan 2000) and 231 mm (McDonald

1977). Individuals captured and measured in the Project study area have been measured with a snout-vent length of 118 mm and total length of 229 mm (Lewis 2016; Plate 2-1). Other individuals have been around or slightly larger with total lengths of to 280 mm (Lewis in prep). Two hatchlings had a SVL of 60 mm and 58 mm and a total length of 113 mm and 112 mm (Couper *et al.* 1992). Similarly, a juvenile or sub adult measured from the Project study area had a SVL of 56 mm and total length of 97 mm (Plate 2-2). Measurements of nine intact specimens had tails that were 9–45% longer than their SVL (McDonald 1977), which suggests a total length of 483–565 mm.



Plate 2-2. Juvenile or hatchling Three-toed Snake Tooth Skink captured from the Project study area (Grafton).

Adults usually have a dark eye-patch, dark ear markings and a distinct wedge-shaped, pointed pale snout (Cogger 2000; Wilson & Swan

2003). Dorsal colour in adults is generally brown to yellowish brown or grey, sometimes with a vague indication of the dark juvenile bands (Wilson & Swan 2003), and side and belly scales paler brown (Cogger 2000). Individual flecked scales are streaked with dark brown, a black collar and often small, scattered dark brown spots on the back, with dark

brown streaks on the throat (Cogger 2000). Ventral scales are normally greyish and dark-edged to form a fine reticulum-like pattern (Wilson & Knowles 1988). Juveniles are cream to brown dorsally with prominent, irregular transverse dark bands that are more conspicuous anteriorly, often absent posteriorly (Wilson & Swan 2003). Juveniles have dark patches centered on the eye and ear depression, the snout is cream, and the scales on the sides of the body are dark-edged, forming irregular longitudinal streaks (Wilson & Swan 2003).

2.3 Distribution

The Three-toed Snake-tooth Skink occurs from Crescent Head on the mid north coast of NSW to Fraser Island in south-east Queensland (DERM 2009a cited in Borsboom 2009; ALA 2013; NSW OEH 2013b). Most records are from the Border Ranges in the vicinity of the NSW/Queensland border (Borsboom 2009). Records in fragmented habitat (Duncan 2009) and restored riparian vegetation (Barung Landcare 2008) indicates that the skink has some adaptability to modified environments as a result of clearing (Lewis 2016).

In NSW, the Three-toed Snake-tooth Skink is known as far south as the Macleay Valley where it is known from a single record at Crescent Head, although it is considered very rare south of Grafton (NSW OEH 2013c). Collections have been made from the Clarence River valley, Tweed River valley, Richmond Range, Beaury State Forest (SF), Koreelah SF, Whian SF, Grafton, Grady's Creek Flora Reserve, Wiangaree SF, Yabbra SF and Mt Lion Road near the Queensland border (Greer & Cogger 1985; Cogger *et al.* 1993).

The species extent of occurrence has been estimated at 20 000 km² (7000 km² in NSW and 13 000 km² in Queensland) (Borsboom 2009), although this estimate excluded outlying records and areas of disjuncture. The area of occupancy for the species in Queensland has been calculated at 1300 km² based on the extent of rainforest and wet sclerophyll forest habitat (Borsboom 2009). No estimate is currently present in NSW.

2.4 Population Information

Given its cryptic habit, there are no population estimates for the Three-toed Snake-tooth Skink (Borsboom 2009).

2.5 Land Tenure of Populations

The Three-toed Snake-tooth Skink has been recorded in NSW from the Border Ranges NP, Koreelah NP, Nightcap NP, Richmond Range NP, Tooloom NP, Whian State Conservation Area, Yabbra NP, Meebin NP, Beaury SF, Ewingar SF, Girard SF, Yabbra SF, Richmond Range SF and Koreelah SF (Australian Museum 2009 cited in Borsboom 2009; NSW DECCW 2009b cited in Borsboom 2009)

2.6 Habitat Associations

The Three-toed Snake-tooth Skink has been found in loose, well mulched friable soil, in and under rotting logs, in forest litter, under fallen hoop pine bark and under decomposing cane mulch (McDonald 1977; Ehmann 1987; DERM 2009a cited in Borsboom 2009; Duncan 2009; Queensland Museum 2009 cited in Borsboom 2009). Projected foliage cover was estimated at 70–80% at two sites (Ehmann 1987).

In NSW, the Three-toed Snake-tooth Skink has been recorded in dry rainforest, northern warm temperate rainforest, subtropical rainforest, grassy wet sclerophyll forest and shrubby sclerophyll forest (NSW DECCW 2009b cited in Borsboom 2009; NSW OEH 2013c). Records have been made in logged and unlogged forest (NSW DECCW 2009b cited in Borsboom 2009). Locally, in Grafton the species appears confined to the residential areas of Grafton, particularly where extensive gardens or large street trees with high foliage projective cover grow on alluvial soils (Lewis in prep). This has included rose garden beds, fruit trees (i.e. Avocado) and ornamental street tree and park plantings (i.e. Small-leaved Fig).

2.7 Life Cycle

The Three-toed Snake-tooth Skink is an egg-layer with 2–6 oviducal eggs recorded in females from Queensland with a SVL of 100–192 mm (McDonald 1977; Greer & Cogger 1985). One of the gravid females was collected south of Lamington and four on the Lamington Plateau. Three of these four gravid females were collected between October and December (Greer & Cogger 1985; McDonald 1977). A clutch of eight eggs has been found in March in moist soil beneath a rotting rainforest log in the Mistake Mountains, Queensland (Couper *et al.* 1992). It is unknown whether it was a single clutch or a site shared by more than one female (Couper *et al.* 1992). The eggs, at 23.7–28.9 mm in length, were considered large for a skink this size (Couper *et al.* 1992). Two of the eight eggs were successfully incubated and hatched early April (Couper *et al.* 1992). The hatchlings had a SVL of 60 mm and 58 mm and a total length of 113 mm and 112 mm (Couper *et al.* 1992). A male with a remnant yolk sac attached was captured mid-March on the Lamington Plateau, and had a SVL of 70 mm and a total length of 138 mm (McDonald 1977).

2.8 Feeding

Examination of the Three-toed Snake-tooth Skink's stomach contents has found earthworms, beetle larva, insect remains and mud (McDonald 1977). It is believed the Three-toed Snake-tooth Skink would encounter earthworms on the forest floor at night and in the loose soil that the skink burrows (McDonald 1977). In captivity, the skink feeds on worms while beneath the soil surface (Ehmann 1987). It has been suggested the pointed and recurved teeth of the skink are an adaptation for preying on worms (Greer & Cogger 1985).

2.9 Movement Patterns

The Three-toed Snake-tooth Skink has been observed diurnally late in the day in January crossing a national park rainforest walking track (Macdonald 2009 cited in Borsboom 2009), and it has been observed active diurnally near the

surface of forest litter (Ehmann 1987). It has also been frequently recorded whilst conducting drive transects around dusk in the Border Ranges (G. Madani pers. comm. Feb 2016).

2.10 Threats and Conservation Status

The Three-toed Snake-tooth Skink is currently listed as a vulnerable species pursuant to both the NSW *Threatened Species Conservation Act* (1995) and the *Environmental Protection and Biodiversity Conservation Act* (1999) for the following reasons:

- Clearing of habitat.
- Removal of fallen logs and leaf litter through frequent fire;
- Loss of leaf litter and compaction of soil through grazing by stock;
- Habitat degradation and loss of shelter and forage habitat through habitat degradation caused by the Pig (*Sus scrofa*);
- Fire causing loss of habitat at the edge of and within rainforest (NSW OEH 2013c)

The Commonwealth also cites threats pursuant to the International Union for Conservation of Nature and Natural Resources (IUCN) threat classification version 1.1 and includes:

- Agriculture and Aquaculture: Agriculture and Aquaculture: Land clearing, habitat fragmentation and/or habitat degradation;
- Agriculture and Aquaculture: Livestock Farming and Grazing: Grazing pressures and associated habitat changes;
- Biological Resource Use: Logging and Wood Harvesting: Habitat loss, modification and degradation due to timber harvesting;
- Climate Change and Severe Weather: Climate Change and Severe Weather: Climate change altering atmosphere/hydrosphere temperatures, rainfall patterns and/or frequency of severe weather events;
- Climate Change and Severe Weather: Habitat Shifting and Alteration: Habitat loss, modification and/or degradation;
- Ecosystem/Community Stresses: Indirect Ecosystem Effects: Loss and/or fragmentation of habitat and/or subpopulations;
- Human Intrusions and Disturbance: Human Intrusions and Disturbance: Human induced disturbance due to unspecified activities;
- Invasive and Other Problematic Species and Genes: Invasive Non-Native/Alien Species: Competition and/or habitat degradation by weeds;
- Invasive and Other Problematic Species and Genes: Invasive and Other Problematic Species and Genes: Predation, competition, habitat degradation and/or spread of pathogens by introduced species; and
- Natural System Modifications: Fire and Fire Suppression: Inappropriate and/or changed fire regimes (frequency, timing, intensity)

Interestingly, the subject population is confined to an urban residential area with dogs and cats where virtually all of the native remnant vegetation has been removed.

2.11 Threat Abatement and Recovery

Activities that would benefit the Three-toed Snake-tooth Skink include (NSW OEH 2013c):

- Control fire in areas of habitat to protect leaf litter and fallen logs.
- Manage cattle grazing in areas of habitat to protect leaf litter and topsoil.
- Retain and protect areas of rainforest and moist eucalypt forest.
- Control Feral Pig (*Sus scrofa*) where they occur within potential habitat for this species.

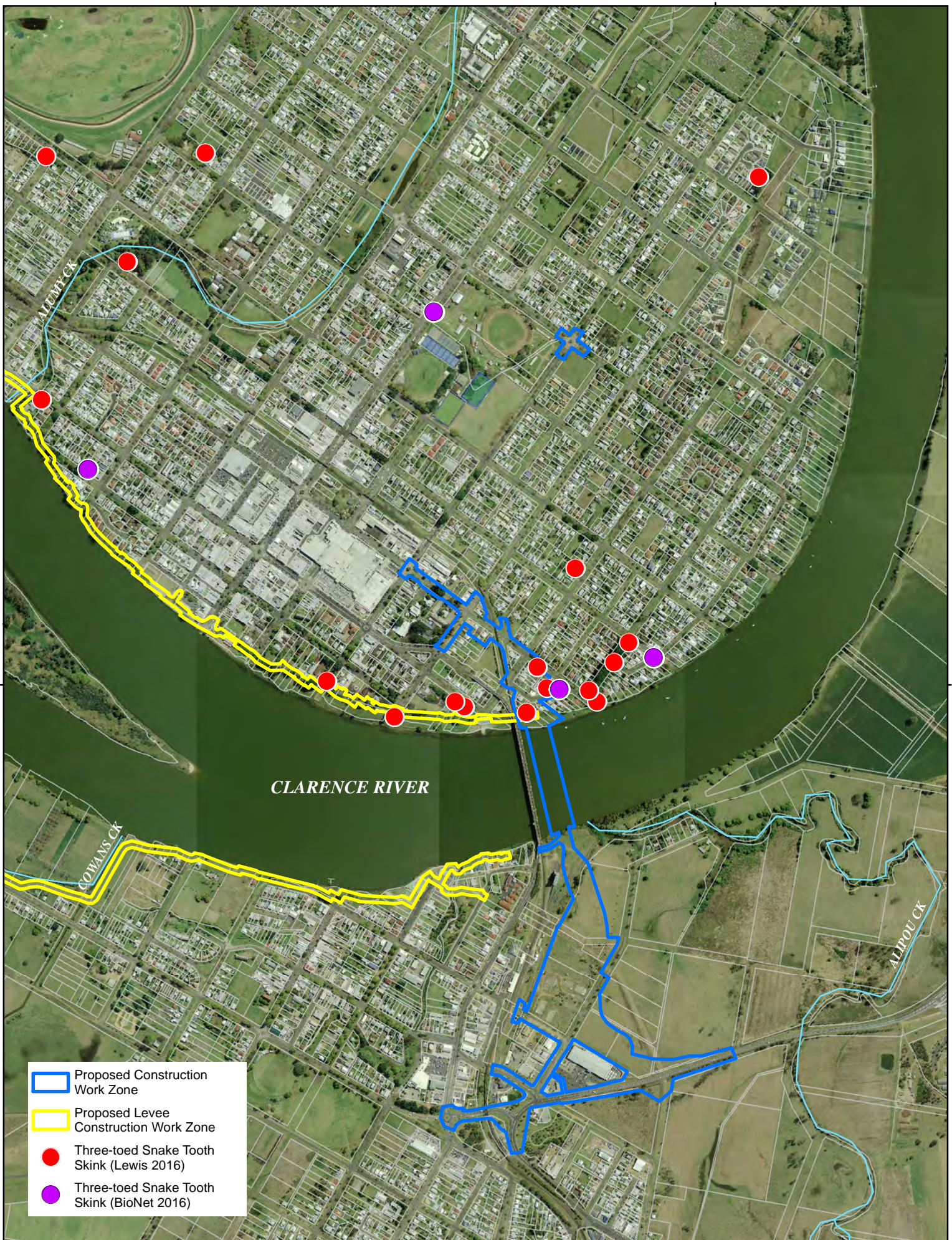
Future surveys for the Three-toed Snake-tooth Skink should target the Big Scrub remnants of north-east NSW (NSW OEH 2013c), rainforest remnants of the Blackall Range, the Maroochydore area and south of Grafton (Borsboom 2009). In NSW state forests, the species is considered adequately protected by general environmental guidelines for forestry operations (NSW Government 2013).

2.12 Current Context of Three-toed Snake Tooth Skink and the Project

The EIS prepared for the Project identified the study area as containing a high likelihood of supporting a population of TTSTS. Subsequent follow up surveys of land that could not be accessed during the preparation of the EIS revealed a population of TTSTS on the northern side of the Clarence River (Lewis 2016). Consequently, surveys were expanded to include all locations within the proposed construction works boundary. This included all of the treatment areas within the levee works construction footprint apart from a portion of land managed by the Australian Rail Track Corporation (ARTC) in the upstream or western end of the northern levee. These unsurveyed areas were later considered TTSTS habitat.

Field surveys were conducted at another 78 locations in the Grafton locality (Appendix B). Generally, surveys were only conducted outside or adjacent to the proposed construction works footprint if they had been recorded within or in close proximity to the proposed construction works footprint. Some additional outlining areas beyond Grafton were surveyed and include four satellite locations approximately 3 km to the north at Junction Hill and Alummy Creek Reserve.

As a result of the field surveys, TTSTS were found at an additional 14 other scattered locations throughout Grafton township and concluded that the population has a close affinity with alluvial soils found within 100 m of drainage lines (Figure 2-1; Figure 2-2; Table 2-1). Consequently, the population is thought to extend over approximately 425 ha of Grafton township which includes parts of the Project, most notably the northern bridge abutment (i.e. ch. 1360-1500) and the associated Grafton levee and road works (Figure 2-2). Interestingly, no TTSTS were recorded from South Grafton indicating there is a reduced likelihood of their occurrence in this area (Figure 2-3). Historic records for TTSTS exist from Susan Island (R. Jago; February 2016 pers. comm.), however, these are not captured on the Bionet wildlife atlas (OEH 2016).



6715000

6715000

LEWIS
ECOLOGICAL

Source:	Aerial Photo: RMS September 2010 Work Zones: RMS 2015 Surveyed Lots: Lewis Ecological 2016	Locations of Three-toed Snake Tooth Skink: Lewis Ecological 2016 & ATLAS Surveyed Lots: Lewis Ecological 2016
Disclaimer:	This plan is based on or contains data provided by others. GeoView gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damages) relating to and use of the data. Data must not be used for direct marketing or be used in breach of privacy laws.	
File:	2751516-FIG-1-TTST-160419	

0 100 200 300 400 500
Meters
A4 Scale 1:15,000
Coordinate System: MGA56 Projection: Transverse Mercator

Figure 2-1:
LOCATIONS OF THREE-TOED SNAKE TOOTH SKINK (*SAIPHOS RETICULATUS*)

493000

494000

495000

6718000

6718000

6717000

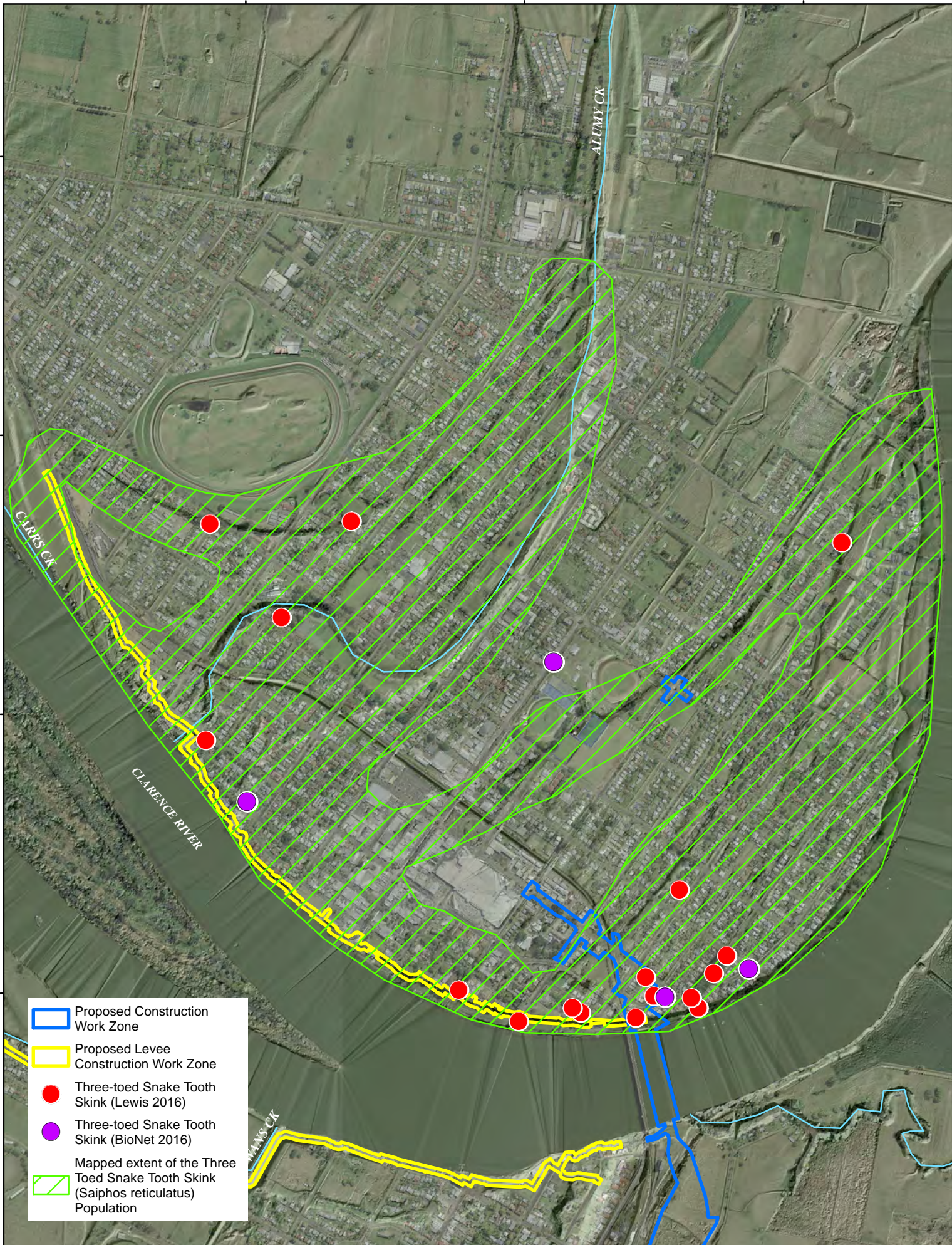
6717000






6716000

6716000

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-  Proposed Construction Work Zone
-  Proposed Levee Construction Work Zone
-  Three-toed Snake Tooth Skink (Lewis 2016)
-  Three-toed Snake Tooth Skink (BioNet 2016)
-  Mapped extent of the Three Toed Snake Tooth Skink (*Saiphos reticulatus*) Population

493000

494000

495000



Source: Aerial Photo: RMS September 2010
 Work Zones: RMS 2015
 Surveyed Lots: Lewis Ecological 2016

Locations of Three-toed Snake Tooth Skink: Lewis Ecological 2016 & ATLAS BioNet database 2016

Disclaimer: This plan is based on or contains data provided by others. GeoView gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to and use of the data. Data must not be used for direct marketing or be used in breach of privacy laws.

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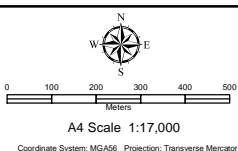


Figure 2-2:
LOCATIONS OF THREE-TOED SNAKE TOOTH SKINK (*SAIPHOS RETICULATUS*)

492000

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6718000

6718000

6717000

6717000

6716000

6716000

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6715000

6714000

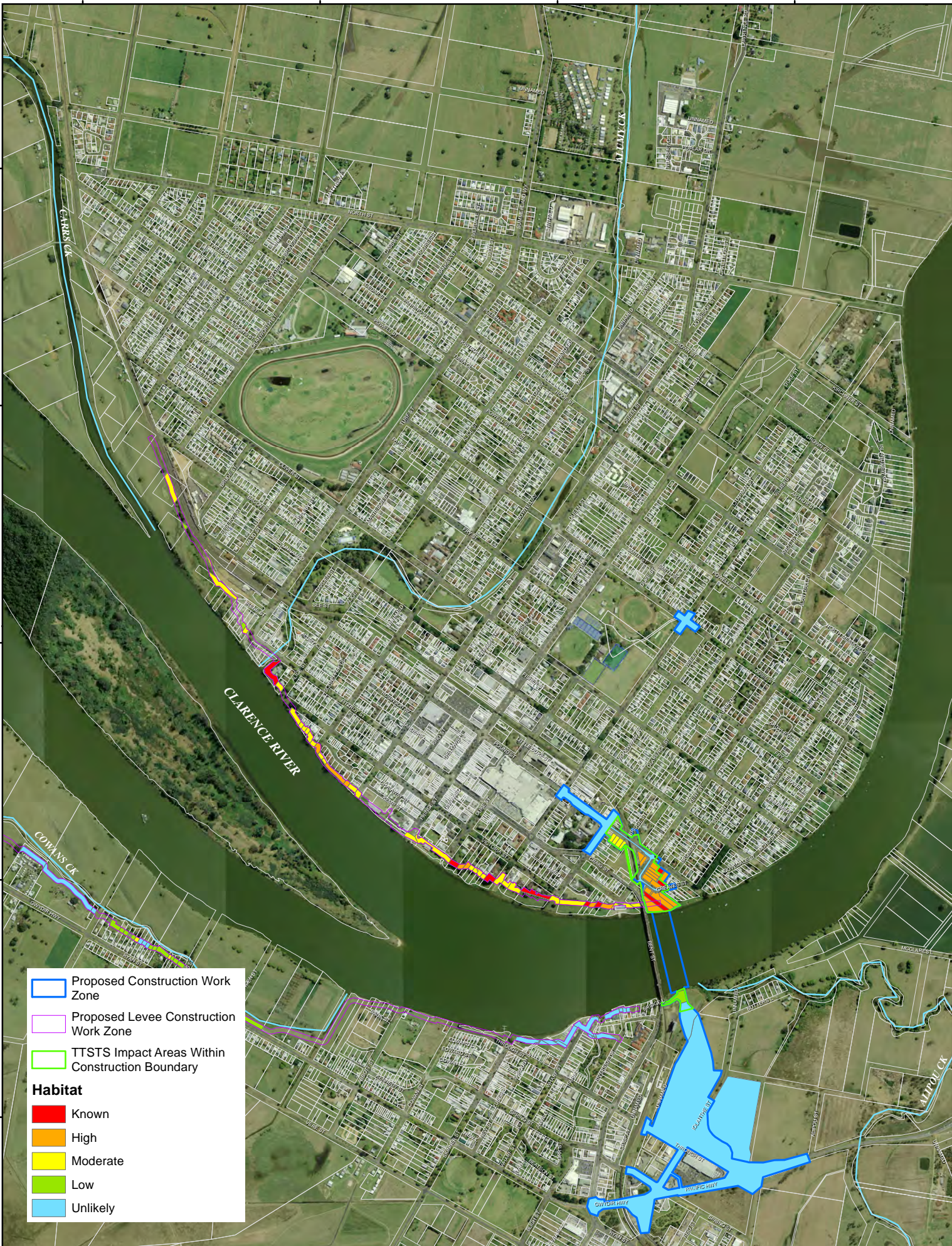
6714000

492000

493000

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495000



- Proposed Construction Work Zone
 - Proposed Levee Construction Work Zone
 - TTSTS Impact Areas Within Construction Boundary
- Habitat**
- Known
 - High
 - Moderate
 - Low
 - Unlikely



Source: Aerial Photo: RMS September 2010
 Work Zones: RMS 2015
 Cadastral database: RMS 2015

Three-toed Snake Tooth Skink Habitat: Lewis Ecological 2016

This plan is based on or contains data provided by others. GeoView gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damages) relating to and use of the data. Data must not be used for direct marketing or be used in breach of privacy laws.

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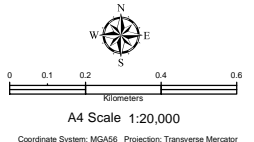







FIGURE 2-3 - HABITAT SUITABILITY AND LIKELIHOOD FOR THE THREE-TOED SNAKE TOOTH SKINK (*SAIPHOS RETICULATUS*)




All of the TTSTS records have been made in somewhat disturbed environments generally described here as park and street tree plantings, gardens and particularly those that receive increased levels of maintenance with mulch (not bark chip or tea-tree mulch but straw mulch and leaf litter) and watering (Table 2-1). This would indicate the species is at least locally tolerant to high rates of habitat disturbance. Land tenure at these sites includes parks and reserve areas managed by Clarence Valley Council (CVC) and private residential holdings. Berimba Ave is listed with the National Heritage Trust for its historical rather than its ecological significance.




Whilst the current population extent has been calculated at 425 ha, the area of suitable habitat within this urban residential landscape is thought to be smaller when taking into account unsuitable microhabitats such as buildings and other hardstand areas such as bitumen roads and concrete pathways (Figure 2-2). GIS was used to calculate the extent of these unsuitable microhabitats via dividing the urban area into 140 x 6.25 ha grids (250 x 250 m) and randomly selecting 14 (i.e. 10%) to derive a standard mean figure for permeable (i.e. lawns, parks, gardens) versus impermeable (i.e. bitumen roads, concrete footpaths, buildings) surfaces. Outliers including the Grafton CBD area and the racecourse were excluded from the assessment given they contain high percentages of either permeable or impermeable surfaces such that any randomly selected grids within these two areas would skew the number used in the correction factor. The resulting approach identified 59% of Grafton's urban residential area contains permeable surfaces which could be inhabited by the TTSTS. Consequently, this was used as the correction factor over the mapped population extent of 425 ha to derive a figure of 251 ha of TTSTS habitat.




Table 2-1. Capture locations for the Three-toed Snake Tooth Skink relevant to this plan.



Location Number	Site Picture	Location (Easting Northing)	Date Recorded	Tenure	On or Off Site	TTSTS Info	Genetic Sample Taken	Notes
1		E-494399 N-6714912	9/02/2016	APO 08	Bridge Abutment B	Adult captured beneath large Avocado Tree with deep 200-300 mm leaf litter	No	First individual captured Area contains a lot of earth worms thought to provide important foraging resource Block wall of levee contains lots of earthworms and considered known habitat
2		E-494464 N-6714990	8/02/2016	APO 13	Bridge Abutment B	Juvenile captured beneath house brick on Pound St (north) side of house	No	Juvenile captured beneath house brick at side of house Resident reported seeing individuals often in their rose garden along northern side of house
3		E-494434 N-6715057	8/02/2016	APO 19	Bridge Abutment B	Adult alluded capture	No	Large and presumably an adult found beneath rotten palm stump

Location Number	Site Picture	Location (Easting Northing)	Date Recorded	Tenure	On or Off Site	TTSTS Info	Genetic Sample Taken	Notes
4		E-494623 N-6714947	17/02/2016	Clarence Valley Council	Offsite	Adult captured on river bank with deep litter	No	CVC Pound Street River End Recent felling of a large tree on council land Recent sites works including removal of fallen branches, spraying and mulch layer added
5		E-494598 N-6714983	17/02/2016	Clarence Valley Council	Offsite	Adult captured at base of small-leaved fig tree	No	Berimba Avenue - Southern end and western Figtree shown in bottom left of plate Large adult found in association with Green Ant nests Used as a reference site on occasion to demonstrate suitable survey conditions
6		E-494678 N-6715071	19/02/2016	Clarence Valley Council	Offsite	Adult captured at base of fig tree	No	Large adult captured from eastern side of road halfway along Figtree Avenue

Location Number	Site Picture	Location (Easting Northing)	Date Recorded	Tenure	On or Off Site	TTSTS Info	Genetic Sample Taken	Notes
7		E-494725 N-6715135	17/02/2016	Clarence Valley Council	Offsite	Adult captured at base of figtree	No	Berimba Avenue - northern end river or east side of Figtree Avenue
8		E-493129 N-6716347	17/02/2016	Clarence Valley Council	Offsite	Adult captured beneath Gynea Lilly in open parkland	Yes	Large adult captured from beneath Gynea Lilly shown in Plate Litter cover thought to habitat Genetic sample taken
9		E-492857 N-6715907	5/04/2016	NG-151	Levee Works	Adult (male) captured in established garden adjacent levee block wall	Yes	Adult suspected as being male with more slender tail captured from manicured gardens at 213 Fitzroy Street Captured from within leaf litter beneath Magnolia Tree not woodchip shown in foreground Genetic sample taken

Location Number	Site Picture	Location (Easting Northing)	Date Recorded	Tenure	On or Off Site	TTSTS Info	Genetic Sample Taken	Notes
10		E-494202 N-6714931	5/04/2016	NG-103	Levee Works	Adult captured beneath garden ornamental plants in deep litter	No	Adult captured from beneath Avocado Tree and Camelia at 3 Fitzroy Street Captured at boundary with 1 Fitzroy St and also considered known habitat
11		E-494172 N-6714947	5/04/2016	NG-105	Levee Works	Adult captured beneath garden ornamental plants in deep litter in	Yes	Adult captured from 150 mm deep litter in manicured gardens at 7 Fitzroy Street Skink moved into 5 Fitzroy St
12		E-492871 N-6716682	7/04/2016	Private Residence	Offsite	Adult captured in low drainage point with rainforest revegetated yard	No	From rainforest regenerated garden established 30 years ago (i.e. 1985 circa) Owner reports individuals frequent porch tiled area at rear of house Considered high quality habitat following a 30 year revegetation project

Location Number	Site Picture	Location (Easting Northing)	Date Recorded	Tenure	On or Off Site	TTSTS Info	Genetic Sample Taken	Notes
13		E-493378 N-6716692	7/04/2016	Clarence Valley Council	Offsite	Adult captured at park private residence boundary	No	Pioneer Park in south eastern precinct where private residence down water pipe diverts into parkland. Site previously surveyed during hot weather conditions in February without any captures.
14		E-495138 N-6716616	8/04/2016	Private Residence	Offsite	Adult female captured in established 30 year old garden beneath bushrock	No	80 Arthur Street where cleared paddock has been restored into a vegetated garden providing suitable skink habitat.
15		E-494555 N-6715371	15/04/2016	Private Residence	Offsite	Juvenile captured in leaf litter	No	32 Bacon Street Captured at rear of yard

Location Number	Site Picture	Location (Easting Northing)	Date Recorded	Tenure	On or Off Site	TTSTS Info	Genetic Sample Taken	Notes
16		E-493764 N-6715012	15/04/2016	NG-112	Levee Works	Adult female captured beneath leaf litter on concrete	Yes	Using concrete with leaf litter to depth of 125 mm but moist base with invertebrates including slaters and earthworms Genetic sample taken
17		E-493979 N-6714898	15/04/2016	NG-108	Levee Works	Sub adult captured in leaf litter at base of concrete stairs and building walls	Yes	1st sub adult captured with immature markings still present Genetic sample taken

3.0 THREE-TOED SNAKE TOOTH SKINK MANAGEMENT

Management actions are proposed to reduce impacts on the TTSTS population during construction. They include:

1. Timing of construction activities to coincide with increased opportunities to capture and relocate TTSTS;
2. Identification of construction activities and TTSTS survey requirements and safeguards;
3. Pre-construction Planning including:
 - a. Engaging a suitably qualified and experienced ecologist to implement key components of this management plan;
 - b. Design an effective temporary exclusion fence; and
 - c. Develop rationale for selecting relocation sites and identifying these on construction drawings and environmental sensitive area plans.
4. Develop management initiatives for the protection of TTSTS habitat adjacent to the construction works footprint and protection of relocation sites;
5. Outline the requirements for the location and installation of temporary exclusion fencing;
6. Develop a survey prescription to be used by the Project Ecologist for adequately surveying areas prior to and during various construction activities;
7. Outline the data collection requirements for all captured TTSTS;
8. Develop guidelines that provide improved opportunities for habitat augmentation in the existing urban design and landscape concept plan;
9. Unexpected finds procedure; and
10. Framework for allowing this management plan to be progressively updated in light of new findings and information.

3.1 Construction Timing

The construction program is divided up into 13 management units summarised in the current dry weather program (see Table 3-1). Most, but not all of the on ground works will be relevant to TTSTS and importantly most of the on ground initial habitat disturbance and removal will take place during the warmer months of the year when TTSTS are active (i.e. September to May). This provides an increased opportunity for the prescribed surveys discussed elsewhere in this document to be more effective in capturing and relocating TTSTS and thus addressing MCoA D46:

(e) (ii) a protocol for the removal and relocation of fauna during clearing, including provision for engagement of a suitably qualified and experienced ecologist to identify locations where they would be present; to oversee clearing activities and facilitate fauna rescue and relocation; and consideration of timing of vegetation clearing during the breeding/nesting periods of threatened species, where feasible and reasonable.

Table 3-1. Summary of forecast construction dry weather program and the on ground relevance to TTSTS.

Project Item/Description	Forecast Commencement Date	Forecast Completion Date	On-ground Relevance to TTSTS
Project Award	June 2016	na	No
Detail Design (including landscaping, urban design)	June 2016	February 2017	Yes
Construction Environmental Management Plan (CEMP including FFMP)	June 2016	February 2017	Yes
Flood Mitigation works (levee and house raising)	October 2016	December 2017	Yes
Ancillary site establishment	August 2016	na	No
Pre-casting of bridge components	December 2016	na	No
Utility Adjustments	October 2016	October 2017	Yes
Roadworks North	January 2017	January 2019	Yes
Roadworks south	January 2017	January 2019	Yes
Bridge construction	January 2017	January 2019	Yes
Rail Viaduct	January 2018	December 2018	Yes
Finishing works	January 2019	June 2019	Yes
Project Completion	na	June 2019	No

3.2 Construction Activities and Sequencing of TTSTS Surveys

Planned construction activities in areas mapped as moderate, high or known TTSTS habitat will require surveys by the Project Ecologist either beforehand and/or during the works (Figure 2-3). The planned construction activities include:

- Clearing and grubbing works;
- Excavation in any form of the existing topography to depths of 1 m. Once this layer has been stripped, no further consideration is required;
- Installation of controls that require ground disturbance such as the installation of TTSTS exclusion fence;
- Geotechnical works that require excavation or accessing known TTSTS habitat in vehicles (i.e. compaction). Graveled or sealed tracks excluded;
- The demolition or relocations of dwelling and other existing structures; and
- Other tasks as deemed necessary by the Project Ecologist.

A summary of the survey requirements is outlined in Table 3-2 and details relating to survey duration is presented in Section 3.6. The Project Ecologist must perform a series of surveys that are commensurate with the construction tasks planned or being performed at that time, taking into account the habitat suitability and/or the likelihood of TTSTS (Figure 2-3). This includes surveys before any planned habitat disturbance or removal (i.e. pre-clearing survey) as well as surveys during the actual disturbance and/or removal (i.e. construction or clearing supervision) until such a time the

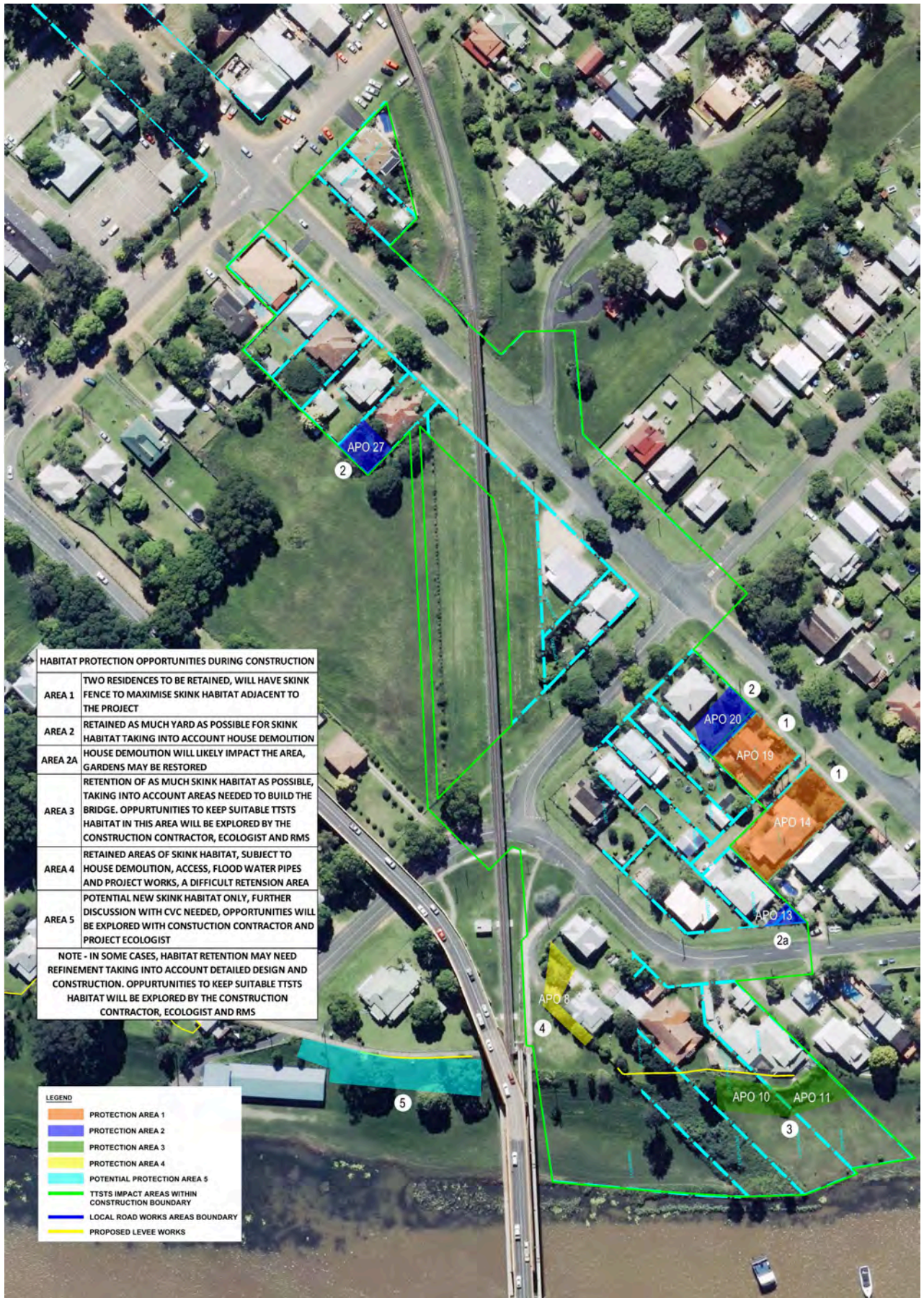


Figure 3-1. Potential relocation points for TTSTS based on current extent of known habitat.

Project Ecologist believes an adequate level of survey supervision has been performed. For example, grassed levees should take less time to perform these works than levees where established gardens will need to be removed.

In areas deemed as having a low or unlikely likelihood to support TTSTS, the Project Ecologist would only perform surveys if directed to by the Environmental Manager or the Roads and Maritime following any unexpected finds procedure.

Table 3-2. Summary of construction activities and the requirements for surveys in areas assessed as moderate, high or known TTSTS habitat shown in Figure 2-3.

Tasks within area of known or potential TTSTS habitat	Pre-clearing Survey (within 24 hours)	Project Ecologist Supervision of Task (i.e. Construction Supervision)	Hold point/Control
Clear and Grub Vegetation	Yes	Yes	Pre-clearing checklist signed before activity commences by Project Ecologist and Environment Manager. A checklist is only valid for that day of works until such a time the Project Ecologist deems the areas as no longer containing TTSTS habitat.
Excavation of ground to 1 m (all works)	Yes	Yes	As Above
Installation of controls that require ground disturbance in the form of excavation	No	Yes	As Above
Geotechnical Works (excavation and compaction from vehicles)	Yes	Yes	As Above
House and Structure Demolition	Yes	Yes	As Above
House and Structure Relocation	Yes	Yes	As Above

3.3 Preconstruction Planning in relation to TTSTS

Four pre-construction planning requirements have been identified including:

- Engaging a suitably qualified and experienced ecologist;
- Design of an effective temporary exclusion fence;
- Identification of potential relocation sites for TTSTS; and
- Progression of the RMS concept design take into account measures to reduce the removal of TTSTS habitat.

3.3.1 Engaging a Suitability Qualified and Experienced Ecologist

The construction contractor must engage a suitably qualified and experienced ecologist with at least 10 years field experience with reptiles. This must include demonstrated first-hand experience with the subject species or some other cryptic threatened reptile, and importantly, the person conducting the onsite duties must possess this experience and not the entity or the company. Contingency for any support role must also possess the same level of experience and must receive endorsement from the RMS and if applicable the Project's Environmental Representative. No provision is made for updates or changes to this component of the plan.

3.3.2 Design of an Effective Exclusion Fence for TTSTS

An effective exclusion fence for the TTSTS must prevent both above ground and below ground movements. As this species is not known to readily climb, an above ground height of 500 mm is considered adequate and no vertical return lip is required. Given that individuals have been captured at depths of 100 to 250 mm in litter, humus and loose friable soil, a fence buried to a depth of 500 mm is considered adequate, although in some instances a depth of 250 mm may be used to avoid where there is a demonstrable risk of damaging utilities. Therefore, a 1 m fence constructed with half of it protruding above the ground should be effective at excluding movement of TTSTS onto the construction footprint.

A suitable fence material may comprise geotextile fabric, strong woven polypropylene, metal sheeting or another alternative material if it is endorsed by the Project Ecologist. The material should be sufficient to endure the intended timing of construction works.

The fence is to be decommissioned at the completion of construction activities and no permanent exclusion fencing is planned. This will allow for unhindered skink movements along the riparian foreshore whilst the northern bridge abutment features a retaining wall that will prevent skinks from accessing the roadway.

3.3.3 Identification of Potential TTSTS Relocation Sites

Known TTSTS habitat occurs within the proposed construction works area outlined in the concept design of the EIS (Figure 2-1). Consequently, and in accordance with MCoA D46 (e) (ii) *a protocol for the removal and relocation of fauna during clearing* relocation sites will need to be identified and based on the current level of information for TTSTS, the following criteria have been developed for identifying a suitable relocation point:

- Within 100 m of the capture site;
- Occurring outside of the construction works footprint;
- Micro habitat consists of loose friable soil with areas of litter, humus or dense vegetative groundcover that provide both cover and foraging resources;
- Exclusion fence has been installed. In instances where an exclusion fence has not been installed but is planned to occur within the next five days, individual TTSTS must be retained and held in captivity using either calico bags or plastic aquaria furnished with leaf litter and soil; and

- No more than 10 adults and 5 sub adults or hatchlings per 100 m² of suitable habitat may be relocated to reduce the risk of over stocking.

Working within the parameters above, all relocations are likely to take place within the one population extant and provide for a high rate of relocation success. The following presents a draft potential relocation site schedule guided by the results of recent field surveys and should be updated accordingly.

i. Bridge Abutment North to Railway

Northern side of the Clarence River and immediately adjacent to the construction footprint boundary, demarcated by indicative Areas 1-5 in Figure 3-1. Within these areas, the garden areas preferably within the following affected property owners (APO):

- Partial areas of APO 8, APO 10, APO 11, APO 13 and the entirety of APO 14 and APO 19, noting all of these have either been purchased by the Roads and Maritime, or the purchase is underway. (Figure 3-1).

Additional, yet partial APO's of 12 and 20 have been nominated as secondary sites should the stocking rates be reached at the above locations. Throughout this area and for some distance beyond it, recent field surveys indicate the local TTSTS population extends for hundreds of metres downstream through the Dovedale area including the southern end of Pound Street, Figtree lined portion of Berimba Avenue and all of the surrounding residential areas (Appendix B).

Given the above, individuals relocated into these areas will be considered to have a high rate of survival as in many cases the habitat type including microhabitat attributes (i.e. soil type, mulch, foraging resources) will be almost identical. Moreover, the mere presence of this species at the capture site indicates a degree of tolerance to habitat disturbance than what has been previously documented (i.e. Sect 2.6).

ii. Pound Street West of Railway

As TTSTS has not been recorded, any discovery should work within the relocation parameters provided above (see Sect 3.3.3). Based on habitat suitability, the most likely relocation points in this area include the southern limits of APO 27 (Figure 3-1).

iii. Northern Levee

Preferably immediately adjacent to the capture location and where there is sufficient ground cover, ensuring the relocation site is within 100 m of the capture location. Records to date include known occurrences along the eastern and western extremities of Fitzroy Street (1-7 and 213 Fitzroy), eastern part of Victoria Street (1-7 and 27 Victoria) and most other areas provide suitable habitat.

iv. Southern Levee

As TTSTS has not been recorded, any discovery should work within the relocation parameters provided above (see Sect 3.3.3).

v. Bridge Abutment South

As TTSTS has not been recorded, any discovery should work within the relocation parameters provided above (see Sect 3.3.3).

vi. Other Works Areas

Working within the relocation parameters provided above (see Sect 3.3.3).

3.3.4 Consideration of TTSTS Habitat During The Design Refinement Process

The progression of the approved RMS concept design will consider and take into account measures to reduce the removal of TTSTS habitat. Such measures may include but is not necessarily limited to the required extents of the levee mitigation works, the locating of ancillary works and infrastructure and further refinement of the Urban Design and Landscape Plan (see Sect 3.8).

3.4 Protection of TTSTS Habitat

As per the TTSTS Impact Area Boundary, shown in Figure 3-1, affected property owners (APO) 14 and 19 will be protected from pre construction and construction related works other than what is considered essential.

Partial areas of APO 10, APO 11, APO 13, APO 20 and APO 27, should be protected from pre construction and construction related works other than what is considered essential to minimise impacts to TTSTS habitat, as outlined in Figure 3-1.

As envisaged in the EIS, temporary works to build the bridge and embankment would also be required, including access tracks, facilities, topsoil stock piles, lay down areas and possibly a small satellite compound in the northern abutment area. All work within the TTSTS Impact Area Boundary will be managed to minimise impacts to the TTSTS habitat. This approach will be in accordance with MCoA.

B1. The clearing of native vegetation shall be generally in accordance with the areas specified in the documents listed in condition A2, and with the objective of reducing impacts to any endangered ecological communities (EECs), threatened species and their habitat to the greatest extent practicable.

D36. The sites for ancillary facilities that are associated with the construction of the SSI and that have not been identified and assessed in the documents listed in condition A2 shall be located in areas of low ecological significance and require no clearing of native vegetation.

All areas considered to provide known habitat for TTSTS are considered to be of high ecological significance and should be managed accordingly. Consequently, the following management initiatives would be adopted during refinement from the concept design into detailed design and construction:

- Habitat mapping developed using categories of known, high, moderate, low and unlikely to be shown on sensitive area plans and construction drawings. To be updated accordingly.
- All nominated relocation sites clearly identified on sensitive area plans and construction drawings to assist in planning of work activities.
- Design processes to reduce the loss of TTSTS habitat where reasonable and feasible.
- Temporary exclusion fencing installed where non levee construction footprint interfaces or is within 30 m of either known habitat or assigned as having a moderate or high likelihood (*see Appendix B*).
- Signage demarcating “Environmental No Go Zone” or wording to a similar effect to enable on ground identification to construction persons. Signage to be placed at intervals of not less than 1 sign per 25 m of exclusion fence.
- Access to those areas controlled by the Environment Manager.

The adoption of these management actions is consistent with the principals of MCoA D46 (e) *a Construction Flora and Fauna Management Plan to detail how construction impacts on ecology will be minimised and managedincluding (i) plans for impacted and adjoining areas showing important flora and fauna habitat areas.*

3.5 Requirement for the Timing and Installation of Temporary TTSTS Fencing

3.5.1 Timing of Installation

The installation of temporary exclusion fencing for TTSTS can be undertaken in two ways. Firstly, the fence is installed prior to any habitat disturbance or habitat removal works (Option A). This would enable any captured TTSTS to be relocated immediately and avoid retaining individuals until the exclusion fence has been installed. The second, or alternative option (Option B) allows for habitat disturbance and removal to take place without the fence installed, however, the exclusion fence must be installed before any captured TTSTS can be relocated. Both have their merits and notably, both are endorsed in this plan.

3.5.2 Location of Temporary TTSTS Exclusion Fencing

For 30 m either side of the relocation point or an area known or assigned as having a moderate or high likelihood of supporting TTSTS and the construction works extend beyond 4 weeks. For construction works of a shorter duration, skinks would be retained in captivity and released upon the completion of those works in any given area to reduce the risk of mortality. The retention of TTSTS in this instance would be in accordance with a NSW Animal Care and Ethics Committee Approval held by the Project Ecologist.

3.6 Prescribed Survey Techniques Used by the Project Ecologist

The following survey techniques would be performed by the Project Ecologist during the course of implementing components of this plan:

- Active Search;
- Pitfall Surveys; and
- Funnel traps.

The use and duration (i.e. survey effort) of these techniques has been developed based on the expertise of the author, Department of Environment (formerly DSEWPC) survey guidelines (DSEWPC 2009) and field survey results from past surveys of the Project study area and surrounds (Lewis 2016).

Active Search – The raking of mulch, litter and topsoil using a small rake or wrecking bar with a handle less than 1 m. This technique must be performed prior to the area being disturbed for construction activities (i.e. pre-clearing survey performed within 24 hrs of planned works). It should also be used as part of the clearing supervision works, particularly during and immediately after the removal of house foundations tree stumps and gardens or during any other tasks deemed warranted by the Project Ecologist. A standardised sampling unit of 30 minutes person effort per 100 m² is considered adequate in areas of known, high and moderate likelihood. Less survey effort may be applied to areas of low likelihood or where the micro habitat consists of mown lawn or grassed rural paddocks (see Appendix B).

Pitfall Surveys – Used at the discretion of the Project Ecologist, in consultation with the Environmental Manager and the RMS. For example, where active search is difficult to effectively implement (i.e. matted tree roots prevents raking of soil) and only when weather conditions are conducive for above ground movement (i.e. daytime maximum exceeding 27°C). Installed pitfall traps must operate over four consecutive nights if this technique is to be relied upon to pre-clear survey a site. Fewer nights can be adopted in instances where most of the area can be efficiently surveyed using the active search technique.

Funnel Traps – Used in two ways, firstly, in conjunction with pitfall surveys described above, and secondly, on the construction side of the TTSTS exclusion fence to capture any displaced individuals not captured during pre-clearing or construction supervision surveys. Funnels placed at 5 metre intervals and left operating over a four night period.

3.7 Captured TTSTS Requirements

Any TTSTS captured during the course of implementing this plan would have the following data collected:

- GPS Coordinates Expressed in GDA 94;
- Date;
- Pre-vailing Air Temperature;
- Micro habitat at capture site using standardised Office of Environment (OEH) field reporting abbreviations;

- Series of measurements including:
 - Snout-vent length,
 - Tail length, and
 - Total length.
- The collection of genetic material may also be required.

At sites where temporary construction works (i.e. <4 weeks – 28 days) are planned, all captured TTSTS would be retained in captivity until the works have been completed and there is no further risk of direct mortality impacts.

3.8 Habitat Augmentation

The urban design and landscaping concept plan presented in the EIS provides a number of opportunities to augment habitat for the TTSTS where dwellings currently exist. In this way, it would be consistent with the following MCoA:

B4. The Proponent shall undertake a targeted rehabilitation program post construction to restore riparian habitat to at least the pre-construction condition or better, unless otherwise agreed by DPI (Fisheries) and NOW

B5. Vegetation shall be established in or adjacent to disturbed areas and include species which may provide habitat for wildlife following the completion of construction in the vicinity of the disturbed area. Revegetation is to be consistent with the Urban Design and Landscape Plan required under condition D42.

Within the areas known to provide TTSTS habitat, a number of native and exotic tree plantings are proposed (Figure 3-2). Some refinement of the concept design with an emphasis on ground or mulch cover would seek to neutralise the overall impact as the hardstand area of the bridge and associated infrastructure is equitable to the footprint of the dwellings identified for removal. Such a refinement could be guided by the following principals:

- Install mulch beds around established isolated planted trees of at least 1 m radius;
- Mulch including tea tree mulch, bark chip or coarse woody vegetation processed using a grinder is not deemed suitable;
- Integrate planting beds with groundcover species listed in the planting schedule of the urban design and landscaping concept plan;
- Mulch beds at least 200 mm depth at their time of installation, and
- Refine existing plantings schedule to increase trees with dense canopy traits.

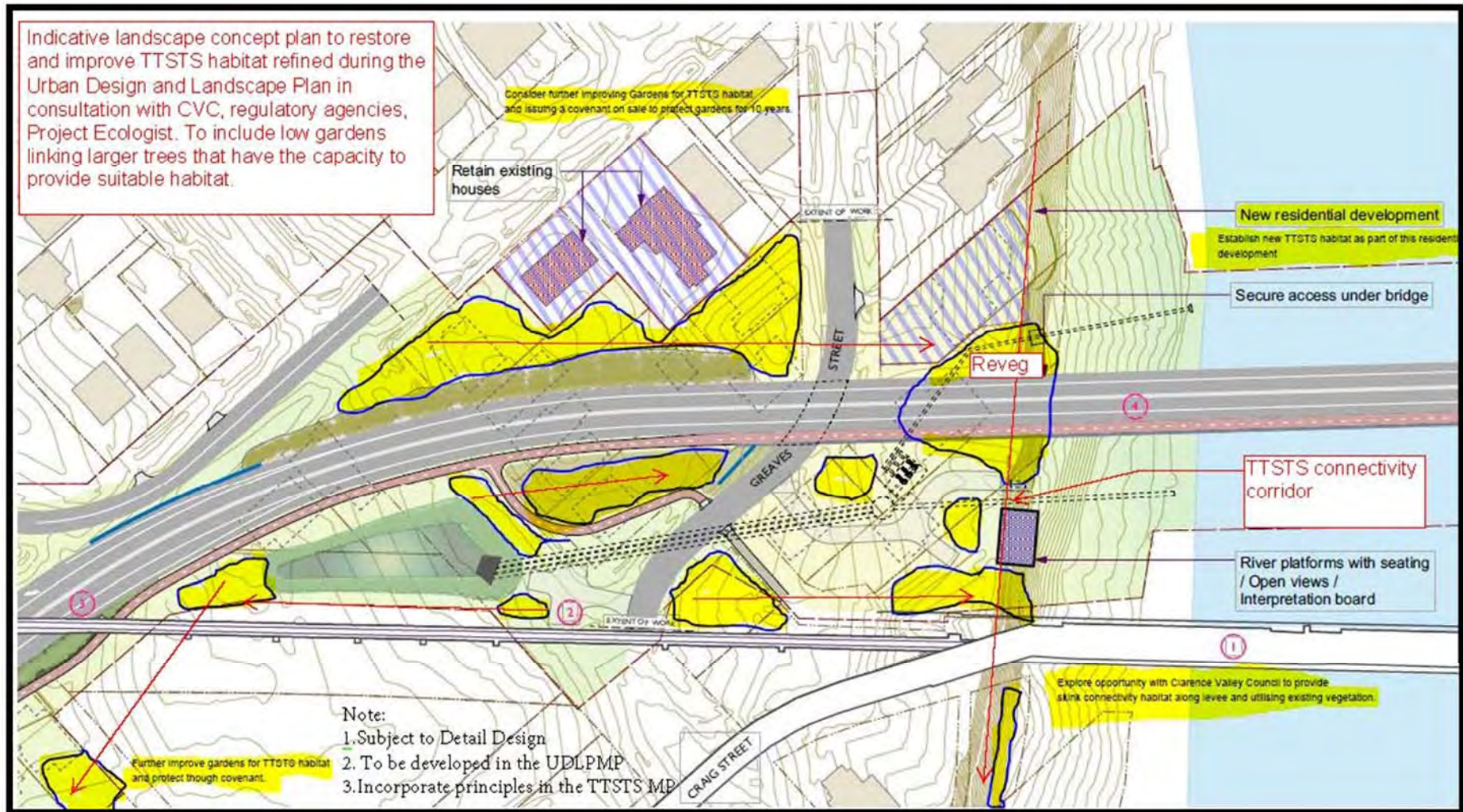


Figure 3-2. Landscape concept plan.

3.9 Unexpected Finds Procedure

An unexpected finds procedure has been developed to manage instances where TTSTS may be detected during pre-clearing surveys, clearing operations or at any other time throughout construction. This is in response to the recognition that parts of the Project study area are relatively linear (i.e. 10 m wide for levee works) and individuals can move into these areas following the field surveys used to inform this management plan.

In an unexpected finds instance, the management strategies outlined in this plan will be adopted and include:

- Protection of TTSTS habitat including provisions for its protection from ancillary areas and their associated impacts consistent with MCoA B1 and D36;
- Installation of temporary exclusion fencing;
- Additional pre-clearing surveys as deemed appropriate by the Project Ecologist;
- Relocation of individuals using the framework developed in this plan;
- Updating of relocation sites, construction drawings and environmental sensitive area plans; and
- A periodic examination and review of the adequacy of the proposed mitigation measures proposed at that site in consultation with the EPA.

3.10 Updates to this Plan

This plan should be updated in circumstances where new information necessitates such an update followed by EPA endorsement and advice to DPE under the normal CEMP and FFMP approval process.

4.0 INSPECTION AND MONITORING IN RELATION TO THE TTSTS

Inspection, monitoring and surveillance regimes will be detailed in the main CEMP document to be prepared by the awarded contractor. The tables below summarise important actions relevant to TTSTS management.

Table 4-1. Environmental Monitoring Requirements.

Inspection	Objectives	Responsibility	Output	Timing
Site Inspection	Review status of all controls and general environmental performance	Environmental Advisor	Weekly Environmental Checklist	Weekly
Site Inspection	Observe general environmental performance	Environmental Manager/ Environmental Advisor	Correct any observed Non- Conformances as they arise	As required to coincide with inspections
Site surveys	Ensure surveys are being completed prior to and during the disturbance and removal of known and potential TTSTS habitat and relocating individual TTSTS in accordance with this plan	Project Ecologist	Daily pre-clearing checklist and post clearing report	Daily and at completion of construction activities that seek to disturb and remove known and potential TTSTS habitat

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6.0 APPENDIX A – FIELD SURVEY REPORTS FOR TTSTS

INSERT:

1. Lewis, B.D (2016). Additional crossing of the Clarence River at Grafton: Biodiversity Gap Field Survey – Stage 2. Report prepared for the Roads and Maritime Services by Lewis Ecological Surveys. ©
2. Lewis, B.D (2016). Additional crossing of the Clarence River at Grafton: Targeted Surveys for Three-toed Snake Tooth Skink – Stage 3. Report prepared for the Roads and Maritime Services by Lewis Ecological Surveys. ©

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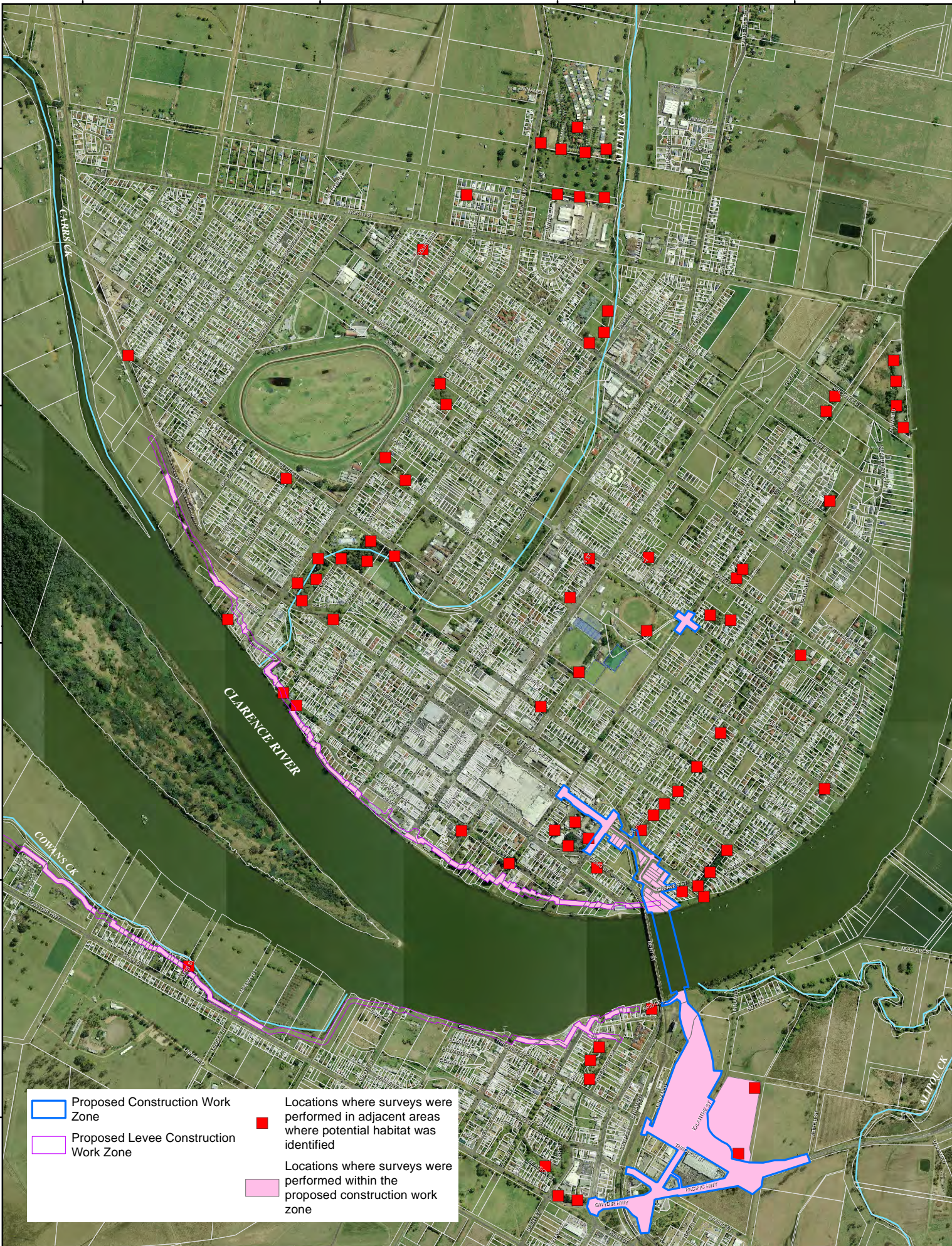
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 Proposed Construction Work Zone	 Locations where surveys were performed in adjacent areas where potential habitat was identified
 Proposed Levee Construction Work Zone	 Locations where surveys were performed within the proposed construction work zone



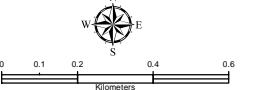
LEWIS
ECOLOGICAL

Source: Aerial Photo: RMS
September 2010
Work Zones: RMS 2015
Cadastral database: RMS
2015

Three-toed Snake Tooth
Skink Habitat: Lewis
Ecological 2016

This plan is based on or contains data provided by others. GeoView gives no warranty in relation to the data (including accuracy, reliability, completeness, currency or suitability) and accepts no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to and use of the data. Data must not be used for direct marketing or be used in breach of privacy laws.

File: 2751516-FIG2-1-TTST-SurveySites-160429



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Kilometers

A4 Scale 1:20,000

Coordinate System: MGA56 Projection: Transverse Mercator

Figure B-1:
**DISTRIBUTION OF THREE-TOED SNAKE
TOOTH SKINK SURVEY SITES**

8.0 APPENDIX C – PHOTOGRAPHS – PICS IDENTIFYING VARABILITY IN INDIVIDUAL TTSTS

Location 1 - APO 8 with one adult (Snout-vent 118 mm and Total Length 229 mm) recorded in leaf litter beneath a mature Avocado Tree (*Persea americana*) immediately adjacent to the block wall levee (Plate 8-1; Plate 8-2). Micro habitat at the capture site included a leaf litter layer up to 300 mm in depth and loose friable soil adjacent to some mown lawns. Numerous earth worms were also observed at this location.



Plate 8-1. Adult Three-toed Snake Tooth Skink captured from APO 8.



Plate 8-2. Capture location (R. Jago positioned) at APO 8 beneath a mature Avocado Tree. Note levee block wall in foreground.

Location 2 – Greaves Street - APO 13 where a sub adult or juvenile (Snout-vent 56 mm and Total Length 97 mm) was recorded beneath a house brick on the eastern side of the dwelling (Plate 8-3 and Plate 8-4). This property has regularly maintained gardens with deep mulch beds to reduce moisture loss for ornamental plantings.



Plate 8-3. Juvenile or sub adult Three-toed Snake Tooth Skink captured from APO 13



Plate 8-4. Capture location at APO 13 with brick displaced.

9.0 APPENDIX D – AGENCY AND KEY STAKEHOLDER COMMENTS

9.1 Project Environmental Representative – Simon Williams

From: Simon Williams [<mailto:SWilliams@geolink.net.au>]

Sent: Monday, 2 May 2016 3:59 PM

To: O'DONNELL John

Cc: NASH Gregory D; Correspondence.Graftonbridge

Subject: RE: Grafton Bridge Draft Three-Toed Snake Tooth Skink Management Plan Vers 2

Hi John,

I have read the MP. Very thorough and I have no comments.

Regards

Simon

Simon Williams

Director

GeoLINK Pty Ltd

M 0488 677 666

P 02 6772 0454

W www.geolink.net.au

9.2 Environmental Protection Agency – Peter Higgs

Hi John,

The EPA appreciates the opportunity to review the draft three toed snake toothed skink management plan for the Grafton bridge project. The EPA is satisfied that the plan is adequate to manage the construction impacts on this cryptic species, and has no further comment at this time.

Happy to discuss this further if necessary.

Regards

Peter

Sent from my iPhone

9.3 Clarence Valley Council – Rodney Wright

From: Rodney Wright [<mailto:Rodney.Wright@clarence.nsw.gov.au>]

Sent: Tuesday, 3 May 2016 9:50 AM

To: O'DONNELL John

Subject: RE: Grafton Bridge Draft Three-Toed Snake Tooth Skink Management Plan Vers 2

Thanks John plan looks good from my end no comments to add. Regards Rod

Rodney Wright

Natural Resource Management Coordinator

Clarence Valley Council

Locked Bag 23, GRAFTON NSW 2460

P: (02) 6645 0265

F: (02) 6642 7647



M: 0417 779 806



www.clarence.nsw.gov.au







Annexure M: Potential threatened flora and fauna species identification guide



MMB9: Threatened species guidelines will be developed for threatened flora and fauna likely to occur directly within the project area and which may be impacted during construction, in order to show and educate construction workers of its appearance and outline what should be done if the species is found during construction. Relevant species include Hairy-joint grass, Three-toed Snake-tooth Skink, Grey-headed Flying-fox and Microbats.



Species	EPBC Act conservation status	TSC Act conservation status	Picture	Source/ Reference
FLORA				
Hairy-joint Grass <i>Arthraxon hispidus</i>	Vulnerable	Vulnerable	 <p data-bbox="1034 788 1384 820">Arthraxon hispidus seed head</p>  <p data-bbox="1034 1278 1256 1310">Arthraxon hispidus</p>	http://rainforestinfo.org.au/spp/npws/arthraxon_hispidus.htm


Species	EPBC Act conservation status	TSC Act conservation status	Picture	Source/ Reference
FAUNA				
Birds				
Masked Owl <i>Tyto novaehollandiae</i>	-	Vulnerable		http://www.birdsinbackyards.net/species/Tyto-novaehollandiae
Mammals				
Hoary Wattled Bat <i>Chalinolobus nigrogriseus</i>	-	Vulnerable	 <p data-bbox="1014 1241 1263 1265">Photographer: Peter Richards</p>	http://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10158

Species	EPBC Act conservation status	TSC Act conservation status	Picture	Source/ Reference
Little Bentwing-bat <i>Miniopterus australis</i>	-	Vulnerable	 <p data-bbox="1014 775 1200 799">Photographer: G Little</p>	http://australianmuseum.net.au/little-bent-wing-bat
Eastern Bentwing-bat <i>Miniopterus schreibersii oceanensis</i>	-	Vulnerable		http://www.environment.nsw.gov.au/savingourspeciesapp/project.aspx?ProfileID=10534

Species	EPBC Act conservation status	TSC Act conservation status	Picture	Source/ Reference
Eastern Freetail-bat <i>Mormopterus norfolkensis</i>	-	Vulnerable	 <p data-bbox="1014 756 1223 778">Photographer: GB Baker</p>	http://australianmuseum.net.au/image/eastern-freetail-bat-grooming
Southern Myotis <i>Myotis macropus</i>	-	Vulnerable	 <p data-bbox="1014 1230 1216 1252">Photographer: A Young</p>	http://australianmuseum.net.au/southern-myotis

Species	EPBC Act conservation status	TSC Act conservation status	Picture	Source/ Reference
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	Vulnerable	Vulnerable	 <p data-bbox="1014 855 1249 874">Photographer: Vivien Jones</p>	http://www.wildlife.org.au/wildlife/speciesprofile/mammals/flyingfox/greyheaded_flyingfox.html
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	-	Vulnerable	 <p data-bbox="1014 1201 1249 1220">Photographer: Ian Gynther</p>	http://wetlandinfo.ehp.qld.gov.au/wetlands/ecology/components/species/?scoteanax-rueppellii#!prettyPhoto[1]/0/

Species	EPBC Act conservation status	TSC Act conservation status	Picture	Source/ Reference
Eastern Cave Bat <i>Vespadelus troughtoni</i>	-	Vulnerable	 <p data-bbox="1014 853 1261 874">Photographer: B.G. Thomson</p>	http://bie.ala.org.au/species/VESPADELUS+TROUGHTONI
Reptiles				
Three-toed Snake-tooth Skink <i>Coeranoscincus reticulatus</i>	Vulnerable	Vulnerable	 <p data-bbox="1014 1281 1305 1302">Photographer: Steward Macdonald</p>	http://www.arkive.org/three-toed-snake-tooth-skink/coeranoscincus-reticulatus/
Fish				

Species	EPBC Act conservation status	TSC Act conservation status	Picture	Source/ Reference
Purple-spotted Gudgeon <i>Mogurnda adspersa</i>	-	Endangered	 <p data-bbox="1016 635 1285 655">Photographer: Gunther Schmida</p>	http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0014/462101/primefact_purple_spotted_gudgeon_20130325.pdf