GREENCAP
Going Further in Managing Risk

STAGE 2 BIODIVERSITY MANAGEMENT PLAN

October 2020
J156455-13

NSW Health Infrastructure
Tweed Valley Hospital

C107778: DL

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Document and Project Control

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Written By:  Senior Environmental Scientist	Checked By:  Principal Consultant Environment	Authorised By:  Regional Practice Manager
Conflict of Interest Statement	Greencap warrants that as at the date of lodgement of the Stage 2 Biodiversity Management Plan, no actual, perceived or potential conflict of interest exists between it or between any one or more of Greencap's officers, employees, consultants or agents and Health Infrastructure, or is likely to arise in relation to the Report that is submitted for this project, and if any conflict of interest arises or is likely to arise Greencap will immediately notify Health Infrastructure in writing of that actual, perceived or potential conflict of interest.	

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Stage 2 Biodiversity Management Plan

NSW Health Infrastructure
Tweed Valley Hospital

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Glossary, Acronyms and Abbreviations

Abbreviation	Definition
APZ	Asset Protection Zone
BC Act	*Biodiversity Conservation Act 2016*
BC Regulation	*Biodiversity Conservation Regulation 2016*
BAM	*Biodiversity Assessment Method Order 2017*
Coastal Management SEPP	State Environmental Planning Policy (Coastal Management) 2018
CKPoM	Tweed Coast Comprehensive Koala Plan of Management 2015
DPIE	NSW Government Department of Planning, Industry and Environment
EEC	Ecological communities that are listed as 'endangered' under the *Biodiversity Conservation Act 2016.*
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Cth)
FMP	Fauna Management Plan
LGA	Local Government Area
OEH	Office of Environment and Heritage
PCT	Plant Community Type
PMF	Probable Maximum Flood
SEARs	Secretary's Environmental Assessment Requirements
SRZ	Structural Root Zone
TEC	Ecological communities that are listed as 'threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* and the *Biodiversity Conservation Act 2016.*
TPZ	Tree Protection Zone
TSC	Tweed Shire Council
VI	Vegetation Integrity
VMP	Vegetation Management Plan
WM Act	NSW Water Management Act 2000
WoNS	Weeds of National Significance
WQMP	Water Quality Management Plan

1. INTRODUCTION

1.1 Overview

Greencap Pty Ltd (Greencap) was commissioned by TSA Management (TSA) on behalf of Health Infrastructure to prepare a Biodiversity Development Assessment Report (BDAR) to support the approval process for the proposed Tweed Valley Hospital (the Project). The approval process for the Project consists of a State Significant Development (SSD) application under Section 4.22 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). All projects which are classified as SSD require the preparation of a BDAR in accordance with the requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act) and the *Biodiversity Assessment Method Order 2017* (BAM).

The Stage 2 BDAR (Greencap 2019b) identifies a range of measures to avoid, minimise or mitigate the potential impacts of the Project on biodiversity. This Stage 2 Biodiversity Management Plan (Stage 2 BMP) provides a plan for how these commitments will be actioned.

1.1.1 Description of the Proposal

On the 11 June 2019 the Minister for Planning and Public Spaces granted approval for the Concept Proposal and Stage 1 Early and Enabling Works for the new Tweed Valley Hospital (SSD 9575) located at 771 Cudgen Road, Cudgen (Lot 11 DP1246853).

Stage 2 of the TVH development (Stage 2 application – SSD 10353) sought approval for detailed design, construction and operation of a new hospital building (two-nine storey in height); three (one-two storey) buildings for support services (Health Hub); a temporary building accommodating a skills centre; car parking areas including the multi-deck carpark; internal road layouts; landscaping; coastal wetland rehabilitation; services; signage; operation and use of the site; and external roadworks including intersection upgrades. On 12 June 2020 the Minister for Planning and Public Spaces consent to the development application.

All documents relating to these consents can be found on the major project website of DPIE at https://www.planningportal.nsw.gov.au/major-projects/project/10756.

The Environmental Impact Statement (EIS) was been prepared to assist in the State Significant Development (SSD) Stage 2 Application for the Tweed Valley Hospital which will be assessed under Part 4 Division 4.7 of the Environmental Planning and Assessment Act 1979 (EP&A Act). This, along with supporting documentation, provides a clear outline of the Stage 2 Application.

The Tweed Valley Hospital Project broadly consists of:

- Construction of a new Level 5 major regional referral hospital to provide the health services required to meet the needs of the growing population of the Tweed-Byron region (in conjunction with the other hospitals and community health facilities across the region);
- Delivery of the supporting infrastructure required for the Tweed Valley Hospital, including green space and other amenities, roads and car parking, external road upgrades and connections, utilities connections, and other supporting infrastructure.

1.1.2 Stage 2 Hospital Main Works and Operation

The Stage 2 SSD component seeks consent for the Main Works and Operation of the Tweed Valley Hospital, including:

• Construction of Main Hospital Building – Main entry and retail area – Administration – Community health – In-Patient units – Outpatient clinics and day only units – Child and Adolescent Services – Intensive Care Unit – Mental Health Unit – Maternity Unit and Birthing Suites – Renal Dialysis – Pathology – Pharmacy – Radiation Oncology as part of integrated Cancer Care – Emergency Department – Perioperative Services – Interventional Cardiology – Medical Imaging – Mortuary – Education, Training, Research – Back of House services – Rooftop Helipad	**• Construction of Support Buildings, referred to as the 'Health Hub', containing:** – Oral Health – Community Health – Aboriginal Health – Administration – Education, Training and Research **• Internal Roads and carparking, including multi-deck parking for staff, patients and visitors;** **• Construction of a temporary building for the 'Tweed Valley Skills Centre'** **• External road infrastructure upgrades and main site access** **• Environmental and wetland rehabilitation, including rehabilitation of existing farm dam as outlined in the Biodiversity Development Assessment** **• Report (BDAR) prepared for the Concept Proposal and Stage 1 works** **• Site landscaping** **• Signage** **• Utility and service works**

The works outlined above comprise five key components, which are subject to various funding allocations and may be delivered independently to each other. Stage 2 has therefore been defined in the following sub-stages (stages are not listed in chronological order and may be delivered independently to each other):

- Stage 2A – Main Hospital Building complete with supporting roads, services infrastructure and landscaping
- Stage 2B – Main Hospital Building incremental expansion areas
- Stage 2C – Health Hub
- Stage 2D – Tweed Valley Skills Centre
- Stage 2E – Multi-deck car park.

Development consent was sought for all 5 components of Stage 2 under this SSDA.

Plans for Stage 2 Main Works and Operation are attached in Appendix B of the EIS. Approval of Stage 2 enables the new Tweed Valley Hospital to be built which will provide a much-needed contemporary health service facilities for the surrounding region.

1.1.3 Potential Future Expansions

Any subsequent stages or modifications to the proposal would be subject to separate applications as required including the potential future expansion of the facility.

1.2 BMP Version History

This BMP addresses the impacts of the Stage 2 Stage Significant Development (SSD 10353). It is a revision of and extension to the Stage 1 BMP (Greencap 2019a). It has been updated to include the detailed design plans and an assessment of any potential additional biodiversity impacts for the Project. This revision for Stage 2 has not removed all information pertaining specifically to Stage 1 works in order to demonstrate consistency with the Stage 1 BMP.

1.3 Purpose, aim and objectives

The aim of this Stage 2 BMP is to identify the activities that will be undertaken to avoid, minimise and/or mitigate impact on biodiversity during the construction and operation of the Project. The purpose of this Stage 2 BMP is to provide an implementation plan for what, when, how and by whom these activities will be undertaken during construction and operational phases. The objectives of the Stage 2 BMP are to:

- Avoid, minimise and mitigate the impact of the project on threatened species and ecological communities;
- Enhance existing flora and fauna habitats and corridors that are proposed to be retained; and
- Control the movement of weeds on and off the Project site in accordance with the general biosecurity duty.

This Stage 2 BMP is comprised of three sub-plans, namely:

- Vegetation Management Plan (VMP) in Section 2;
- Fauna Management Plan (FMP) in Section 3; and
- Water Quality Management Plan (WQMP) in Section 4.

The three sub-plans are to be implemented during the Stage 2 construction and operation phases of the Project and include adaptive management measures for impacts on biodiversity that are uncertain.

1.4 Related plans

This Stage 2 BMP has been prepared based on the Project information made available for Stage 2.

This Stage 2 BMP was prepared in alignment with the *Tweed Valley Hospital Stage 2 Management Plan – Soil and Water* (Construction Soil and Water Management Plan, CSWMP; LLB 2020) and the *Project Construction Environmental, Health & Safety Management Plan- Main Works* Rev 05 (CEMP; LLB 2019), developed as per the SSD 9575 Conditions and SSD 10353 Secretary's Environmental Assessment Requirements (SEARs) dated 18 July 2019.

The CEMP outlines measures to mitigate environmental impacts during the Stage 2 construction phase. The CEMP addresses a range of indirect impacts on biodiversity that were identified in the Stage 1 and Stage 2 BDARs (Greencap 2019b, Greencap 2019d).

Whilst not strictly relating to impacts on biodiversity, the Landscape Masterplan documentation including the Zonal Plan (Turf 2019c) and Site-wide Landscape Plan (Turf 2019d) have been developed with consideration of the existing landscape context and ecology with plant selection that relates to the local climate and landscape character (see **Section 2.2**). It is intended that this Stage 2 BMP informs the development of implementation plans subsequent to the abovementioned documentation.

Consultant reports or advice informing or referenced in this Stage 2 BMP (including those in draft form) are provided in **Table 1**.

Table 1 Related Plans and consultant Reports

Report	Author	Version
Tweed Valley Hospital Proposed Site Plan – STB-AR-SKE-PRW-1000015A[1]	STH Batessmart	Rev 1, 6th September 2019
Auxiliary Lane and Roundabout Tree Clearance Plans Drawing numbers: RBG-CV-DWG-RIE-83-151 and RBG-CV-DWG-RIE-81-101	Robert Bird Group	Rev 2, 26th August 2019
Main Entrance General Arrangement Plans Drawing numbers: RBG-CV-DWG-RIE-87-300,301 & 302	Robert Bird Group	Rev 1, 16th August 2019
Tweed Valley Hospital Development Zonal Plan – LS_DWG-10-003	Turf Design Studios	Rev 8, 21st September 2019
Tweed Valley Hospital Development Site-wide Landscape Plan – LS_DWG-10-001	Turf Design Studios	Rev 7, 23rd September 2019
Tree Removal and Preservation Plan LS-DWG-02-001	Turf Design Studios	Rev 7, 23rd September 2019
SSD2 Landscape Report	Turf Design Studios	23rd September 2019
State Significant Development Aviation Report; Tweed Valley Hospital SSD-10353	AviPro	19th November 2019
Bushfire Hazard Assessment Tweed Valley Hospital	GeoLINK	Version 3, 14th August 2019
External Lighting Strategy Report Tweed Valley Hospital	LCI	15th August 2019
Groundwater and soil investigation report 771 Cudgen Rd, Cudgen, NSW	Cavvanba	19038 R02, August 2019
Noise & Vibration Impact Assessment for SSDA – Tweed Valley Hospital Stage 2	JHA	Rev C, 15th August 2019
Preliminary and Detailed Site Investigation	Octief	6th September 2018
Stormwater Management Plan – Tweed Valley Hospital, Prepared for Stage 2 SSD Application	Robert Bird Group	Issue C, 16th August 2019
Tweed Valley Hospital Construction & Environmental Management Plan – Main Works (CEMP)	Lendlease Building	Rev 05, 16th August 2019
Tweed Valley Hospital – Stage 2 Conservation and Habitat Management Sub-plan (CHMSP)	Lendlease Building	Revision 2.2, 12th July 2019
Tweed Valley Hospital – Stage 2 Heritage and Archaeological Management Sub-plan (CHAMSP)	Lendlease Building	Revision 2.2, 12th July 2019

Report	Author	Version
Tweed Valley Hospital – Stage 2 Construction Air Quality Management and Dust Management Sub-plan (CAQMADM)	Lendlease Building	Rev 3.0, 9th July 2019
Tweed Valley Hospital – Stage 2 Construction Soil & Water Management Sub-plan (CSWMSP)	Lendlease Building	Rev 3.3, 11th August 2020
Tweed Valley Hospital – Stage 2 Construction Noise & Vibration Management Sub-plan (CNVMP)	Lendlease Building	Rev 2.2, 12th July 2019
Tweed Valley Hospital – Stage 2 Preliminary Construction Traffic Management Plan (CTPMSP)	Lendlease Building	Rev 3, 16th August 2019
Tweed Valley Hospital – Stage 2 Construction Waste Management Sub-Plan (CWMSP)	Lendlease Building	Rev 4, 19thAugust 2019
Tweed Valley Hospital – Stage 2 Sediment and Erosion Control Management Sub-plan	Lendlease Building	Rev 3.1, 12th July 2019
Tweed Valley Hospital Hydrology Assessment (Draft Final)	SMEC	Rev 2, 15th August 2019
Management Plan for the Mitchell's Rainforest Snail *Thersites mitchellae* (Cox, 1864) at 771 Cudgen Rd, Cudgen, New South Wales	Invertebrate Identification Australasia	Draft, June 2019
Pre-construction baseline survey of *Thersites mitchellae* (Cox, 1864) (Mitchell's Rainforest Snail) at 771 Cudgen Rd, Cudgen, New South Wales	Invertebrate Identification Australasia	Draft, 3rd June 2019
Tweed Valley Hospital Project Traffic Impact Assessment	Bitzios Consulting	16th August 2019
Biodiversity Development Assessment Report – Tweed Valley Hospital	Greencap	Rev H, 25th January 2019
Stage 2 SSD: Biodiversity Development Assessment Report, Tweed Valley Hospital	Greencap	23rd September 2019
Stage 1 Biodiversity Management Plan – Tweed Valley Hospital	Greencap	Rev 2, 9th September 2019

1.5 Legal requirements

1.5.1 Related environmental legislation

The following legislation is applicable to the management of biodiversity on this site:

- *Biodiversity Conservation Act 2016*
- *Environmental Planning and Assessment Act 1979* and related instruments, including:
    - SEPP Coastal Management 2018
    - SEPP 44 Koala Habitat Protection
- *Coastal Management Act 2016*
- *Biosecurity Act 2015*; and
- *Environmental Protection and Biodiversity Conservation Act, 1999 (Cth).*

1.5.2 Conditions of approval

The State Significant Development (SSD 9575) Final Conditions of Development Consent dated 11 June 2019 Conditions B20 and B21 as per Schedule 2 Part B – Conditions to be satisfied in future development application(s) as listed below in **Table 2** are addressed in this Stage 2 BMP.

The State Significant Development (SSD 10353) Final Conditions of Development Consent dated 12 June 2020 Conditions B18 and B31 of Schedule 2 Part B – Conditions to be satisfied prior to commencement of construction and Condition D40 of Schedule 2 Part D – Conditions to be satisfied prior to commencement of operation as listed below in **Table 2** are addressed in this Stage 2 BMP.

Table 2 Final conditions relevant to BMP

Condition	BMP Reference(s)
SSD 9575	
B20. The Stage 2 application must demonstrate that the proposal is consistent with the endorsed *Biodiversity Development Assessment Report* prepared by Greencap dated January 2019 (BDAR) and the *Matters of National Environmental Significance Report* (MNES) prepared by Greencap dated February 2019 and all recommendations to mitigate the direct, indirect and prescribed impacts in the BDAR and the MNES.	**Section 1.11**
B21. The Stage 2 application must be supported by a long-term Biodiversity Management Plan (BMP) including the following:	
(a) details of long term measures to protect and maintain the vegetation on the northern part of the Site, specifically the coastal wetlands mapped under the Coastal Management SEPP;	**VMP Section 2.3.3** **Table 7**
(b) details of measures to protect the retained vegetation in the Tweed Coast Road / Cudgen Road intersection upgrade site;	**VMP Section 2.3.1** **Table 5 (Items 1 and 2)** **Figure 7**
(c) details of measures to protect the identified trees for retention in the Preliminary Arboricultural Report prepared by Arbor safe dated 17 October 2018;	**VMP Section 2.3.1** **Table 5 (Items 1 and 2)**
(d) a Vegetation Management Sub-Plan (VMP) for the Site that incorporates revegetation of the exotic grassland in Zone 9 with rainforest species, regeneration and weed management of retained remnant vegetation in the north of the Site;	**VMP Sections 2.3.2.1, 2.3.2.7, 2.3.4, 2.3.5 and 2.3.6** **Table 5 (Item 11)** **Table 7 (Item 16)** **Table 8** **Table 9 (Items 19, 23, 26, 37 and 110)**
(e) installation of the identified 'stepping-stone' habitats and rain gardens within the Site to improve threatened species connectivity;	**VMP Section 2.4.2** **Table 9 (Items 20 and 21)** **FMP Section 3.3.2** Error! Reference source not found.
(f) identify suitable wildlife friendly fencing that would not impede the movement of fauna in the future with no fencing on the northern boundary of the Site;	**FMP Section 3.3.1** **Figure 7**

Condition	BMP Reference(s)
(g) details of how the VMP links to the Landscape Masterplan for the Site which is focused on the regeneration of retained windrows, as well as native landscape plantings;	**Section 1.4** **VMP Section 2.3** **Table 4**
(h) details of a lighting strategy to mitigate impacts on light sensitive fauna (if relevant) due to light spill from the development;	**FMP Section 3.9.1**
(i) a water quality management plan including the water quality monitoring techniques to be adopted to ensure that the water quality targets to be achieved for the Site are always maintained (except large flood events);	**WQMP Section 4.4**
(j) a Habitat Management Sub-Plan (HMP) for the identified threatened species, ecological endangered communities (EEC) and threatened ecological communities (TEC);	**Section 1.10** **VMP Section 2** **FMP Section 3 and** **WQMP Section 4** **Appendix D**
(k) proposed measures contributing to the recovery of the Mitchell's rainforest snail (*Thersites mitchellae*), consistent with the published recovery plan (NPWS 2011);	**VMP Section 2.4.4** **FMP Section 3.2.2**
(l) proposed measures of rehabilitating the existing dam at the north-western corner of the Site to prevent the growth of salvinia (*Salvinia molesta*) in the dam and agricultural drain;	**VMP Section 2.3.2.7**
(m) A Fauna Management Sub-Plan (FMP) for the Site including details of impacts and proposed mitigation measures due to loss of connectivity, impact on movement, details of fencing to allow movement, restricting developments in identified areas, light spill and operational noise; and	**FMP Section 3**
(n) evidence of consultation with the Office of Environment and Heritage (OEH) in the preparation of the BMP.[1]	**Section 1.9**
SSD 10353	
B18. The Applicant must prepare a Construction Soil and Water Management Plan (CSWMSP) and the plan must address, but not be limited to the following:	
(c) (iv) the recommendations in Section 3.2.4 of the Stage 2 SSD Biodiversity Assessment Report prepared by Greencap dated September 2019 (BDAR).	**Table 1** **Table 14 (Item 101)**
(j) management measures for cane toad Rhinella marina around sediment basins during construction works in accordance with the Stage 2 Biodiversity Management Plan prepared by Greencap dated September 2019 (as updated by conditions of this development consent) (Stage 2 BMP);	**Section 2.4.2** **Section 3.4**
(k) monitoring methods for aquatic weeds (particularly salvinia *Salvinia molesta*) in sediment basins in accordance with the recommendations of Stage 2 BMP;	**Section 2.3.2.7**
B31. Prior to commencement of any construction the Stage 2 BMP must be updated to the satisfaction of the Planning Secretary to include the following commitments:	
(a) deletion of the recommendation to introduce Duckweed and Azolla to supress the growth of Salvinia;	**VMP Section 2.3.2.6**
(b) define the areas of 'environmental conservation';	**Section 1.12**

Condition	BMP Reference(s)
	Table 3 and Table 4 **Figure 3 to Figure 6**
(c) describe how pet animals would be restricted with an on-leash control;	**FMP Section 3.5** **Table 11 (Item 53)**
(d) include responsibilities for the Mitchell's Rainforest Snail both during and post construction works; and	**VMP Section 2.4.4** **FMP Section 3.2.2** **Table 10**
(e) include salvage measures for animals that could be impacted by the dam infill works.	**VMP Section 2.3.2.7**
D40. Prior to commencement, a detailed Helicopter Operations Manual is to be developed by a suitably qualified and experienced aviation professional in consultation with relevant stakeholders to ensure protocols and management of helicopter operations on the site minimise impacts to neighbours, the environment and biodiversity impacts in line with all applicable measures set out in the AviPro Report 'Aviation Response to Submissions in Relation to Aviation Report' dated 26 November 2019, and the prevailing requirements of the Civil Aviation Regulation 92.	**FMP Section 3.8.3**
Appendix 3. Environmental Management and Mitigation Measures	**Sections 1.11, 3.8.3, 3.9.2 and 3.9.3** **Table 11 and Table 14** **Attachment 1**

[1]Now the NSW Department of Planning, Industry and Environment (DPIE) (formerly the NSW Office of Environment and Heritage (OEH))

1.6 Guidelines and standards

A range of guidelines and industry standards have been referenced throughout this plan including:

- *AS 4970-2009 Protection of trees on development sites* (Standards Australia 2009)
- *Byron Shire Council: Excluding cane toads from water bodies* (BSC 2013)
- *National Standards for the Practice of Ecological Restoration in Australia* (SERA 2018)
- *New South Wales Weed Control Handbook: A guide to weed control in non-crop, aquatic and bushland situations, NSW DPI Management Guide* (DPI 2018)
- *Planning for Bushfire Protection* (RFS 2006) , *Addendum 3 to PBP and PBP Pre-release 2018*
- *Salvinia Control Manual* (NSW DPI 2006)
- *Standards for Asset Protection Zones* (RFS 2007)
- *Subtropical Rainforest Restoration: A practical manual and data source for landcare groups, land managers and rainforest regenerators* (BSRLG 2005)
- *Tweed Shire Council: Native Species Planting Guide* (TSC 2019)
- *Tweed Shire Council: Development Design Specification D7 Stormwater quality* (TSC 2016)
- *Water Sensitive Urban Design: Technical design guidelines for south east Queensland* (Healthy Waterways 2006)

The full citation the above and other references are detailed in **Section 6.**

1.7 The Site

The Project site is located at 771 Cudgen Road, Cudgen (Lot 11 DP 1246853) within the Tweed Shire Council LGA (**Figure 1** and **Figure 2**) (the 'Site'). The 19.4 ha Site is located between the existing residential areas of Kingscliff and Cudgen, situated opposite Kingscliff TAFE. Approximately 16.4 ha of the Site is above the Probable Maximum Flood (PMF), a legislated requirement for hospital developments.

The northern section of the Site is located on the Tweed River floodplain and is part of an important forested wetland that has been mapped under *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP). The wetland is part of a mapped regional fauna corridor (Department of Environment, Climate Change and Water [DECCW], 2010;) and is a significant stepping-stone habitat to the Cudgen Creek estuary located approximately 800 m to the south-east of the Site.

The southern section of the Site was a working farm under cultivation (approximately 11.24 ha) and apart from the self-sown windrows along the Site boundary, most of the southern section has been cleared of native vegetation.

The northern section of the Site has high biodiversity value and is part of a mapped fauna corridor that affords connectivity and enables the movement of threatened species. At a local scale this forested wetland with associated rainforest components blends eastward into a coastal floodplain wetland (Keith, 2004) that extends to within 200 m of the coast. This area of remnant vegetation has been avoided by the development footprint and therefore avoids directly impacting threatened species and Threatened Ecological Communities (TECs). Direct impacts on several other windrows located along the western, southern and eastern boundaries of the site have also been avoided.

The only areas of native vegetation proposed to be cleared are parts of the self-sown windrows in the southern section of the Site. These windrows are composed of self-sown early regrowth rainforest species as well as High Threat Exotic woody weeds including mature planted slash pine *Pinus elliottii* with an understory predominately consisting of camphor laurel *Cinnamomum camphora*, small leaved privet *Ligustrum sinense* and umbrella tree *Schefflera actinophylla*.

1.8 Stage 2 Project Phases

In order to achieve objectives of the VMP, FMP, WQMP and address the SSD 9575 and SSD 10353 Final Conditions of Development Consent, several activities will be undertaken at different phases (i.e. construction or operation) of the Project during Stage 2. Certain vegetation management measures commence during Stage 1 early works upon Stage 1 SSD approval as identified in the Stage 1 BMP (Greencap 2019c) and will continue throughout Stage 2. Therefore, this Stage 2 BMP also includes some Stage 1 components which are carried over into Stage 2.

The timing of the Stage 2 BMP activities has been described as per the following two Project phases:

- Construction (C); and
- Operations (O).

1.9 Consultation

In accordance with SSD 9575 Schedule 2 Condition B21, this Stage 2 BMP has been prepared in consultation with the NSW Department of Planning, Industry and Environment (DPIE) (formerly the NSW Office of Environment and Heritage (OEH)) and will be submitted to the Planning Secretary for

approval prior to the commencement of any works on the Site, approved under Stage 2 of this consent.

Consultation with DPIE for this Stage 2 BMP commenced in late 2019. Comments were received from the Biodiversity and Conservation Division (BCD) of DPIE on Monday 16 September 2019 following the submission of version 1 the draft Stage 2 BMP and on 30 September 2020 following review of version 4 of the Stage 2 BMP.

1.10 Habitat Management Sub-Plan

In accordance with Condition 2 B21 (j), the Stage 2 BMP must include a Habitat Management Sub-Plan (HMP) for the identified threatened species, ecological endangered communities (EEC) and threatened ecological communities (TEC) including the Koala food trees Zone 6. The mitigation and management measures for the identified threatened species, EEC's and Koala food trees identified on or directly adjacent to the Site are addressed within the VMP (**Section 2**), FMP (**Section 3**) and WQMP (**Section 4**) sub-sections and therefore collectively these sub-plans address the requirements for a HMP. An equivalency table is presented in **Appendix D** consolidating requirements within the VMP, FMP and WQMP substantiating a HMP.

1.11 Mitigation measures

This Stage 2 BMP addresses all recommendations to mitigate the direct, indirect and prescribed impacts for Stage 2 works contained in the endorsed BDAR, the MNES Report and the management and mitigation measures in Appendix 2 of the conditions.

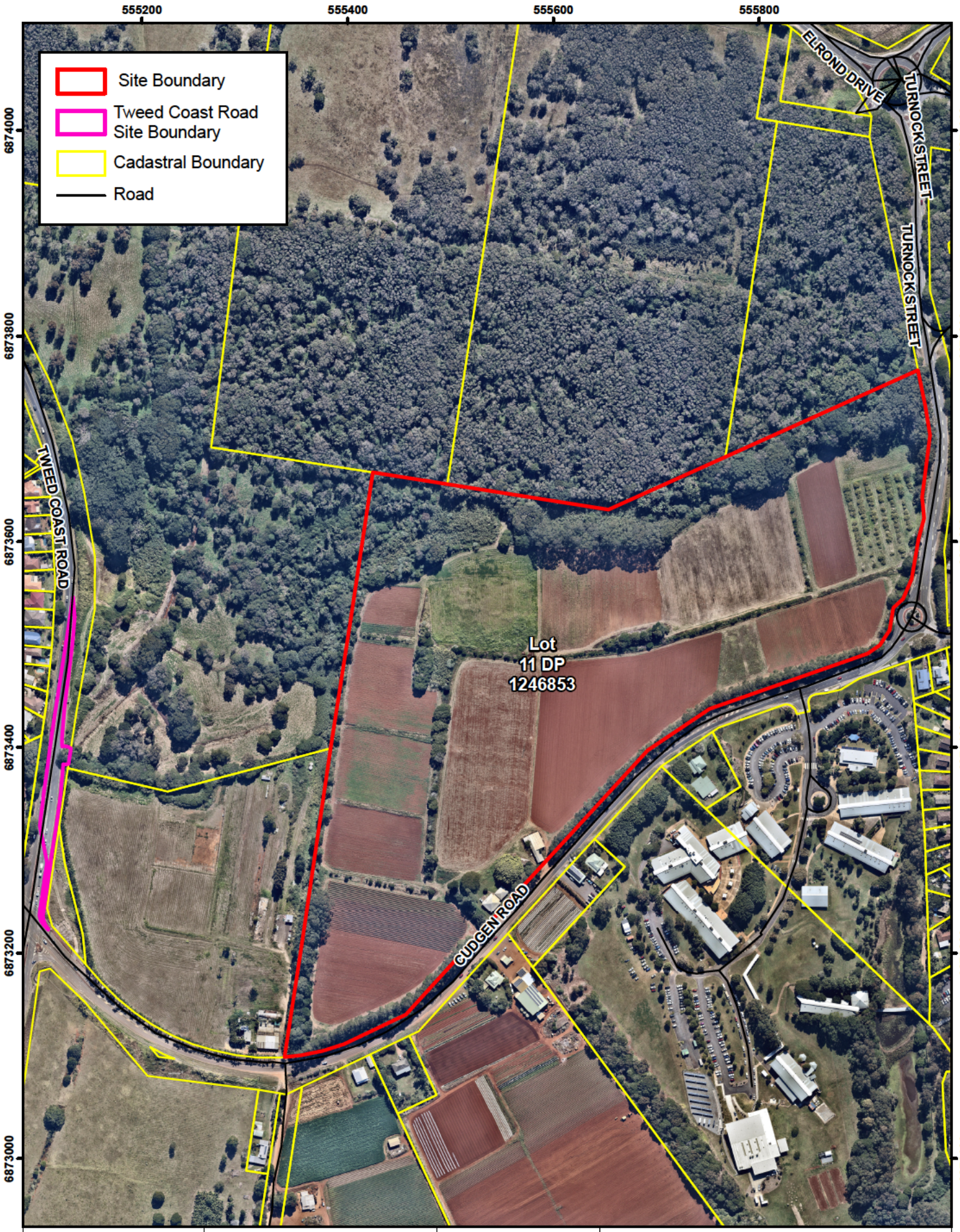
Mitigation measures and where they are addressed in this Stage 2 BMP is shown in **Attachment 1**.

1.12 Areas of environmental conservation

Areas of environmental significance exist across the site and are further detailed within the various subsections below. Areas of environmental conservation are defined as portions of the site where native vegetation is to be retained and/or regenerated (**Table 3** and **Figure 3** to **Figure 6**Error! Reference source not found.). They are described as BMP Management Zones 1.1 to 1.6 (**Table 4**) herein.

Management Zones 1.1 to 1.6 will be subject to ongoing management and monitoring throughout both the construction and operational phases of the project. Timing of various activities are listed as either Construction (C), Operational (O) or both for activities and measures detailed throughout the BMP. Ongoing management measures for MZs 1.1 to 1.6 are captured within:

- General vegetation management – **Section 2.3**
    - Coastal vegetation management – **Section 2.3.1.1**
    - Weed management – **Section 2.3.2**
    - Restoration – **Section 2.3.3**
    - **Table 9** – Summary of Vegetation Management Activities
- Management of MZ's relative to threatened fauna:
    - Koala habitat management – **Section 3.2.1**
    - MRS habitat management – **Section 3.2.2**
- Management of MZ's relevant to Water Quality – **Section 4.4**



Client: C107778	N 0 50 100 m	Scale (@A4): 1:4,750	**Site Map**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checked [redacted]	*Note: All data is approx only & subject to survey. Imagery 8th August 2018 (7.5 cm) © Nearmap 2018 Cadastre © NSW Department of Finance, Services and Innovation 2018*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 1**
Date: 15/10/2020			
GREENCAP Going Further in Managing Risk	*No warranty is given in relation to the data (including accuracy reliability completeness or suitability) and accept no liability (including without limitation liability in negligence) for any loss damage or costs (including consequential damage) relating to any use of or reliance upon the data. Data must not be used for direct marketing or be used in breach of privacy laws.*		

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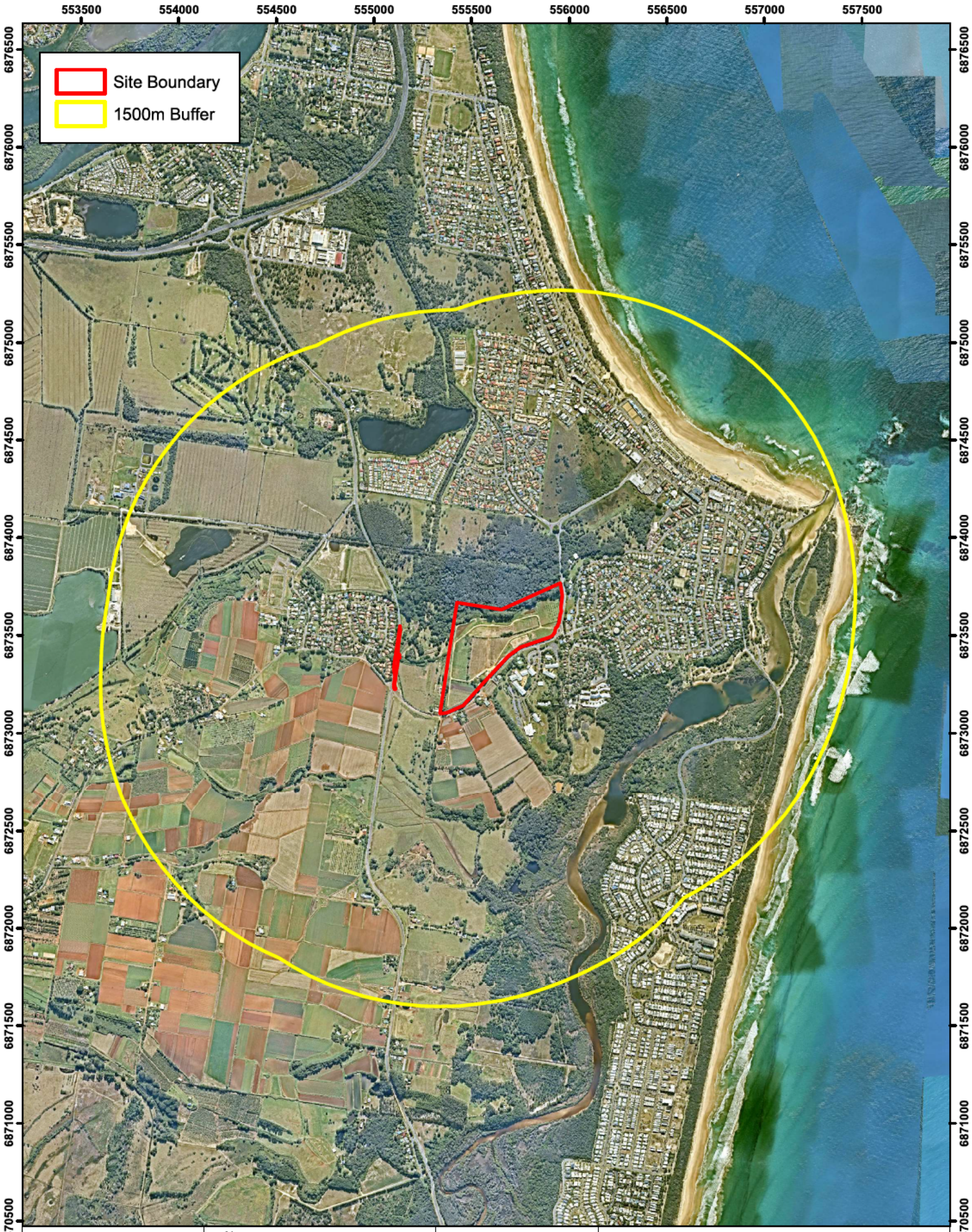

Client: C107778	N 0 350 700 m	Scale (@A4): 1:25,000	**Location Map – Stage 2**
Job #: J156455-13	Coordinate System: GDA 1994 MGA Zone 56		
Author: [redacted]	*Note: All data is approx only & subject to survey.*	Tweed Valley Hospital BMP	**Figure 2**
Checke	*Imagery 15th July 2019 (1.2 m) © Nearmap 2019*	771 Cudgen Road Cudgen NSW	
Date: 1/08/2019			
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2. VEGETATION MANAGEMENT PLAN

2.1 Vegetation management aims and objectives

The objective of this Vegetation Management Plan (VMP) is to contribute to the conservation and enhancement of biodiversity values on the Site and avoid and mitigate any potential impacts on threatened species, in particular the Mitchell's rainforest snail *Thersites mitchellae* which have been identified adjacent to this site, Threatened Ecological Communities (TEC), Koala food trees and the coastal wetlands mapped under the Coastal Management SEPP (refer **Section 4.1** and **Figure 11**). These measures will mitigate the residual impacts of the Project as outlined in the BDAR [Appendix I and J] (Greencap 2019b). This Vegetation Management Plan refers to the Vegetation Management Zones as shown in **Figure 6**Error! Reference source not found..

2.2 Existing vegetation on the Site

Observations from field surveys indicated the presence of two distinct areas of vegetation (Greencap 2019). The northern section of the Site that is located on the floodplain is substantially remnant native vegetation. The southern section of the Site that is located on a ridge is land that has been substantially cleared of native vegetation.

The remnant native vegetation is classified as forested wetland and rainforest formations (Keith 2004; **Table 3**). Adjoining the remnant vegetation is a large patch of exotic vegetation near the north-west corner and planted eucalypt windrows classified as wet sclerophyll forest shrubby sub-formation. Along the southern edge of this vegetation and extending roughly west to east across the Site, rocks that have been cleared from the cultivated fields have formed a steep slope and, in some areas, have been fashioned into a dry-stone wall up to 3 m high.

Most of the southern section of the Site is cleared land under cultivation. Rocks that have been cleared from the cultivated fields have been piled into linear mounds composed of loosely consolidated rock and soil throughout the Site. Early regrowth rainforest species and woody weeds that are classified as High Threat Exotics (HTE) under the BAM have self-sown in these areas to form windrows classified as rainforest. Along the Cudgen Road/Turnock Street boundary there is a planted slash pine *Pinus elliottii* windrow with an understory also composed of self-sown early regrowth rainforest species and woody weeds. There is also a planted eucalypt windrow in the south-west corner of the Site classified as wet sclerophyll forest shrubby sub-formation. On the eastern boundary of the Site there is a planted casuarina windrow classified as a forested wetland.

Plant community types (PCT), TECs and BDAR vegetation zones were identified using plot-based vegetation surveys undertaken as part of development of the BDAR (Greencap 2019b). A combination of the quantitative data recorded in the plot-based floristic vegetation surveys, mapping data and Site observations was used to identify PCTs and Vegetation Zones (**Table 3**, **Figure 3**). In addition to the data and information above, the Final Determinations of the former NSW Scientific Committee were then employed to confirm TECs that are located on the Site. It was assessed that two TECs are located on the Site, namely; Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC and Lowland rainforest on floodplain in the NSW North Coast Bioregion EEC, comprising of a total 1.8 ha (**Figure 3**).

A total of 63 native and 51 exotic plant species were recorded in vegetation surveys. All plant species recorded during the plot-based floristic surveys are presented in **Appendix A**. Given that the vegetation surveys were undertaken using a plot-based methodology this represents an indicative list of the plant species recorded on the Site, not a comprehensive inventory. Targeted flora species surveys were also undertaken to addresses the requirements set out in the BAM (Greencap 2019).

Except for an observation of three, stinking Cryptocarya *Cryptocarya foetida* plants there were no threatened flora species recorded during the targeted surveys (**Figure 4**).

All native vegetation on the Site will be retained with the exception of 0.95 ha of native White Booyong - Fig Subtropical Rainforest vegetation in self-sown windrows (Zones 4 and 8) which will be cleared during Stage 1 works (**Figure 5**). The majority of windrow vegetation on the southern site boundary along Cudgen Road was cleared as documented in the Stage 1 BDAR (Greencap 2019b). However, native vegetation in the windrow marked as 'vegetation to be removed' in the Stage 1 BDAR Figure 21, which will eventually form part of the MZ 7 vegetation buffer during Stage 2 works, may be retained where possible.

Vegetation to be retained, inclusive of retained forest and selected windrows is also presented in the Site-wide Landscape Plan (Turf 2019d) and Zonal Plan (Turf 2019d).

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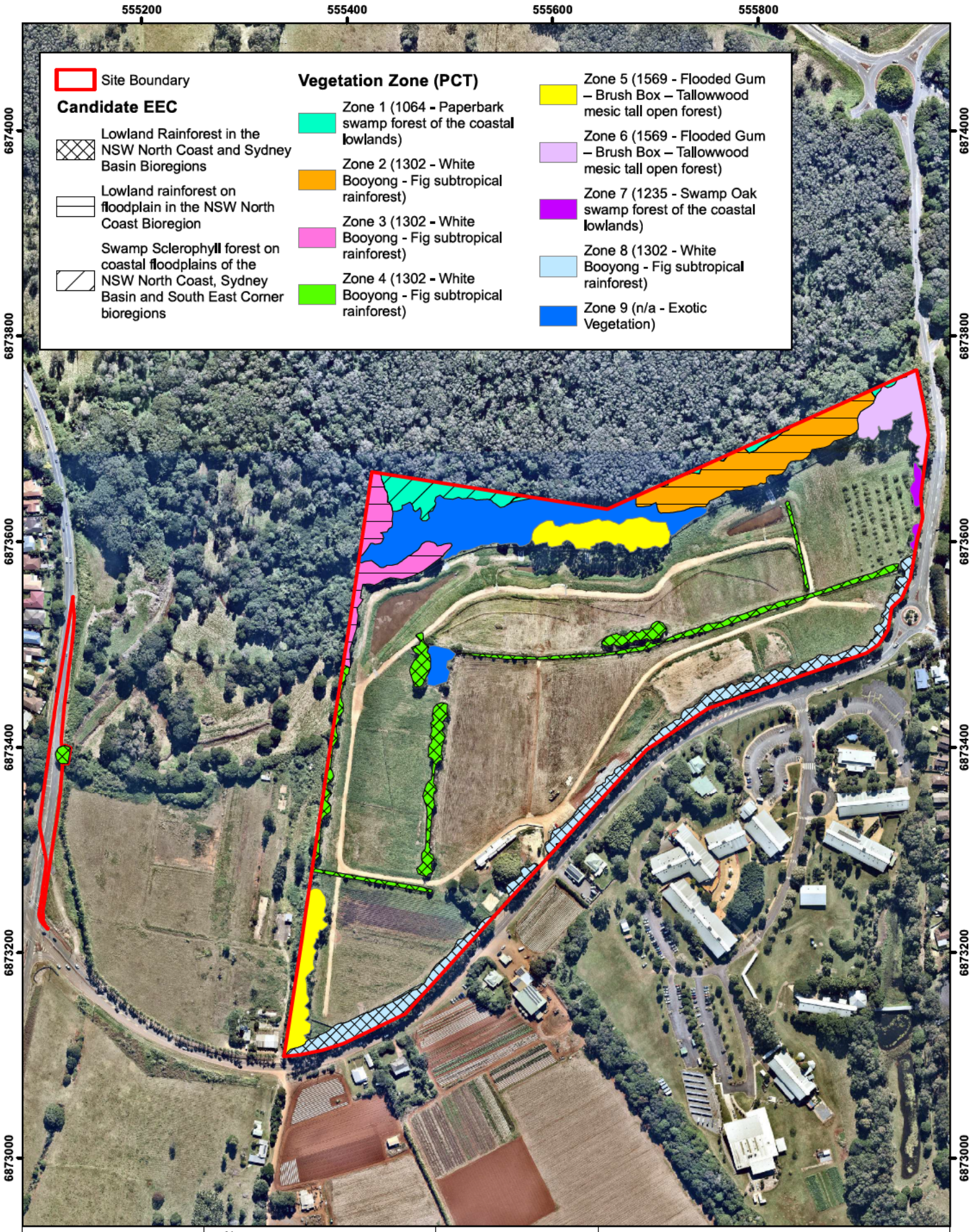
Table 3 Plant Community Types, Threatened Ecological Communities and BDAR Vegetation Zones identified on the Site

PCT	PCT Common Name	Vegetation formation	Vegetation class	Threatened Ecological Community	BDAR Vegetation Zone	Condition class	Area (ha)
1064	Paperbark swamp forest	Forested Wetland	Coastal Swamp Forest	Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC	1	Moderate	0.29
1302	White Booyong – Fig subtropical rainforest	Rainforest	Subtropical Rainforest	Lowland rainforest on floodplain in the NSW North Coast Bioregion EEC	2	Moderate	0.73
					3	Low	0.36
				Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	4	Self-sown windrow	0.61 (0.55 to be cleared)[1]
1569	Flooded Gum – Brush Box – Tallowwood mesic tall open forest	Wet Sclerophyll Forests (Shrubby sub-formation)	North Coast Wet Sclerophyll Forest	This PCT is not a TEC	5	Planted windrow	0.57
				This PCT is not a TEC	6	Planted windrow	0.29
1235	Swamp Oak swamp forest	Forested Wetland	Coastal Floodplain Wetlands	This PCT is not a TEC. Did not conform to Final Determination.	7	Planted windrow	0.05
1302	White Booyong – Fig subtropical rainforest	Rainforest	Subtropical Rainforest	Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions	8	Self-sown windrow	0.75 (0.40 to be cleared)[1]
N/A	Barner Grass – Camphor Laurel – Small-leaf Privet exotic vegetation	N/A	N/A	N/A	9	Exotic	1.02

[1] The areas of direct impacts on native vegetation are consistent with the Stage 1 BDAR.



Client: C107778	N 0 50 100 m	Scale (@A4): 1:4,750	**BDAR Vegetation Zone (PCT) and Threatened Ecological Community – Stage 2**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke	*Imagery 15th July 2019 (7.5 cm) @ Nearmap 2019* *Vegetation mapping: Greencap (2018)*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 3**
Date: 1/08/2019			
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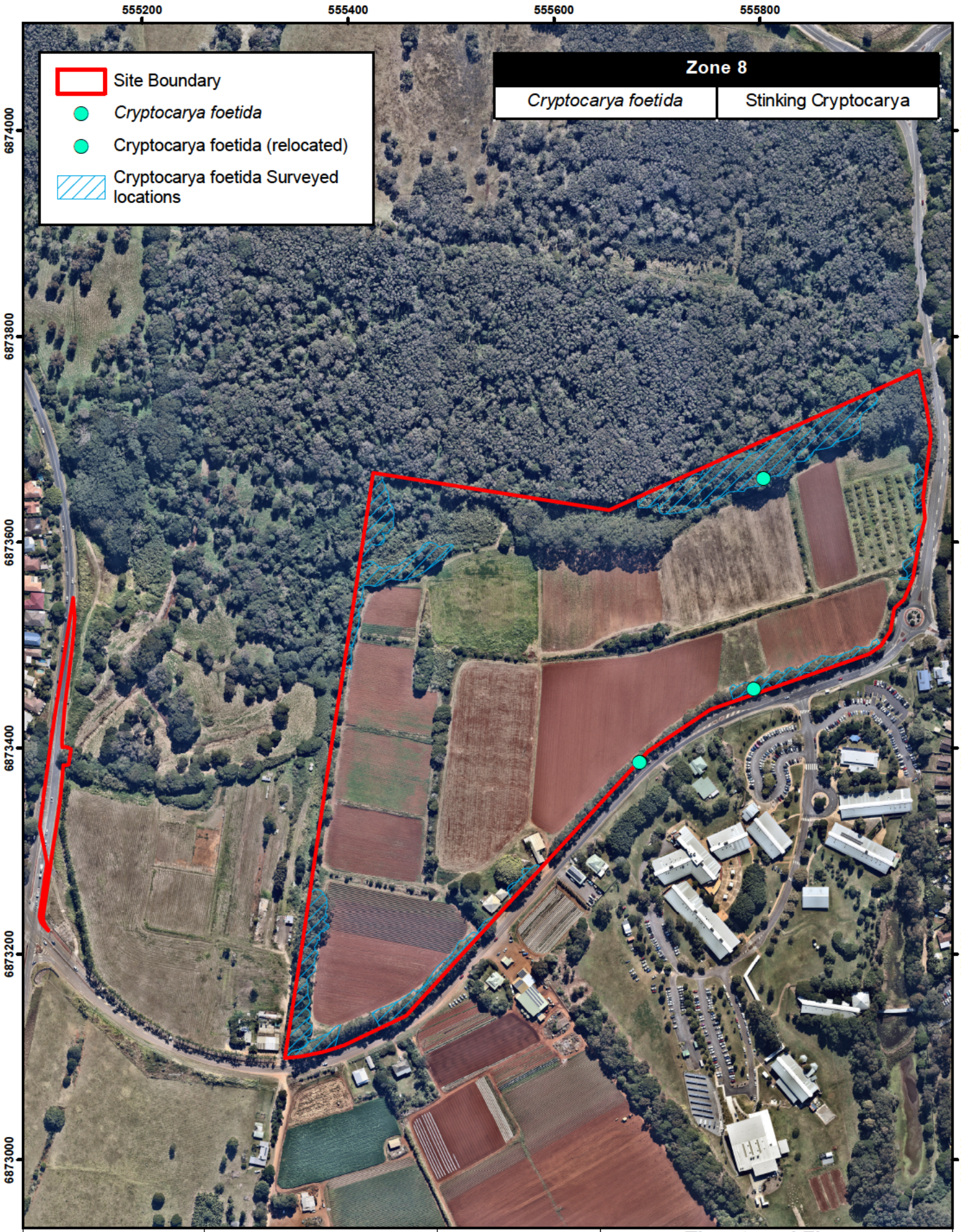

Client: C107778	N 0 50 100 m	Scale (@A4): 1:4,750	**Threatened Flora - Three-veined laurel *Cryptocarya foetida* plants**
Job #: J56455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke[redacted]	*Imagery 8th August 2018 (7.5 cm) © Nearmap 2018* *Vegetation mapping: Greencap (2018)*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 4**
Date: 15/10/2020			
GREENCAP			

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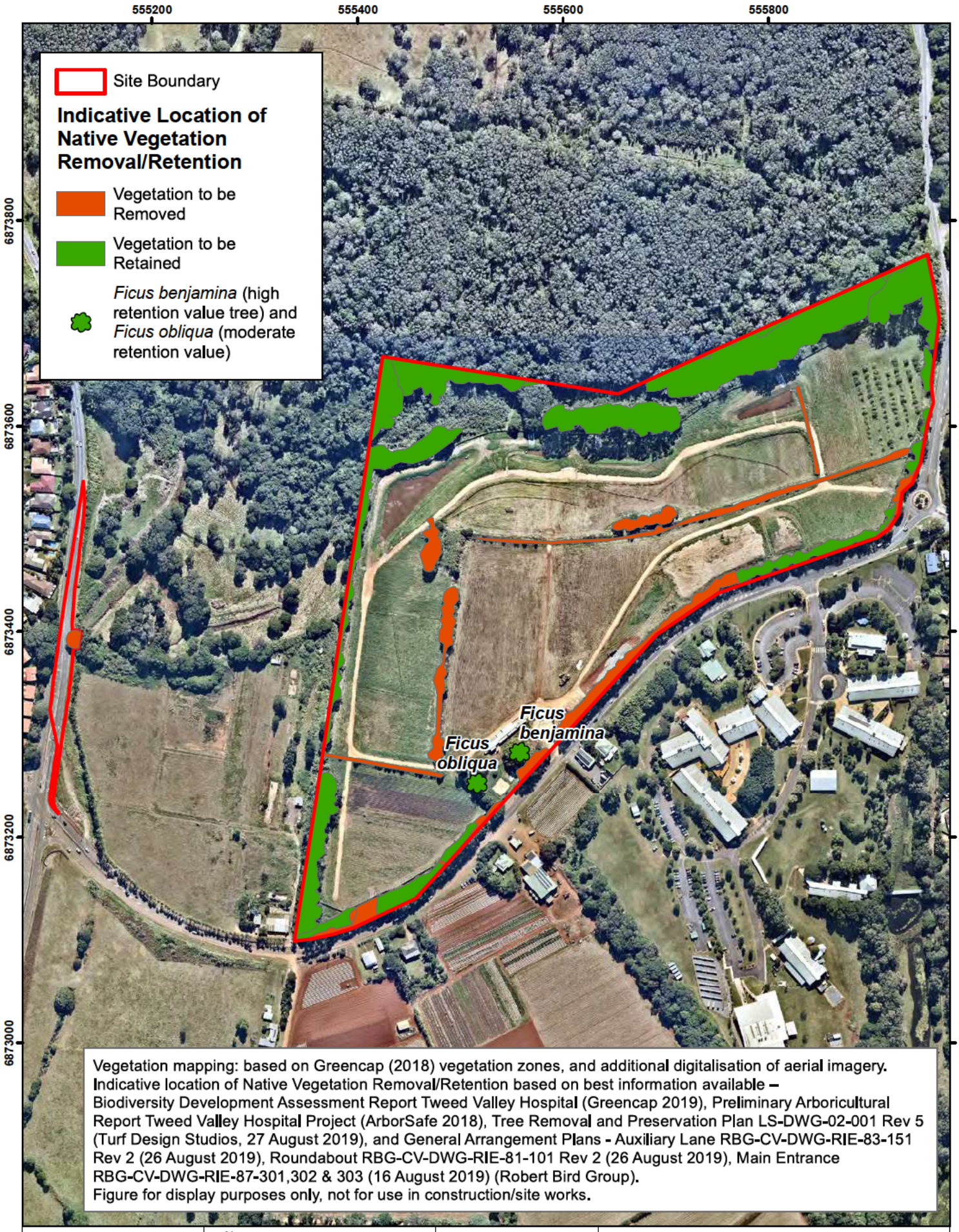

Vegetation mapping: based on Greencap (2018) vegetation zones, and additional digitalisation of aerial imagery. Indicative location of Native Vegetation Removal/Retention based on best information available – Biodiversity Development Assessment Report Tweed Valley Hospital (Greencap 2019), Preliminary Arboricultural Report Tweed Valley Hospital Project (ArborSafe 2018), Tree Removal and Preservation Plan LS-DWG-02-001 Rev 5 (Turf Design Studios, 27 August 2019), and General Arrangement Plans - Auxiliary Lane RBG-CV-DWG-RIE-83-151 Rev 2 (26 August 2019), Roundabout RBG-CV-DWG-RIE-81-101 Rev 2 (26 August 2019), Main Entrance RBG-CV-DWG-RIE-87-301,302 & 303 (16 August 2019) (Robert Bird Group).
Figure for display purposes only, not for use in construction/site works.

Client: C107778	N 0 50 100 m	Scale (@A4): 1:4,750	**Indicative location of Native Vegetation Removal/Retention**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke	*Imagery 15th July 2019 (7.5 cm) @ Nearmap 2019*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 5**
Date: 29/08/2019			
GREENCAP			

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2.3 Vegetation management overview

To enable effective vegetation management throughout the life of the project this Stage 2 BMP identifies vegetation management zones (MZ) in **Figure 6**Error! Reference source not found.. The MZs reflect the landscape zones that have been identified in the Zonal Plan (Turf 2019c) and Site-wide Landscape Plan (Turf 2019d) and MZs broadly reflect the BDAR Vegetation Zones (VZ; Greencap 2019b) as shown in **Table 4.**

A range of vegetation management activities will be implemented on the Site throughout Stage 2 of the project including:

- Weed control (biosecurity risk);
- Native vegetation protection measures;
- Regeneration (i.e. assisted regeneration that includes supplementary planting);
- Revegetation;
- Maintenance; and
- Monitoring and reporting.

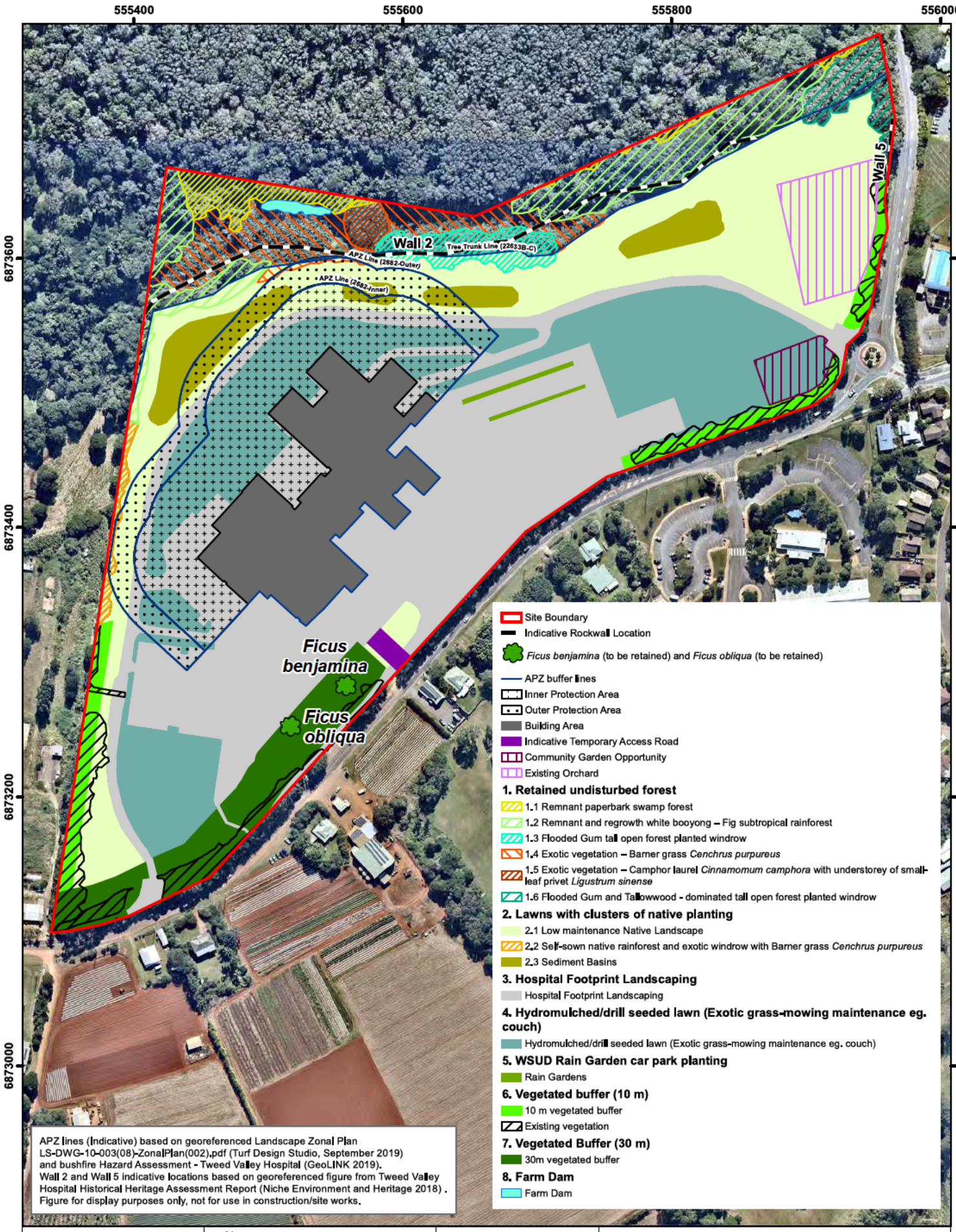
A range of general vegetation management and biosecurity controls to mitigate the impact of Stage 2 Project activities on biodiversity are identified in (**Table 5**). Vegetation management activities including; Weed control (biosecurity risk), Native vegetation protection measures (tree protection zones), monitoring and reporting have been addressed in the Stage 1 BMP and these activities will continue into the Stage 2 program.

Table 4 BMP Vegetation Management Zones

BMP MZ	BMP Management Zone (MZ) Description	Schematic LZP (Turf, 6 September 2019)	Equivalent BDAR Vegetation Zone
1.1	Remnant paperbark swamp forest	1. Retained forest	1
1.2	Remnant and regrowth white booyong – fig subtropical rainforest		2
1.3	Flooded Gum tall open forest planted windrow		3
1.4	Exotic vegetation – barner grass *Cenchrus purpureus*		9
1.5	Exotic vegetation – camphor laurel *Cinnamomum camphora* with understorey of small-leaf privet *Ligustrum sinense*		9
1.6	Flooded Gum and Tallowwood - dominated tall open forest planted windrow		6
2.1	Low maintenance Native Landscape	10. Lawn with clusters of native planting (min 20m apart) *Note: All zones vegetated in accordance with Asset Protection Zone (APZ) guidelines where required. Refer to 'Bushfire Constraints Assessment'. ** Includes zone 12 existing orchard	N/A
2.2	Self-sown native rainforest and exotic windrow with barner grass *Cenchrus purpureus*		4 (western boundary)
2.3	Sediment basins	2a Bioretention planting	N/A

BMP MZ	BMP Management Zone (MZ) Description	Schematic LZP (Turf, 6 September 2019)	Equivalent BDAR Vegetation Zone
3	Hospital Footprint Landscaping	3. Hospital Landscape 4. Green Spine 5. Feature Entries/Hospital landscape fringe 6. Landscaped courtyards within hospital envelope	N/A
4	Hydromulched/drill seeded lawn (exotic grass-mowing maintenance e.g. couch)	9. Hydromulched/drill seeded lawn (exotic grass-mowing maintenance e.g. couch) with clusters of native planting (min 20m apart)	N/A
5	WSUD car park and roadway planting	2b WSUD car park and roadway planting	N/A
6	10 m wide vegetated buffer	7. Vegetated buffer (10 m); and 8. Embellished buffer. Retain and augment existing vegetation.	5 (south western boundary) and retained portions of 7 and 8 (Cudgen Rd and Turnock St boundary)
7	30 m wide vegetated buffer	7. Vegetated buffer (30 m)	8 (south western boundary)
8	Farm Dam	N/A	N/A

BDAR Vegetation Zone 9 (**Figure 3**), represented by BMP Management Zones 1.4 and 1.5 (**Figure 6**) is exotic vegetation to be removed and revegetated (**Figure 5** and **Table 5** Item 11).



Client: C107778	N 0 40 80 m	Scale (@A4): 1:3,632	**Vegetation Management Zones – Stage 2**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke[redacted]	*Imagery 15th July 2019 (7.5 cm) @ Nearmap 2019.* *Vegetation mapping: Greencap (2018). Vegetation management zones based on best information available – Biodiversity Development Assessment Report Tweed Valley Hospital (Greencap 2019), georeferenced Landscape Zonal Plan LS-DWG-10-003(08)-ZonalPlan(002).pdf (Turf Design Studio, September 2019) (Turf Design Studio, August 2019), Preliminary Arboricultural Report Tweed Valley Hospital Project (ArborSafe 2018), and the Civil Engineering Drawings Aerial Overlay (Indicative) (Lendlease Group, May 2019). Figure for display purposes only, not for use in construction/site works.*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 6**
Date: 12/09/2019			
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Table 5 General vegetation management controls

Item	Task	Description/method	Outcome	Performance measure	Project Phase[1]	Who
Protection of trees during pre-construction and construction						
1	Maintain tree protection zone (TPZ) and structural root zone (SRZ) around retained native vegetation inside the temporary boundary fence, including the two high and moderate retention value *Ficus sp.* Trees and one *Cryptocarya foetida*. Establish a TPZ at the Tweed Coast Road/Cudgen Road Intersection.	• During Stage 1, a TPZ has been defined around all native trees and vegetation to be retained in accordance with AS4970 – 2009 to protect retained vegetation during construction works and must be maintained throughout Stage 2 construction works; • The TPZ must not be less than 2 m nor greater than 15 m (except where crown protection is required). • As per the *preliminary arboricultural report* (ArborSafe, October 2018), the TPZ for the high retention value tree weeping fig *Ficus benjamina* is 15m and the SRZ is 3.9m and the TPZ for the moderate retention value tree small leafed Fig *Ficus obliqua* identified for retention within the development footprint area is 12m, and the SRZ is 4.4m, measured at a radial distance from the centre of the trunk. The average TPZ for the regenerating native trees in the windrow along Cudgen Road boundary is 2m, as per Section 5.4.12 of the preliminary arboricultural report (ArborSafe, October 2018). • Due to the limited space available for the proposed construction and the radial size of the TPZ's, construction works may be required within the TPZ's. If the proposed encroachment is greater than 10% of the TPZ or inside the SRZ the project arborist must demonstrate that the trees would remain viable post construction (ArborSafe 2018). • During Stage 2 works, a TPZ must be installed to protect early regrowth rainforest adjacent to the *Guioa semiglauca* to be cleared which is surrounded by dense grass and woody weeds at the Tweed Coast Road / Cudgen Road intersection upgrade site and at the farm dam during infilling works. An indicative TPZ of 5m is shown in **Figure 7,** however this is indicative only and an arborist needs to assess the native vegetation and determine exact TPZ requirements in accordance with AS4970 – 2009 before the fencing is installed.	• Retained trees and native vegetation are protected from construction related activity. • Activity that is excluded from the TPZ includes: excavation (including trenching), parking of vehicles/plant, refuelling, cleaning/wash down, placement of fill and soil level changes (refer to AS4970 – 2009 for a comprehensive list of exclusions.	• Construction activity is excluded from the TPZ of retained vegetation.	Stage 2 C	Management, Construction Contractor
2	Maintain protective fencing and signage	• Maintain temporary fencing and signage around the tree protection zone of any retained trees and vegetation as per **Figure 7**, including at the Tweed Coast Road/Cudgen Road Intersection upgrade. • Fencing is to only be removed upon approval and the completion of all construction activities.	• Retained trees and native vegetation are protected from construction related activity. • Activity that is excluded from the TPZ includes: excavation (including trenching), parking of vehicles/plant, refuelling, cleaning/wash down, placement of fill and soil level changes (refer to AS4970 – 2009 for a comprehensive list of exclusions.	• Temporary fencing 1.8 m high is to be erected before machinery and materials are brought onto Site and before commencement of works. ○ Once erected, temporary fencing must not be removed or altered without approval. ○ Shade cloth or similar material may be attached to reduce the transport of dust. • Install signage that is visible from within the construction footprint to identify the TPZ.	Stage 2 C	Management, Construction Contractor
Engagement of suitably qualified contractors						
3	Vegetation management works within areas containing native vegetation must be undertaken by a suitably qualified and experienced bush regeneration contractors	• Bush regeneration contractors must be members of the Australian Association of Bush Regenerators or fulfil the membership criteria. • Team leaders should hold a Certificate III in Conservation & Land Management or possess equivalent field experience and certification. • For bush regeneration works to be conducted in MZ 1.1-1.6 it is highly desirable that the contractor has demonstrated experience working in Mitchell's rainforest snail *Thersites mitchellae* (MRS) habitat. • Bush regeneration contractors are not required to undertake vegetation clearing works within the areas of vegetation to be removed as depicted in • **Figure 5** or to undertake hydro mulching. • The bush regeneration contractor would have been engaged in Stage 1 and provided a detailed schedule of prioritised management actions for the site in consideration of the strategies outlined in **Section 3.2.2.** The	• Bush regeneration contractors carry out best practice bush regeneration techniques in accordance with relevant legislation and/or guidelines.	• Evidence of membership, certification and experience is provided by contractors prior to engagement.	Stage 2 C & O	Management, Bush Regeneration Contractor

Item	Task	Description/method	Outcome	Performance measure	Project Phase[1]	Who
		detailed schedule of prioritised management actions is to be updated prior to the commencement of Stage 2 works.				
4	Suitably qualified and experienced arborists must be engaged to undertake vegetation clearing works	• Arborist contractors must be members of Aboriculture Australia or fulfil the membership criteria. • Team leaders should hold Diploma of Arboriculture (Level 5) or possess equivalent filed experience and certification.	• Arborist contractors conduct vegetation clearing works in accordance with industry best practice.		Stage 2 C	Management, Arborist Contractor
Managing biosecurity risk						
5	Implement inspection and wash-down procedures	• The vehicle inspection and wash-down facility and signage will be maintained as required during the Stage 2 construction works to enable the washdown of vehicles, plant and equipment for seeds. • Washdown of vehicles, plant and equipment for seeds will be implemented based upon a risk evaluation, including visual inspection, based upon the activities being conducted (See item 5). • Vehicles, plant and equipment cannot leave the Site without being clean and free from weed and seed material. • Vehicles will be cleaned in accordance with the 'Decontamination of vehicles and equipment guide' prepared by the NSW Department of Primary Industries available at: https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0010/545554/procedure-decontamination-vehicles-and-equipment.pdf	• All personnel working on site are take reasonable measures to prevent, eliminate or minimise biosecurity risks.	• The facility is inspected at least quarterly for weed seedlings which may have germinated from seeds washed off vehicles. • Any weeds will be immediately controlled. • Vehicle inspection and wash-down procedures are implemented.	Stage 2 C Stage 2 C	Management, Construction Contractor All Site Personnel
6	Top soil management	• Topsoil stripped from areas containing high densities of weed will be managed appropriately to ensure that weed impacted top soil does not contribute to the spread of weeds across the Site. Weed inspections undertaken throughout preconstruction/construction including of topsoil stockpiles will identify the likely density of weed seeds expected to be in topsoil.		• Contaminated/ potentially contaminated topsoil identified and managed appropriately.	Stage 2 C	Management, Contractor
7	Implementation of wash-down procedures to keep entering/ exiting vehicles free of weeds	• To prevent spreading weeds, all site personnel entering/exiting the site have a general biosecurity duty to keep their vehicle free of weeds by: ○ Ensuring as far as is reasonably practicable that all plant equipment and vehicles are free of plant material before entering the Site; ○ Avoiding driving through weedy areas; ○ Vehicles, plant and equipment that may have been exposed to weeds or weed seed (i.e. driven in areas off designated construction roads) shall be inspected and washed down on entering and exiting the site, it is the driver's responsibility to ensure a wash-down is completed; and ○ Checking clothing, footwear and vehicle (including floor mats) on the completion of works. Plant material found in these items will be removed and appropriately disposed of in order to mitigate the biosecurity risk.		• Vehicles, plant and equipment entering/existing Site are free of weeds.	Stage 2 C	Management, Contractor
8	Communicate biosecurity risk management to all personnel	• Training on biosecurity risk and vehicle inspection and wash-down procedures is undertaken during site induction.		• Personnel understand their obligations regarding biosecurity risks.	Stage 2 C	Management, All Site Personnel
9	Disposal of weed contaminated material	• Vegetation that has been cleared is to be disposed of at an approved green waste facility		• Contractors to provide documentation as evidence that weed contaminated material has been disposed of appropriately. • It is an acceptable solution for weeds that have been treated with herbicide to be left *in situ*.	Stage 2 C & O	Management, Contractor
Clearing of vegetation						
10	Approved vegetation clearing at the Tweed Coast Road/Cudgen Road Intersection upgrade	• Prior to the commencement of any clearing: ○ Areas of vegetation approved to be cleared will be surveyed and the extent of the area will be marked on-ground with survey pegs.	• Only vegetation that is approved to be cleared is removed.	• Clearing of vegetation is only conducted within the surveyed clearing area.	Stage 2 C	Management, Contractor

Item	Task	Description/method	Outcome	Performance measure	Project Phase[1]	Who
		○ Areas of vegetation approved to be cleared will be identified on clearing plans that can be easily interpreted by clearing contractors. ○ Clearing plans are to be provided to contractors responsible for clearing prior to commencing works. ○ All personnel involved in the clearing works will be made aware of the clearing boundary on both the clearing plans and on ground.				
11	Weed control measures	• Exotic vegetation - camphor laurel *Cinnamomum camphora* with understorey of small-leaf privet *Ligustrum sinense* and barner grass *Cenchrus purpureus* monocultures in MZ 1.4 and 1.5 are adjacent to the Subtropical rainforest vegetation which is habitat for the MRS, therefore a staged approach to remove this vegetation will be employed to mitigate any potential impacts of habitat desiccation.	• Exotic plant monocultures removed with no impact on adjacent threatened species habitat	• MRS monitoring criteria as per **Section 3.2.2**	Stage 2 C	Management, Bush Regeneration Contractor
12	Translocation of threatened plant *Cryptocarya foetida*	• The single stinking Cryptocarya *Cryptocarya foetida* plant (sapling) that was located along the Cudgen Road boundary windrow was translocated for conservation, see **Figure 4.** • Ongoing care and maintenance including regular checks, watering and weeding is required during Stage 2. • Maintain the temporary protective barrier around the sapling during Stage 2 construction.	• No avoidable loss of threatened plant species	• Successful translocation and survival of the *Cryptocarya foetida* plant	Stage 2 C and O	Management, Specialist Ecologist Contractor
13	Contractor awareness	• Information on this Stage 2 BMP including biodiversity values that are to be retained and protected are to be provided to all contractors during an induction prior to commencing works. Including, but not limited to; ○ All personnel involved in the clearing works will be made aware of the clearing boundary on both the clearing plans and on ground; ○ Biosecurity measures (i.e. weed control); ○ Exclusion zones (i.e. TPZ and areas of conservation significance); ○ Fauna interaction protocols and Fauna Management Procedure; and ○ Waste management protocols.	• Information outlining biodiversity values that are to be retained and protected to be included in the Site induction	• No avoidable loss of threatened plant or animal species	Stage 2 C	Management, Contractors
Heritage and archaeological considerations						
14	Weed control measures	• Avoid removing trees and vegetation which may be supporting Walls 2 and 5. • Weed control activities undertaken during Stage 2 will only employ methods which do not damage rock heritage stone walls (e.g. herbicide application through spot spraying, cut and paint or stem injection). • No stump removal or manual removal techniques are to be undertaken along the heritage stone walls.	• Identified Heritage and Archaeological items are managed appropriately during the construction phase	• Measures taken to minimise damage to the heritage stone walls on the Site (LLB 2019)	Stage 2 C & O	Management, Bush Regeneration Contractor

[1] Project phases: Stage 2: Construction (C) and Operation (O)

2.3.1 Vegetation protection measures

For the duration of the construction works all trees on the Site that are not approved for removal must be suitably protected during construction as per recommendations of the BMP required by Conditions B33 and C25 of Schedule 3.

All vegetation protection exclusion fences (temporary boundary fence or TPZ) have been installed during Stage 1 works in accordance with TPZ guideline and AS4970 – 2009 (**Table 5** and **Figure 7**). Vegetation protection exclusion fences include around the trees identified for retention in the *preliminary arboricultural report,* namely; weeping fig *Ficus benjamina* and small leafed Fig *Ficus obliqua* (ArborSafe 2018) as well as the MZ 6 windrow along Cudgen Road, opposite the Kingscliff TAFE. All vegetation protection exclusion fences must be maintained throughout the Stage 2 construction works, and for any encroachment the project arborist must demonstrate that the trees would remain viable post construction (ArborSafe 2018).

As detailed in **Table 5** and **Figure 7** the average TPZ for the regenerating subtropical rainforest in the windrow along Cudgen Road boundary (MZ 6) is 2 m, as per Section 5.4.12 of the *preliminary arboricultural report* (ArborSafe, October 2018), however, all vegetation protection exclusion fences should be installed to allow for any revegetation works which will occur in the 10 m or 30 m wide vegetated buffers (MZ 6 and 7).

TPZ fencing will be installed in Stage 2 works to protect early regrowth rainforest adjacent to the *Guioa semiglauca* to be cleared at the Tweed Coast Road / Cudgen Road intersection upgrade site and at the farm dam during the decommissioning/infilling works. Due to the limited space available and the impracticality of installing high fences in these two areas, a temporary barricade fence constructed from high-vis mesh and steel posts should be installed alongside the native vegetation to be retained.

As per Schedule 3 Condition C25, if access to the area within the tree protection exclusion fence (temporary boundary fence or TPZ) is required during the works, it must be carried out under the supervision of a qualified arborist with alternative tree protection measures installed (or retrofitted) as required. Temporary fencing should also consider fauna connectivity measures discussed in **Section 3.3.1.** Following completion of the construction works, the removal of vegetation protection exclusion fences must be carried out under the supervision of a qualified arborist.

2.3.1.1 Coastal wetland management

Responsibilities for the long term protection and management of the coastal wetlands located along the northern boundary of the site (MZ 1.1) are summarised in **Table 6** as per SSD 9575 Condition B21(a).

Table 6 Summary of coastal wetland management activities

	BMP Reference
Vegetation and Habitat management	
General commitment and objective	**Sections 2.1 and 2.3**
Appropriately experienced bush regeneration contractors to demonstrate experience in working with coastal wetland habitat (or similar)	**Table 5 (Item 3)**
Implementation of appropriate primary and secondary weed control measures	**Sections 2.3.2.1 and 2.3.2.7** **Table 9 (Items 18 and 32)**

	BMP Reference
Selection and planting of appropriate species for revegetation	**Section 2.3.3.3** **Table 9 (Item 20)**
Implementation of ongoing maintenance, monitoring and ongoing weed control measures	**Table 9 (Items 24-25, 27-30)**
Review of performance	**Table 7 (Item 17)**
Fauna management	
Protection of existing populations and habitat	**Section 3.2.2.2**
Pest animal management	**Section 3.4**
Mitigation measures	**Table 11 (Items 33 to 38)**

2.3.2 Weed management

2.3.2.1 Weeds identified on the Site

A total of 51 exotic plant species were recorded on Site including 18 species classified as High Threat Exotic (HTE) species under the BAM. Three of these HTE species are also classified as Weeds of National Significance (WONS), namely: ground asparagus *Asparagus aethiopicus*, bitou bush *Chrysanthemoides monilifera and* lantana *Lantana camara.* Exotic and HTE species that were recorded on the Site are detailed by MZ in **Appendix A**.

Several classes of weeds are defined under the *Biosecurity Act 2015*. No high priority weeds were detected during plot-based vegetation surveys undertaken as part of the BDAR, however, the regional priority weeds giant devil's fig *Solanum chrysotrichum* (MZ 1.1 and 1.2) and the State priority weed bitou bush *Chrysanthemoides monilifera* (MZ 1.6) were recorded.

Field assessment of the existing farm dam located at the north of the Site (MZ 1.4) recorded dense mature infestations of salvinia *Salvinia molesta* (Greencap 2019). Salvinia is a WONS and is regulated under the *Biosecurity Act 2015* with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk. The presence of salvinia *Salvinia molesta* has substantially degraded this microhabitat. Management of this weed is discussed below in **Sections 2.3.2.6** and **2.3.2.7.**

2.3.2.2 Stages of weed control

In order to ensure efficient and effective use of resources weed control will be undertaken by suitably qualified contractors using best-practice methods in three stages:

- Primary weed control;
- Secondary; and
- Maintenance.

Primary weed control refers to the initial control of weed species on the Site that will be undertaken in accordance with published guidelines (i.e. BSRLG 2005; DPI 2018).

Secondary weed control will; be conducted 6-8 weeks following primary weed control and aims to control weeds that have regrown following primary treatment, new weeds that have germinated in response to the availability of resources (e.g. light, nutrients) and allow native plant species to re-establish.

Regular and ongoing maintenance of areas that have undergone primary and secondary weed control is critical to ensuring long term success and will be undertaken during Stage 2 construction and operations phases. Weeds can re-establish through natural dispersal or from weed propagules remaining in the soil. Undertaking maintenance activity to control the movement of weeds on and off a site can be considered a reasonable measure for a landholder to undertake that is in accordance with the general biosecurity duty identified in the *Biosecurity Act 2015.*

The frequency of weed control activities including maintenance, monitoring and reporting is summarised in **Table 7**.

2.3.2.3 Weed Control Techniques

It is anticipated that weed control will employ a range of techniques depending upon factors such as the species and life-stage of the weed and may include:

- Hand weeding
- Mechanical removal (e.g. slashing, cutting)
- Herbicide application (e.g. spot spraying, cut and paint, stem injection)
- Mulching
- Hydro mulching of cleared land
- Natural shading techniques (revegetation)

As noted in Item 3 in **Table 5** above, a detailed schedule of prioritised management actions for the site is to be updated by the bush regeneration contractor prior to the commencement of Stage 2 and will be revised on an annual basis as per **Table 7**.

2.3.2.4 Hydro mulching

The majority of land in MZ's 2.1 and 2.3 was treated with hydro mulch in the pre-construction phase, and ongoing maintenance throughout Stage 2 will need to be undertaken to control weed growth in areas of bare or disturbed soil as required. Marcus Koolen from Perfect Earth (2019, pers. comm. 27 February) in a personal conversation outlined the following recommended process for the most efficient establishment and effective long term weed control for hydro mulch:

- Prior to achieving successful weed control and full coverage with hydro mulch, irrigation will cease in all areas to reduce weed growth and allow greater sunlight access to soil surfaces which should assist desired grass germination;
- Slashing can be undertaken prior to herbicide treatment to remove weed flowers, prevent development of weed seed and to maintain sunlight access to topsoil to enable cover crop/native seed germination.
    - During months where flower and seed is not visible slashing will not be required.
    - For areas that cannot be mechanically slashed these will need to be managed through hand slashing or brush cutting;
- Apply primary weed control with an appropriate herbicide (e.g. broad-acre glyphosate);
- Leave treated areas for approximately 4 weeks to allow weed seeds germinate;
- Apply secondary weed control with an appropriate herbicide;
- 24 hours after secondary weed control, cultivate land running parallel to contour lines to prepare for hydro mulching;

- Cultivation is more effective if weeds are ploughed-in before flowering and under reasonably dry conditions;

- Hydro mulch with grass seed mix;
  - Depending upon the season that hydro mulching is being conducted, it is recommended to use either a millet or a rye cover crop to suppress weed growth and improve soil condition (BSRLG 2005);
  - Grass seed varieties must be suitable for use within an APZ and must meet the requirements of Appendix 4 of Planning for Bushfire Protection (PBP) (RFS 2017);
  - Stabilisation of sediment basin banks is a high priority for hydro mulching and has been undertaken in pre-construction works;
- Establishment of grasses;
  - Maintenance to control weeds is undertaken by slashing and/or spot spraying;
  - Upon inspections following the primary and secondary weed control measures and hydro mulching, should any notable or dense areas of weed species be observed, then these areas will be slashed/brush cut to remove flower heads and prevent weed seed formation.

2.3.2.5 Heritage and archaeological considerations

In accordance with the Heritage and Archaeological Management Plan (LLB 2019), measures must be taken to minimise damage to the heritage stone walls 2 and 5 (MZ's 1.2, 1.3, 1.4 and 1.6), as shown in **Figure 6**Error! Reference source not found. below and Figure 12 in the Historical Heritage Assessment Report (Niche 2018). These measures include avoiding removal of trees and vegetation which may be supporting the walls. Weed control activities undertaken during bush regeneration activities in Stage 1 will only employ methods which do not damage to rock walls (e.g. herbicide application through spot spraying, cut and paint or stem injection). No stump removal or manual removal techniques are to be undertaken along the heritage stone walls.

2.3.2.6 *Salvinia molesta* and other aquatic vegetation control

Aquatic weed infestations are common within the agricultural drains that are prevalent in the wetland area to the north of the site. Monitoring the sediment/bio-detention basins for aquatic weeds in (particularly salvinia *Salvinia molesta*) must be regularly undertaken.

Early detection is critical to eradicate an infestation before it has time to establish. Should *Salvinia molesta* be detected in the basins, eradication of new infestations can be undertaken as per methods outlined below.

Kim Kurtis from Rous County Council Weed Services (2019, pers. comm. 7 June 2019) in a personal conversation provided the following recommendations for *Salvina molesta* control options:

- Manual removal (for large areas a 'weed harvester' can be used, for small areas such as the basins, pool scoops, nets, mesh etc are the most appropriate methods to use);
- Biological control with salvinia weevil (*Cytobagous salviniae*); and
- Herbicide – 'frog-friendly' surfactant free glyphosate is a potential option. Further advice on herbicides and other salvinia control measures is provided in the Salvinia Control Manual (NSW DPI 2006). It is recommended that a specialist weed control contractor with experience in salvinia *Salvina molesta* control is engaged to provide specific advice on which specific

herbicide would be most successful as there are many site-specific factors that need to be considered.

Should *Salvina molesta* spread to the sediment/bio-detention basins, the suggested method for this situation is to remove the bulk of the salvinia *Salvina molesta* vegetation by manual methods (winter is the best time of year), followed by releasing the salvinia weevil (i.e. biological control) in Spring. Biological control insects require one third of the water surface to be clear, fresh young growth and sun. Because they will only remove young growth, they cannot be effectively applied to dense, mature infestations, therefore manual removal prior to releasing the insects is required. Areas around the edge of the basins can be treated with 'frog-friendly' surfactant free glyphosate sprayed directly onto the salvinia *Salvina molesta*. A swimming pool scoop or similar device can be used to manually remove salvinia *Salvina molesta* plants on a regular basis until eradication is achieved. Regular follow up treatment is vital because a single remaining leaf can reinfest the area in a relatively short period of time.

Once manually removed, salvinia *Salvina molesta* can be disposed of on site in an appropriate dry contained area and left to dry out and die. Controls measures will be in place to mitigate the risk of any removed weeds, or water removed from the dam, infesting the sediment basins if disposed of on site.

Ongoing long-term monitoring and treatment (i.e. manual removal) would be required in order to target re-infestations which may occur as a result of spreading by natural means such as during flood events or by fauna. However, as the dam is being decommissioned and the sediment basins are to be routinely drained in accordance with the CSWMP standing water will not remain present in which infestations may occur.

Should *Azolla filiculoides*, *Azolla pinnata*, *Phragmites australis* and *Typha orientalis* be inadvertently introduced associated with project activities in the rehabilitation of plant zones and adjacent waterbodies they are to be controlled in accordance with the methods presented above.

2.3.2.7 Rehabilitation of the farm dam and agricultural drain

The BDAR for the approved Stage 1 Tweed Valley Hospital (SSD 18_9575) recommended that decommissioning the dam would remove the requirement for ongoing monitoring and treatment of salvinia *Salvina molesta* in this zone.

The dam will be incrementally infilled without dewatering in a monitored and staged approach to ensure gradual displacement of water so that the impact of the process on native aquatic fauna is mitigated. Dam infill operations detailed below will be staged over a number of days to allow for adequate salvage of animals from the dam (as per stages 1 to 3 below). Advice was sought from a local fauna ecologist with experience dam decommissions (Ben Gunston, 2019, pers. comm. 26 June) on the best practice process to mitigate impacts on native fauna. The following best practice method will be employed to decommission the dam and mitigate impacts on native flora and fauna:

- **Overarching Process**
    - A suitably qualified and experienced fauna rescue person shall be present for the dam decommissioning, including the removal of any vegetation around the dam (i.e. the tall dense barner grass *Cenchrus purpureus* in MZ 1.4), as native frogs may use these areas as habitat (likelihood of frogs species present to be determined during the initial frog survey).

- If any fauna is found during vegetation clearing or dam infilling works, where possible, uninjured native fauna detected will be caught by the fauna rescue personnel and released at a predetermined location of appropriate nearby habitat, but outside of the Project footprint.

- **Stage 1 – Site Preparation**
  - Nocturnal frog survey (on a rainy night, any time of year) to assess if frogs are in the area.
  - Install tree protection fences to protect adjacent native vegetation prior to commencement of works (See **Section 2.3.1**).
  - Install sediment and erosion control measures downstream/gradient of the works.
  - Establish sediment control to surface stormwater pathways upstream/gradient of the works.
  - Clear exotic vegetation around the from the southern and western side of the dam to Create access into the dam remediation area to allow machine and truck access and movement. This would not require any topsoil stripping. Clearing native vegetation around the dam will be avoided.

- **Stage 2 – Incremental Infill**
  - Conduct civil works as required.
  - Efforts will be made to rescue and relocate any native fauna which may currently be in the dam, this could potentially include fish, eels, turtles, yabbies and tadpoles:
    - First Sweep – Electrofish/ gill net to capture the majority of aquatic fauna.
    - Remove the bulk of the floating weed salvinia *Salvinia molesta* from surface of dam vegetation (using an excavator bucket or similar).
    - Second Sweep – Electrofish/gill net to capture the remaining aquatic fauna.
    - Third Sweep – Turtle/yabby nets will be used to capture and relocate turtles, eels and yabbies that may have been missed through electro fish/gill net operations.
    - Incrementally infill dam from one end by tipping re-use rock (up to 150mm diameter) and topsoil from site into the dam from a dump truck without pumping the water out.
    - Systematic and opportunistic sweeps – Hand net the decreasing sections of remaining water to capture any remaining fauna as it is incrementally infilled.

- **Stage 3 – Post-Infill**
  - Install geofabric to reduce the bogginess of the area.
  - Install topsoil and planting
  - Upon completion of the works, vegetation restoration, maintenance, weed management activities and monitoring and reporting will be undertaken around the decommissioned dam (MZ 1.1 and 1.4) in accordance with Sections **2.3.4** and **2.3.5**.

Alternative methods to decommission the dam may be implemented subject to approval as appropriate.

An Acid Sulfate Soil management plan will not be required because the soil is not being disturbed.

An analysis of the impact of any change in hydrological flows on the wetland as a result of infilling the dam was undertaken by SMEC (2019) as described in **Section 4.1.3**. The assessment identified that filling the dam back to natural ground level will have no impact on the 1% AEP (100 year ARI), the 20% AEP (5 year ARI) flood levels and no material impact from more frequent events post development. The report recommends that the detailed design of the dam infilling incorporate a minimal downhill grade, low flow channel or path to allow flows to travel from the upstream to the downstream side of the decommissioned dam and minimise the amount of ponding water that could become reinfested with *Salivina molesta* (SMEC 2019).

The functionality of the existing agricultural drain is to be reassessed following the decommissioning of the dam with the following considerations to be made:

- If the drain is no longer required and serves no hydrological function it is to be decommissioned in a manner consistent with the decommissioning of the dam.
- If the drain is to be retained as it serves a required hydrological function it is to be reformed to ensure it is free flowing and does not allow water to pond.

In the event the drain is retained and holds water without readily draining it is to be managed in accordance with **Section 2.3.2.6**.

2.3.3 Restoration

An overview of vegetation management monitoring and performance criteria is outlined in **Table 7** and revegetation activities including MZ, timing, and responsibility is outlined in **Table 9**.

The restoration approaches for the Site that set out in this Stage 2 BMP include:

- Natural regeneration
- Assisted regeneration
- Revegetation

2.3.3.1 Site preparation

Revegetation is to be undertaken by a suitably qualified and experienced bush regeneration contractor. The bush regeneration contractor engaged in Stage 1 would have undertaken initial works involving project initiation meetings, inductions, site familiarisation and preparation of a detailed schedule of prioritised management actions including a schedule, revegetation works, methods, resources required, and cost with start and finish times and milestones. This schedule will need to be updated before the commencement of the Stage 2 works. Foremost, it is recommended that primary and follow up weed control be conducted two to three months prior to planting or at a minimum of four weeks, as described in **Section 2.3.2**. Vegetation protection fencing will be established using temporary fencing around all remnant vegetation and revegetation areas (buffer zones) as per **Section 2.3.1** and **Section 3.3.1.**

Buffer zones MZ 6 and 7 will contain areas of revegetation over previously cultivated land or access tracks. Soil compaction may be severe in some cleared areas, particularly along internal tracks. Once the buffer zone areas for revegetation have been defined, site assessment by bush regenerators will determine whether it is deemed necessary to prepare the soil in these areas with deep ripping. If ripping is required it should preferably be carried out at least six months prior to planting to allow the soil to settle and reconsolidate. However, ripping should be avoided where practical as it will

encourage weed growth. All areas of plantings will require mulching, including; *in situ* sprayed grass, leaf litter, straw, woodchips and bark (BSRLG 2005).

2.3.3.2 Planting considerations

Following site preparation, timing for revegetation will be influenced by a number of factors, however ideally the best time to plant is following the onset of the wet season, from late February to late April, preferable when raining or overcast. Planting should be avoided from November to late January when days are long and hot (BSRLG 2005). These factors will be taken into consideration by the bush regeneration contractor as they prepare a schedule for the main planting activities.

Water, at a rate of about 2 to 5 litres per tree will be required for planting unless it is undertaken during rain in late autumn (BSRLG 2005). Depending on rainfall, watering may be required for a period of about six weeks. It is also recommended that seedlings are planted with saturated water storage crystals and a slow release fertiliser that is suitable for native plants around the root ball to assist in plant establishment. At the discretion of the bush regeneration contractor, plant guards may be required for plantings in areas that are at risk from herbivory by native animals (e.g. MZ 1.1-1.6).

2.3.3.3 Plant species selection

Plant species proposed for assisted regeneration and revegetation on the Site have been selected using with Tweed Shire Council guidelines (TSC 2019).

To filter species selection, the 'late succession planting- mixed species' model was broadly adopted (Kooyman 1996). This model aims to achieve fast site domination by rainforest tree species (12-24 months), with maintenance reduced to low levels in that time. This model ideally suited to sites which have small seed sources, including cleared ex-rainforest agricultural land sites (Kooyman 1996). Some pioneer species were recommended for MZ 1.1 to 1.6. These management zones are adjacent to remnant rainforest that can provide seed sources for natural recruitment (Kooyman 1996).

Recommended pioneer, secondary, mature and edge plant species have been selected based on habit (i.e. tree, shrub or palm) and in consideration of local environmental variations on either: Lowland rainforest on floodplain (MZ 1.2 to 1.6); or Sub-tropical/Warm Temperate Rainforest on bedrock substrates (buffer MZ 6 and 7). With the exception of edge planting, groundcovers are not recommended as these species will establish on most sites naturally if the site is well maintained to control exotic grasses, herbs and woody weeds.

Ideally, a wide variety of species from each growth form group will be planted to achieve structural complexity, species diversity and enhance habitat values. As a general guide, it is recommended that 20 to 50 different species are planted in order to achieve ecological restoration objectives (Catterall and Kanowski 2010). Recommended plant species lists for revegetation is provided in **Appendix B**.

It is recommended that any native Subtropical Rainforest species identified during vegetation surveys undertaken on the Site in 2018 to inform the Biodiversity Development Assessment Report (BDAR; Greencap 2019b) are considered as a priority when selecting species for planting. These surveys were undertaken using the plot-based method as detailed by the Biodiversity Assessment Method (BAM). As a result, the list of native species compiled from these vegetation surveys does not represent a complete Site inventory of native plant species but is considered an indicative native species list for the site (**Appendix A**).

It is also recommended that planting consists of tube-stock (most preferred for tree and shrub species,) or Hiko and Viro cells (grasses and other groundcover species). Bush regeneration contractors must ensure that all planting is done effectively to minimise any defects or loss through

incorrect planting. For example, plants must be buried in the topsoil with saturated water storage crystals, slow release fertiliser, no air gaps or roots left exposed to dry out and mulch must not smother any plants.

For recommended Koala feed tree species see **Section 3.2.1** and **Appendix B.** For recommended species for the bio-detention basins and WSUD car park plantings see **Section 2.4.2** and **Appendix B.**

2.3.3.4 Edge species

Edge species are typically hardy species with a bushy habit recommended to be planted along the perimeter of buffer zones and along the tree line of the remnant vegetation. Fast growing edge species help to seal the edge of the planting from drying out and the effects of the sun and wind whilst slower growing edge species provide a permanent edge in the longer term which assists in weed control.

It is recommended that one row of edge species planted 1.8m apart will be planted along the perimeter of each buffer zone (MZ 6 and 7) and along the remnant vegetation tree line in the northern section of the Site (MZ 1.2 to 1.6). A list of recommended edge species is provided in **Appendix B.**

2.3.3.5 Planting density

Planting densities and layouts are as per recommended guidelines (BSRLG 2005). High density planting of 1.5 m spacing (or approximately 5,100 trees per hectare or 2 m^2 per tree) is recommended to achieve faster canopy closure and therefore less ongoing weed maintenance, faster achievement of habitat values, better aesthetic values and lower ongoing maintenance costs as opposed to low density plantings. This provides habitat for specialist rainforest dependent species such as the Mitchell's rainforest snail *Thersites mitchellae* and avoid attracting open habitat generalist species.

Replanting layouts may be either 'random' or 'in row(s)' depending on the nature and replating requirements of the specific MZ. Provisions will be made for ensuring access ways to facilitate the transport of trees, mulch and water as well as considerations for concurrent civil and construction works.

2.3.3.6 Assisted regeneration

Following primary and follow up weed control works, assisted regeneration will be undertaken in Zones 1.1, 1.2, 1.3, 1.6 and 2.2 and within retained buffer zone (Zone 6 and 7) vegetation. Assisted regeneration involves planting Subtropical Rainforest species within existing vegetation where canopy gaps exist. Assisted regeneration aims to improve habitat quality for threatened rainforest species by increasing biodiversity, plant density and reducing canopy gaps which facilitate weed invasion and favour common generalist species, such as noisy miners *Manorina melanocephala*.

A spacing of approximately 2.5 m will be aimed for in assisted regeneration zones, however, spacing and planting densities will ultimately be determined by the amount of weeds removed, amount of unassisted regeneration and the presence canopy gaps.

2.3.3.7 Sourcing plants

All planting stock will be sought from local provenance. The local nursery providing planting stock should be able to provide information on the sources of their seed. When accepting the stock, the plant health should be assessed to ensure that the plants look healthy and vigorous and are not showing any signs of stress or disease as this can impact the success rate of the revegetation program (BSRLG 2005). Plant orders must be given to suppliers with enough time (minimum of 3 to 6 months) to allow them to harvest propagules, propagate and grow on tubestock. A bush regeneration team

leader must inspect the planting stock prior to delivery to the Site to sign off on quality. Any plant stock showing signs of disease, poor health or lacking vigour should not be brought on to the Site and alternative plant stock will be sourced.

2.3.4 Vegetation maintenance

The vegetation maintenance program will involve:

- Maintenance of planting areas in MZ 1.4 and 1.5 will be carried out over a minimum of four maintenance events per year for a five-year maintenance period following the primary works as detailed in **Section 2.3.2.2**. Should performance criteria not be met at the completion the five-year period, then the program will be reviewed and extended until performance criteria are met;
- Maintenance of planting areas in MZ 6 and 7, sediment/bio-detention basins and supplementary plantings within established vegetation (MZs 1.1, 1.2, 1.3, 1.6, 2.1, 2.2, 2.3 and 5) will be carried out over a minimum of four maintenance events per year for a three year period, following the primary works as detailed in **Section 2.3.2.2**. If performance criteria are not met after a three-year period, then the program will be reviewed and extended until performance criteria are met;
- The first two months of establishment is the critical time for plant survival. Therefore, following planting, provisions should allow for weekly inspections to be conducted for the first two months and any additional maintenance of planting areas i.e. weed control, watering or replacement planting;
- Weed control works will be carried out over a minimum of four maintenance events per year with provisions to allow for additional events during the peak weed growth period over summer and spring (i.e. every month). Weed control maintenance involving inspections conducted at a minimum frequency of every three months during operation of the Project and will be evaluated annually upon submission of an annual weed control report. Inspections are to be conducted to identify new weed infestation areas or follow up weed control requirements for any previously treated weeds;
- Edges of conservation areas are currently fenced and will remain so during the construction phase of the project. Post-construction, vegetation management zones will be demarcated via a combination of fencing and signposting. The final position is in planning and is to be agreed and approved by the relevant parties prior to commencement of operations.

Vegetation maintenance works will also include the following activities as required:

- Inspections;
- Timely and effective weed control (spot spraying) (See **Section 2.3.2**);
- Supplementary planting to replace dead, poorly growing or diseased plants;
- Management of insect damage, if necessary; and
- Watering during dry periods;
- Records of all works undertaken (See **Section 2.3.5**); and
- Reporting and evaluation of performance criteria (See **Section 2.3.5**).

A summary of the vegetation maintenance program is provided in **Table 9**.

2.3.5 Monitoring, reporting and performance criteria

Regular monitoring and reporting will be undertaken to evaluate the progress and compliance with the VMP. The monitoring programme will commence following completion of any primary and secondary weed control works.

The contractor will undertake monitoring and reporting in accordance with the frequency and performance criteria as specified in **Table 7**. If a performance criterion is not met, then a review of methods would be undertaken and follow up weed control measures would be implemented. For each vegetation maintenance event, contractors must complete a record of all works undertaken, including but not limited to:

General information

- Date
- Personnel
- Time including time spent on each task
- Location
- Works carried out
- Weather
- Site conditions
- A description of any issues/problems
- Quarterly photo monitoring images relative to the baseline (initial event)

Weed control

- Area treated
- Weed control methods used
- Herbicide and other chemicals used, including quantity, dilution rate and other relevant information
- Weed species treated;
- If required, photos and/or maps of weed distribution and density

Revegetation

- Percentage survival rates for plantings
- Supplementary planting (number, species and location)
- Any other observations including insect attack/plant disease;

A rapid monitoring methodology has developed to capture key indicators of vegetation management success on the Site, including weed cover, survival rate of all plantings, canopy cover and leaf litter. Photo monitoring will monitor vegetation condition by detecting any changes in growth, vigour, vegetation structure, regeneration and species composition. A typical loss of 2 to 10% is expected in rainforest revegetation sites, therefore 90% survival rate criteria will be used to evaluate planting success rates (BSRLG 2005).

As per the Stage 1 BMP, baseline reports will be submitted prior to Stage 2 works documenting the primary and secondary weed control activities undertaken in MZ 1.4, 1.5, 1.6, 2.1, 6 and 7.

A summary of the vegetation monitoring program is provided in **Table 9**.

Table 7 Vegetation monitoring, reporting and performance criteria

Item	MZ	Frequency	Performance Criteria	Monitoring Methodology	Reporting	Project Phase[1]	Who
16	MZ 1.4 and 1.5	Following completion of primary works, 2 monitoring events per year for the 5-year maintenance period.	• Following completion of primary and secondary weed control works, less than 5% weed cover is recorded at every monitoring event. • Following revegetation greater than 90% survival rate of all plants. • At the end of the 5-year maintenance period, greater than 70% canopy cover. • At the end of the 5-year maintenance period, greater than 90% leaf litter cover	• Visual inspection of each MZ to determine percentage weed cover and rate of revegetation/assisted regeneration planting survivorship. GPS locations of any significant weed infestations or high priority weeds. • Establish permanent 20 x 20 m vegetation monitoring plots to monitor: o 3 x random replicate 1m x 1m quadrats in each plot to measure estimated percentage cover and leaf litter; and o Photo monitoring • Photo monitoring: The centre of each 20 m x 20 m plot will be marked by a permanent post and represented a fixed photo-point. From this point a landscape photograph of a labelled site marker board positioned 1.5 m away will be taken while facing each corner post. • These images will monitor vegetation condition by the	• One baseline report following completion of primary works (including primary and secondary weed control). • One half-yearly and one annual vegetation monitoring report following each monitoring event for the 5-year maintenance period. • All reports (baseline, half-yearly and annual) are to include: o Work record for each management event. o Photo monitoring photographs presented relative to the 2019 baseline. o Results of visual inspection data against performance criteria. o Locations of any major weed infestations or high priority weeds mapped. • Annual reports are to compare the results with previous reporting periods and include a review of the vegetation management program.	Stage 2 C & O	Management, Bush Regeneration Contractor

Item	MZ	Frequency	Performance Criteria	Monitoring Methodology	Reporting	Project Phase[1]	Who
				detection of potential changes in growth, vigour, vegetation structure, regeneration and species composition over time. • Use a field proforma to capture and record photo monitoring, visual inspection (% weed cover and survivorship), estimated % cover and leaf litter cover data.			
17	MZ 1.1, 1.2, 1.3, 1.6, 2.1, 2.2, 2.3, 5, 6 and 7.	Following completion of primary works, 2 monitoring events per year for the 3-year maintenance period.	• Following completion of primary and secondary weed control works, less than 5% weed cover is recorded at every monitoring event. • Following revegetation and/or assisted regeneration, greater than 90% survival rate of all plants.	• Visual inspection of each MZ to determine weed cover and rate of revegetation/assisted regeneration planting survivorship. GPS locations of any significant weed infestations or high priority weeds. • Photo monitoring methods (one location at each zone). • To establish the permanent location, mark the exact photo monitoring location with a permanent star picket and label the location with a number on the safety cap, record the latitude and longitude and compass bearing.	• One baseline report following completion of primary works (including primary and secondary weed control). • One half-yearly and one annual vegetation monitoring report following each monitoring event for the 3-year maintenance period. • All reports (baseline, half-yearly and annual) are to include: o Work record for each management event. o Photo monitoring photographs presented relative to the 2019 baseline. o Results of visual inspection data against performance criteria.	Stage 2 C & O (Monitoring events may be required during the operational phase depending on the timing of commencement of primary works and the length of construction).	Management, Bush Regeneration Contractor

Item	MZ	Frequency	Performance Criteria	Monitoring Methodology	Reporting	Project Phase[1]	Who
				• Take a photo to capture the exact same frame and angle as has been captured previously. • Take landscape photographs and centre the photo so that the sky and ground are captured in equal proportions. • Use a field proforma to capture and record photo monitoring data. • These images will monitor vegetation condition by the detection of potential changes in growth, vigour, vegetation structure, regeneration and species composition over time.	○ Locations of any major weed infestations or high priority weeds mapped. • Annual reports are to compare the results with previous reporting periods and include a review of the vegetation management program.		

[1] Project phases: Stage 2: Construction (C) and Operation (O)

2.4 Other considerations

2.4.1 Bushfire protection

Both an Asset Protection Zone (APZ) has been identified in accordance with RFS 2018. The APZ coincides with MZ 2.1, 2.2, 2.3 and 4 and must be landscaped and maintained in accordance with the relevant guidelines (Appendix 4 of PBP; RFS 2018) as described in the *Bushfire Hazard Assessment Report* (GeoLINK 2019). As shown in **Figure 6**Error! Reference source not found., there will be minimal impact to retained native vegetation as most of this is outside of APZ.

The APZ needs to be landscaped and maintained to prevent the spread of fire towards the building. As per the Schematic LZP (Turf 2019c), landscaping will consist of clumps of separated native vegetation and appropriate grasses (couch) and will meet the requirements of Asset Protection Zone Standards (Appendix 4 of PBP; RFS 2018). The separation of an APZ into Inner (IPA) and Outer (OPA) applies to forest vegetation and therefore is required for this site, which was classified as Coastal Swamp Forest, so the 67 m APZ is divided up into a 20m OPA and a 47m IPA (GeoLINK 2019).

Koala feed trees such as Tallowwood *Eucalyptus microcorys*, Small-fruited grey gum *Eucalyptus propinqua* and Swamp Mahogany *Eucalyptus robusta* will be included in the landscaping within MZ 2.1 (Zone 10 in the Turf Zonal Plan [2019c]), as long as they meet the landscaping requirements of PBP Pre-release (RFS 2018). Rather than including clusters of Koala feed trees, these would need to be single trees (due to requirement for 2-5 m canopy separation). Koala feed trees within the Inner Protection Area (IPA) is not recommended (Veronica Silver, 2019, pers. comm. 18 November).

Requirements when establishing and maintaining an IPA and OPA are listed in Table 4.2 and Table 4.3 of the *Bushfire Hazard Assessment Report* (GeoLINK 2019).

No retained vegetation is within the IPA. Retained vegetation within the OPA (MZ 2.2) may need to be pruned to meet the requirements outlined in Table 4.3 of the *Bushfire Hazard Assessment Report* (GeoLINK 2019) including;

- Tree canopy cover should be less than 30%;
- Trees should have canopy separation;
- Canopies should be separated by 2-5m;
- Shrubs should not form a continuous canopy;
- Shrubs should form no more than 20% of ground cover;
- Grass should be kept to no more than 100 mm in height; and
- Leaves and other vegetation debris should be mown, slashed or mulched.

With reference to the above guidelines, species selection for revegetation in the APZ should consider less flammable plants from the recommended species list in **Appendix B** that have the following features:

- Do not retain dead material or deposit excessive quantities of ground fuel in a short period;
- High moisture content;
- High levels of salt;
- Low volatile oil content of leaves;
- Smooth barks and ever green species; and
- Dense crown and elevated branches.

Maintenance of the IPA and OPA to the standards given in the *Bushfire Hazard Assessment Report* (GeoLINK 2019) will be undertaken as per the frequency outlined in **Table 9** during construction and operations, at a minimum on an annual basis, in advance of the fire season (generally prior to September). Maintenance within the APZ to reduce the impact of bushfires should include, but is not limited to:

- Removal of any weeds as a first priority;
- Raking or removing fine fuels such as leaves, twigs and bark on a regular basis;
- Moving or slashing grass. Once established, native grasses such as will need to be cut back heavily in summer to prevent flammable fuel loads (below 10 centimetres). Care must be taken to consider timing as dry cut material may become a fire hazard. A slashing regime should reduce as cooler weather develops;
- Existing vegetation can be managed by pruning trees, shrubs and understorey; and
- Do not store materials such as wood, large quantities of mulch or building materials within the APZ.

Implementing these measures addresses requirements detailed in Section 4.2 of the *Bushfire Hazard Assessment Report* (GeoLINK 2019) to prevent the spread of a fire towards the hospital buildings and prevent flame contact and reduce radiant heat to buildings, minimise the potential for wind driven embers to cause ignition and reduce the effect of smoke on residents and fire-fighters.

2.4.2 WSUD specifications

A range of WSUD features will be incorporated into the design of the site in order to minimise the impact of water quality and protect the TEC in the wetland area and provide a range of 'stepping stone' habitat and 'moist corridors' to facilitate the movement of threatened species. These features include:

- Sediment basins (MZ 2.3) have been constructed as part of preliminary works which will capture and treat stormwater on the Site during the construction phase of the project.
- Once the site excavation works and roads have been completed and all surfaces have been stabilised with appropriate ground cover (i.e. landscaping has commenced) (~June 2021), the sediment basins will then be converted into bio-detention basins (MZ 2.3) that will capture and treat stormwater on the Site for the operational life of the project.
- New plantings within rain gardens, swales and carparks in MZ 2.3 and 5 will treat both stormwater quality and contribute to providing a range of 'steppingstone' habitat and 'moist corridors' across the site to facilitate the movement of threatened species.

Water quality outcomes and the functionality of sediment and bio-detention basins for the Project are addressed further in the WQMP in **Section 4** and in the SWMP (RBG 2019).

Design, establishment and operation

The planning of bio-detention systems requires specialist planting design and documented procedures to operate the system, the development of which is beyond the scope of this BMP. Moreover, once planted bio-detention systems require extended establishment period (18-24 months). During the establishment period the system will require intense management by wetland specialists that involves both frequent scheduled maintenance and maintenance that is triggered by rainfall events. Notwithstanding the above, consideration of guidelines for the design of bioretention systems (Healthy Waterways 2006, Water by Design 2014, TSC 2016) the following recommendations are made.

Configuration

Design of planting configuration will consider the separate functional components of a bio-detention system as described in **Section 4.1.2.2**.

Plant selection

Plant selection must consider the different species which are suitable for growing in different zones of the bio-detention basins. A range of specialist species are recommended for water sensitive urban design (WSUD) features. For the bio-detention basins located in MZ 2.3, planting needs to be drought resistant, but also tolerant of occasional inundation, high nutrient intake, ideally native medium and fast-growing aquatic and grass-like plant species associated with sedgeland/rushland and freshwater wetland vegetation are recommended. For rain gardens and other WSUD assets located in MZ 5, medium and fast-growing small tree and tree species have been selected from the Broad-leaved paperbark vegetation types.

For appropriate species to plant behind the hard edge of *Lomandra longifolia* for cane toad exclusion please refer to the species list in **Appendix B**.

Planting and establishment

Grow bags should be used to protect from feeding by water birds such as swamp hens which will pull up seedlings. Jute matting and/or mulching of areas on the batter and surrounding the basins will suppress weed growth while plants establish. Consideration should be given to planting at a suitable time of year. For instance, planting in September-October will allow for plant establishment and root growth before the summer storm season whilst also reducing the maintenance water requirements. Maintenance of the basins will require supplementary planting to replace dead, poorly growing or diseased plants.

Cane toad exclusion

In accordance with TSC (2016) and the CSWMP (Lendlease Building 2020) sediment/bio-detention basins on the site will incorporate measures to discourage breeding of cane toads *Rhinella marina* in accordance with published guidelines (BSC 2013) as described in **Section 3.4**.

Salvinia exclusion

Consideration should be given to planting native aquatic species such as nardoo *Marsilea mutica* that may outcompete and potentially suppress the growth of salvinia *Salvinia molesta* in the bio-detention and sediment basins.

Aquatic weed infestations are common within the agricultural drains in the wetland area to the north of the site and control of aquatic weeds in (particularly salvinia *Salvinia molesta*) must be undertaken as described in **Section 2.3.2.6**.

2.4.3 Land use conflict

The *Land Use Conflict Risk Assessment* report (Tim Fitzroy & Associates 2018) outlines recommendations for vegetated buffers to provide an effective safeguard to spray drift. In consideration of these recommendations, it is advised that where practical the species with larger or rough leaves (e.g. sandpaper fig *Ficus fraseri*) and species with compound leaves (e.g. white cedar *Melia azedarach*) are planted in MZ 6 and 7 on the western side of the Site to assist in capturing spray drift.

2.4.4 Mitchell's rainforest snail *Thersites mitchellae* habitat

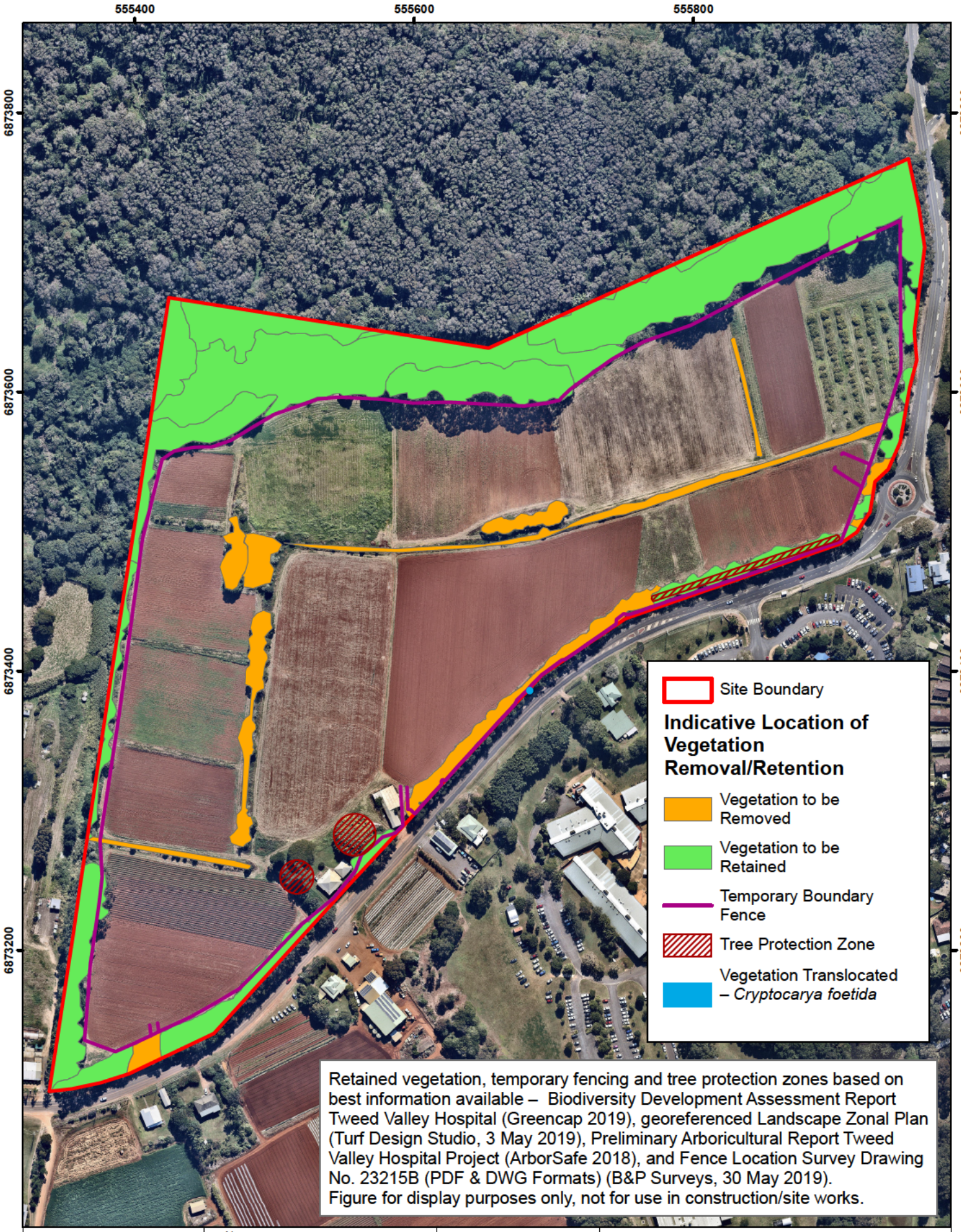
For bush regeneration works conducted in the retained undisturbed forest (i.e. MZs 1.1-1.6) it is essential that the contractor has demonstrated experience working in MRS habitat. Upon Stage 1 SSD approval, a bush regeneration contractor will be engaged and provide a detailed schedule of prioritised weed management actions for the site in consideration of the strategies outlined below.

As described in **Table 9** the removal of barner grass *Cenchrus purpureus* in MZ 1.4 and woody weeds in MZ 1.5 will be undertaken in a staged approach together with revegetation of a hard edge in order to prevent desiccation of adjacent rainforest habitat.

Core habitat for MRS is in the paperbark swamp forest of MZ 1.1 and Subtropical Rainforest of MZ 1.2. Weed control within MZs 1.1 and 1.2 will be targeted (spot spraying, drill and fill or cut and paint methods) and staged to minimise any potential direct impact on the MRS. Weed control in MZ 1.1 and 1.2 will be undertaken in a staged approach to retain undisturbed areas for MRS habitat to allow areas under weed management to recover and regenerate with native plant species, thereby developing additional preferable habitat for the MRS.

Weed control activities will be initially undertaken in non-core areas of MZs 1.3 to 1.6 which contain a higher density of weeds. This will enable the MRS to disperse into the rehabilitated areas before disturbing the core MRS habitat (MZ 1.1 and 1.2). The following strategies have been adapted from the *Weed Reduction Strategy Mitchell's Rainforest Snail Habitat* (Bushland Restoration Services 2016) for restoration of MRS habitat. These strategies were developed in consultation with Dr John Stanisic, an MRS expert, and will be undertaken to control weeds in MRS core habitat MZ 1.1 and 1.2:

- Plan activities and methods to minimise impact on canopy and forest debris (e.g. logs, leaf litter, fallen palm fronds and edges of the remnant vegetation);
- Identify and target invasive weed species that threaten or degrade MRS habitat (e.g. madeira vine *Anredera cordifolia*, barner grass *Cenchrus purpureus*, morning glory *Ipomoea indica and* climbing asparagus fern *Asparagus aethiopicus*);
- Stage the removal of weed species that provide MRS habitat (e.g. Alexander palm *Archontophoenix alexandrae* and umbrella trees *Schefflera actinophylla*). These species should be controlled later as condition of the MRS habitat improves;
- Target areas along edges that do not provide habitat for MRS as a first priority (e.g. dense areas of Lantana *Lantana camara* or barner grass *Cenchrus purpureus*) to encourage fast-growing native rainforest species to colonise and create a new 'closed edge' and expand habitat; and
- Maintain areas under management by controlling weed regrowth and encourage regeneration of native species; and
- Report and evaluate progress as per **Section 2.3.5**.



Retained vegetation, temporary fencing and tree protection zones based on best information available – Biodiversity Development Assessment Report Tweed Valley Hospital (Greencap 2019), georeferenced Landscape Zonal Plan (Turf Design Studio, 3 May 2019), Preliminary Arboricultural Report Tweed Valley Hospital Project (ArborSafe 2018), and Fence Location Survey Drawing No. 23215B (PDF & DWG Formats) (B&P Surveys, 30 May 2019).
Figure for display purposes only, not for use in construction/site works.

Client: C107778	N 0 40 80 m	Scale (@A4): 1:3,500	**Temporary Boundary Fencing and Vegetation Protection Fencing**
Job #: J156455			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke		Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 7**
Date: 26/06/2019	*Imagery 8th August 2018 (7.5 cm) © Nearmap 2018*		
GREENCAP			

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2.5 VMP Overview

The guidance presented in this VMP is intended to facilitate effective vegetation management throughout the life of the project via the application of tailored weed control, regeneration, revegetation, maintenance, monitoring and reporting. The timing of various activities is also aligned with the different phases of the Project. **Table 9** provides a general overview of the key objectives, activities and timing.

2.6 Timing

The timing for vegetation management measures as shown for each MZ in **Table 8** and in the Project Phase column of **Table 9** is indicative only and based on the information available at the time of writing this Stage 2 BMP.

Weed control commenced during Stage 1 early works in June 2019. Some measures, such as hydro mulching commenced in the Stage 1 pre-construction phase in late-2018 to mid-2019 prior to approval.

As per the Stage 1 BMP, primary and secondary (conducted 6-8 weeks following the primary treatment) weed control activities were undertaken in the following areas during Stage 1;

- Exotic vegetation adjacent to the farm dam (MZ 1.4, 1.5 and 8);
- Koala habitat (MZ 1.6);
- Hydro-mulched lawn/farm landscape (MZ 4);
- The low maintenance native landscape/ around the site entrances (MZ 2.1);
- The vegetated buffers (MZ 6 and 7); and
- The development footprint (before topsoil stripping).

Stage 2 primary and secondary weed control activities will commence in the remaining areas; MZ's 1.1 to 1.3, 2.1, 2.2 and 2.3.

Expected timing for Stage 2 Project Phases is as follows;

- Construction: June 2020 to late-2022; and
- Operation: Targeting opening in early-2023.

Revegetation will commence during the construction phase of the Stage 2 following primary and secondary weed control activities, as shown in **Table 8.**

Table 8 Indicative timing for commencement of revegetation activities during Stage 2

MZ	Description	Revegetation commences
1.1 to 1.3 and 1.6	Remnant paperbark swamp forest/subtropical rainforest/Flooded Gum forest/ incl. Koala and MRS habitat	Q2 June 2020 – Q4 November 2020
1.4 and 1.5	Exotic vegetation	Q2 June 2020
2.1 and 2.2	Low maintenance Native Landscape and Remnant Vegetation windrows	Q2 June 2020 – Q2 June 2021
2.3	Bio-detention basins	Q2 June 2021 Please note: Sediment basins have been hydro mulched with grass seed during Stage 1 and do not require further planting. The sediment basins will be converted into bio-detention basins in Q2 June 2021, once the site excavation works and roads have been completed and all surfaces have been stabilised with appropriate ground cover (i.e. landscaping has commenced).
4	Hydromulched lawn	NA: Planting not required. Lawn maintenance only.

MZ	Description	Revegetation commences
5	WSUD carpark/roadway planting	Q3 2021 – Q4 2021 (once the carparks/roads have been completed)
6 and 7	Vegetated buffers	Q2 June 2021
8	Farm dam	Q2 June 2020 (dam decommissioning works)

[1] Q1: January to March, Q2: April to June, Q3: July to September and Q4 October to December.

A number of management zones (i.e. MZ 6 and 7) will not be established until revegetation is undertaken during the later stages of Stage 2, once the majority of construction activities and primary and secondary weed control activities have been completed.

Table 9 Summary of vegetation management activities (weed control, planting, maintenance, monitoring, reporting)

Item	MZ	Activity[4]	Frequency	Project Phase[1]	Who[2]
Primary and secondary weed control					
18	MZ's 1.1 to 1.3, 2.1, 2.2 and 2.3	Conduct primary weed control. MZ 1.1 and 1.2 activities must consider strategies to protect MRS habitat as per **Section 2.4.4**. For open grassy areas (i.e. MZ 2.1 and 2.3) slashing/ brush cutting (if required, see **Section 2.3.2.4**) and spot spray with an appropriate herbicide (e.g. glyphosate). Secondary weed control to be conducted 6-8 weeks following primary weed control. Follow up hydro mulch application where required. See **Section 2.3.1.3** for hydro mulching in MZ 2.1 and 4. Maintenance of MZ's 2.1, 2.2 and 1.6 must comply with APZ guidelines as per **Section 2.4.1**. *Please note: Primary and Secondary weed control were conducted during Stage 1, as per the Stage 1 BMP in MZ's 1.4, 1.5, sections of 2.1, 4, 6, 7 and 8 and the project footprint.*	Two main events as per the bush regeneration contractor detailed schedule (See **Table 5** and **Table 7**).	Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control)
Planting					
19	MZ 1.4 and 1.5	Following completion of the staged primary and secondary weed control and site preparation activities as per **Section 2.4.4**, **revegetate** as per **Section 2.3.3** and **Section 2.4.4** to lowland rainforest on floodplain to increase area of habitat available for threatened species, particularly the MRS.	As per the bush regeneration contractor detailed schedule (See **Table 5** and **Table 7**).	Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control)
20	MZ 1.1, 1.2, 1.3, 1.6, 2.1, 2.2 and 5	Following completion of primary and secondary weed control and site preparation activities, **assisted regeneration** as per **Section 2.3.3.6** and **Section 2.4.4** to retain and enhance biodiversity values and Koala habitat values (MZ 1.6), create stepping-stone or 'moist corridor' habitat corridors across the site. MZ's 2.1, 2.2 and 1.6 must comply with APZ guidelines as per **Section 2.4.1**. The planting design includes lawn with clusters of native planting (min 20m apart) as per the Schematic LZP by Turf Design (June 2019).	As per the bush regeneration contractor detailed schedule (See **Table 5** and **Table 7**).	Stage 2 C	

Item	MZ	Activity[4]	Frequency	Project Phase[1]	Who[2]
21	MZ 2.3	**Revegetate** basins as per **Section 2.4.2** to enhance biodiversity values and create stepping-stone or 'moist corridor' habitat across the site.	As per the bush regeneration contractor detailed schedule (See **Table 5** and **Table 7**).	Stage 2 C	
22	MZ 6 and 7	Following completion of primary and secondary weed control and site preparation activities, retain existing vegetation (where possible) and **revegetate buffer zones** to Subtropical Rainforest as per **Section 2.3.3.** Increase area of habitat available for threatened species. Create habitat corridors across the site.	As per the bush regeneration contractor detailed schedule (See **Table 5** and **Table 7**).	Stage 2 C	
Maintenance, monitoring and ongoing weed control [3]					
23	MZ 1.4 and 1.5	Maintenance of planting areas	Following completion of primary works, minimum of **four maintenance events per year** for the **five-year** period. If performance criteria are not met after a five-year period then the program will be reviewed and extended until performance criteria are met.	Stage 2 C & O* *Events may be required during the operational phase depending on the timing and success of primary works. Monitoring, maintenance and weed control events can be conducted in conjunction.	Management, Contractor (Bush Regeneration/ Weed control)
24	MZ 1.1, 1.2, 1.3, 1.6, 2.1, 2.2, 2.3, 5, 6 and 7.	Maintenance of planting areas	Following completion of primary works, minimum of **four maintenance events per year** for the **three-year** period. If performance criteria are not met after a three-year period then the program will be reviewed and extended until performance criteria are met.		
25	All MZs	Vegetation maintenance report	For each vegetation maintenance event (**four per year**), contractors must complete a record of all works undertaken to be submitted to management and all data will be		

Item	MZ	Activity[4]	Frequency	Project Phase[1]	Who[2]
			compiled into an annual vegetation maintenance report.		
26	MZ 1.4 and 1.5	Monitoring of planting areas	Following completion of primary works, **two monitoring events per year** for the **five-year** period. If performance criteria are not met after a five-year period then the program will be reviewed and extended until performance criteria are met.		
27	MZ 1.1, 1.2, 1.3, 1.6, 2.1, 2.2, 2.3, 5, 6 and 7.	Monitoring of planting areas	Following completion of primary works, **two monitoring events per year** for the **three-year** period. If performance criteria are not met after a three-year period then the program will be reviewed and extended until performance criteria are met.		
28	All MZs	Vegetation monitoring report	**Two per year** following **each monitoring event** and **one annual vegetation monitoring report**. All data will be compiled into an annual report to assess the effectiveness of the works undertaken in accordance with the performance criteria as specified in **Table 7** and recommendations for program adjustments.		
29	All MZs and Project footprint	Weed control activities and inspections as per **Section 2.3.2**, and specifically **Section 2.3.2.6** for *Salvinia molesta* control MZ's 2.1, 2.2 and 1.6 must comply with APZ guidelines as per **Section 2.4.1**.	A minimum of **four events per year with provisions to allow for additional events** during the peak weed growth period over summer		

Item	MZ	Activity[4]	Frequency	Project Phase[1]	Who[2]
			and spring (i.e. every month), **in perpetuity.**		
30	All MZs	Weed control reporting	Contractors must complete a record of all works undertaken to be submitted to management per event and all data will be compiled into an annual weed control report.		
Measures of rehabilitating the existing dam					
31	MZ 8	The dam will be incrementally infilled without dewatering in a monitored and staged approach to ensure gradual displacement of water so that the impact of the process on native aquatic fauna is mitigated. Advice was sought from a local fauna ecologist with experience dam decommissions (Ben Gunston, 2019, pers. comm. 26 June) on the best practice process to mitigate impacts on native fauna. The best practice method will be employed to decommission the dam and mitigate impacts on native flora and fauna as per **Section 2.3.2.7.**	Several events, prior to civil works which are expected to be undertaken in June 2020, and as per the bush regeneration contractor and fauna rescue contractor detailed schedule.	Stage 2 C	Management, Fauna Rescue Contractor, Construction Contractor, Bush Regeneration Contractor
32	MZ 1.1 and 1.4	Following completion of the dam works (expected in June 2020), vegetation restoration, maintenance, weed management activities and monitoring and reporting will be undertaken around the decommissioned dam in accordance with **Sections 2.3.4** and **2.3.5**.	<u>Planting:</u> Upon completion of works, and as per the bush regeneration contractor detailed schedule. <u>Maintenance:</u> Following completion of primary works, minimum of **four maintenance events per year** for the **five-year** period. <u>Monitoring:</u> Following completion of primary works, **two monitoring events per year** for the **five-year** period. <u>Reporting:</u>	Stage 2 C & O	Management, Bush Regeneration Contractor

Item	MZ	Activity[4]	Frequency	Project Phase[1]	Who[2]
			Two per year following **each monitoring event** and **one annual vegetation monitoring report**.		

[1] Project phases: Stage 2: Construction (C) and Operation (O)

[2] Suitably qualified and experienced bush regeneration contractors must be engaged to undertake vegetation management works within all areas containing native vegetation except for mechanical removal of slash pine *Pinus ellioti.*

[3] Prior to the undertaking of each maintenance event a site inspection is to be completed to determine what, if any, weed control is required.

[4] Vegetation management works within MZ 1.1 to 1.6 should refer to strategies to protect the MRS habitat as per **Section 2.4.4.**

3. FAUNA MANAGEMENT PLAN

3.1 Fauna management aims and objectives

The objective of this FMP is to conserve and enhance biodiversity values on the Site and avoid and mitigate any potential impacts on threatened species, in particular MRS, which has been identified adjacent to the Site. In order to achieve this objective, several activities will be undertaken at different phases of the Project during Stage 2 as outlined in **Table 9.**

These measures will mitigate the residual impacts of the Project as outlined in the BDAR (Greencap 2019b; Appendix I, J). This FMP refers to the MZ identified in **Figure 6**Error! Reference source not found..

3.2 Threatened Species

Threatened species surveys were undertaken on the Site in 2018 to inform the development of a BDAR (Greencap 2019b). Targeted fauna surveys were undertaken using methodology as detailed in the BDAR (Greencap 2019b). There were no threatened fauna species recorded on the Site. However, MRS was found outside and adjacent to the Project Site boundary (**Section 3.2.2**),

The following subsections address potential impacts of the Project on the known population of the endangered MRS directly adjacent to the Site and a small area of preferred habitat for the endangered population of Koala *Phascolarctos cinereus* on the Site. Water quality impacts on pH dependent threatened amphibians in the downstream receiving wetland environment are also addressed. Furthermore, highly mobile threatened species that have been recorded in the Tweed LGA, namely; grey-headed flying fox *Pteropus poliocephalus,* eastern osprey *Pandion cristatus* and white-bellied sea eagle *Haliaeetus leucogaster* are described below and potential impacts on these species due to Project related aviation activities are addressed in **Section 3.8.3**.

3.2.1 Koala habitat

A population of the Koala *Phascolarctos cinereus* between the Tweed and Brunswick Rivers east of the Pacific Highway is listed under the BC Act as an endangered population, consisting of an estimated 144 animals (TSC 2014). A small 0.2 ha area of preferred Koala Phascolarctos cinereus habitat is located on Site in MZ 1.6, in the far north-east corner of the Site outside the Project footprint area (**Figure 6**Error! Reference source not found.). This vegetation contains preferred food source trees (tallowwood *Eucalyptus microcorys*) and meets the definition of 'Secondary (Class A) Habitat' as defined in the Tweed Coast Comprehensive Koala Plan of Management (CKPoM) and 'Potential Koala Habitat' as defined in State Environmental Planning Policy 44 – Koala habitat protection 44.

Targeted Koala *Phascolarctos cinereus* surveys were undertaken in July and December 2018 to inform the development of the BDAR, however no Koalas *Phascolarctos cinereus* were recorded (Greencap 2019b). Whilst undertaking the survey, it was also observed that weedy vegetation and growth of vines would be challenging for Koalas *Phascolarctos cinereus* to utilise the trees. Whilst no Koalas *Phascolarctos cinereus* were recorded on Site during the BDAR surveys, measures will be taken to avoid any disruption to the movement or impacts on habitat connectivity for this species as outlined below in **Section 3.3** or any impacts during the native vegetation clearing activities as outlined below in **Section 3.7**. Primary and secondary weed control measures commenced during Stage 1 in the area of preferred Koala *Phascolarctos cinereus* habitat (MZ 1.6)**.** Ongoing weed control works during Stage 2 will be a priority for this area of habitat. A tree protection zone (TPZ) and signage has been installed to protect this area of Koala *Phascolarctos cinereus* habitat as outlined in the VMP **Section 2.3.**

Appendix B includes the following recommended Koala feed tree species for the Site:

Primary food trees:

- Tallowwood *Eucalyptus microcorys* (MZ's 1.6, 6, 7 and 2.1 to 2.3)
- Forest Red Gum *Eucalyptus tereticornis* (MZ 2.3)
- Swamp Mahogany *Eucalyptus robusta* (MZ's 1.6, 2.1 to 2.3)

Secondary/supplementary food tree species:

- Small-fruited grey gum *Eucalyptus propinqua* (MZ's 1.6, 6, 7 and 2.1 to 2.3)

Koala feed trees Tallowwood *Eucalyptus microcorys* and Small-fruited grey gum *Eucalyptus propinqua* will be included in the landscaping within MZ's 6, 7 and 2.1 (Zones 7 and 10 respectively in the Turf Zonal Plan [2019c]), and Swamp Mahogany *Eucalyptus robusta* in MZ 2.1 only. Koala feed tree species will be planted in MZ 1.6 by the Bush Regeneration Contractor as required for supplementary planting within the existing vegetation where canopy gaps exist once weed control has been undertaken. As Section 2.3.3.6 describes, a spacing of approximately 2.5 m will be aimed for in assisted regeneration zones.

3.2.2 Mitchell's rainforest snail *Thersites mitchellae*

3.2.2.1 Records

To date, no MRS specimens were found on the Site, however, MRS were detected during surveys outside the Project Site boundary in the northern portion of former Lot 102 DP 870722. **Figure 10** presents the locations of the MRS survey results undertaken as part of the BDAR in 2018 as well as suitable MRS habitat (MZs 1.1 and 1.2) and an area of Subtropical rainforest restoration that will potentially provide further suitable habitat for this species (MZs 1.4 and 1.5). Survey records of MRS are as follows;

- On 19 November 2018, an opportunistic recording of MRS by Dr Damian Licari and David Milledge. One live individual was recorded at the ecotone between the Subtropical Rainforest and Coastal Swamp Forest, and one dead shell was recorded on the perimeter of MZ 1.2 outside the Project Site boundary.
- On 19 and 20 December 2018, targeted diurnal and nocturnal surveys for the snail concentrating on windrow vegetation to be cleared were undertaken by Dr Stephanie Clark (invertebrate identification specialist), Dr David Robertson and Craig Faulkner. Whilst no specimens were recorded in windrow vegetation to be cleared on Site, the target species was detected in paperbark swamp forest in the northern extremity of former Lot 102 DP 870722. One living individual and three dead shells were found.
- On 21 and 22 May 2019, during the pre-construction baseline survey by Dr Stephanie Clark, three living MRS were found on the ground, under logs and crawling at night and three empty shells were also found, all of which were outside the Project Site boundary (Clark 2019c). Some of the empty shells showed signs of predation by birds (such as brush turkey *Alectura lathami*) and by mammals (such as black rat *Rattus rattus*) both of which were observed on the Site (Clark 2019c).

In addition, there are known records for MRS to the east and west of this location (NSW BioNet database searched, 7 December 2018).

The targeted survey undertaken by Dr Clark concluded that the clearing of 0.95 ha of rainforest vegetation from the proposed development area during Stage 1 would not significantly impact Mitchell's rainforest snail habitat as this was not considered suitable habitat for MRS (Clark 2019a).

3.2.2.2 Protection of snail populations and habitat

The MRS is classified as endangered in NSW under the BC Act (OEH 2018) and Critically Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and has an adopted recovery plan (NPWS 2001). Under this Stage 2 BMP, MRS habitat will be managed to protect this threatened species, including the management of vegetation and invasive species which may be harmful to threatened species, in particular weeds and rats which are one of the known threats to the MRS (OEH 2018; NPWS 2001). Ongoing long-term monitoring and reporting will be undertaken to establish an estimated population size at the Site and to monitor any changes in population over time. Changes to MRS populations are to be addressed with adaptive management actions. Mitigation and management measures to protect MRS populations are aligned with the recovery plan and are described below.

Vegetation Management

Vegetation in core MRS habitat (MZs 1.1 and 1.2) will be managed to protect and increase the quality of habitat by improving key habitat requirements of well-developed leaf litter and intact canopy (NPWS 2001). Weed control commenced in Stage 1 and assisted regeneration with rainforest plants will be undertaken in Stage 2 as outlined in the VMP (**Section 2**).

Under the BMP, the Vegetation Management Plan (VMP) incorporates revegetation of MZs 1.4 and 1.5 (total area of approx. 0.95 ha) which are currently dominated by weed species barner grass *Cenchrus purpureus* and camphor laurel *Cinnamomum camphora*. Once established, revegetation of MZs 1.4 and 1.5 will represent an overall net increase in MRS Subtropical rainforest habitat on the Site. Revegetation will consist of high density planting with a diverse range of rainforest species to achieve a closed canopy rainforest with a thick leaf litter cover which is addressed in **Section 2.4.4**.

As described in the VMP **Section 2.4.4,** weed control activities within the retained undisturbed forest will be undertaken in a staged approach to minimise the disturbance on MRS habitat and a bush regeneration contractor who has demonstrated experience working in MRS habitat is to be engaged.

Bushfire risk will be managed in accordance with the adopted guidelines (RFS 2006) and Asset Protection Zone (APZ) regulations (RFS 2007). Furthermore, during construction of the Project, if smoking is to be permitted on site, designated smoking areas will be established, and suitable receptacles will be provided for cigarette butts.

Pest management

Predation by introduced black rat *Rattus rattus* is a potential impact on the MRS (OEH 2018; NPWS 2001). Several black rats were detected on the Site during BAM surveys and during the baseline MRS survey (Greencap 2019a; Clark 2019c). This has consequently been identified as a potential threat to the MRS on the Site. A black rat *Rattus rattus* control program will be implemented during construction of the Project. In order to avoid impact on non-target native species, control measures are to be undertaken around the ancillary facilities and not within native animal habitat (i.e. MZs 1.1 to 7). A specialist pest control contractor will be engaged to develop a black rat *Rattus rattus* control program for the Site.

Water quality

Stormwater run-off containing poisons and other chemicals has the potential to adversely directly impact the MRS, as well as indirectly through changes in vegetation structure from change in water quality and flow regimes (Clarke 2019b). The quality of stormwater entering the downstream wetland MRS habitat (MZs 1.1 and 1.2) will be managed and monitored in accordance to measures outlined in the WQMP in **Section 4** of this Stage 2 BMP.

Monitoring program

A specialist invertebrate consultant, Dr Stephanie Clark, has been engaged to develop a scientific survey and management plan for the MRS at the Site. A pre-construction survey was undertaken in May 2019 to collect baseline data on population size, with further surveys to resume later in 2019 during warmer weather when snails are more active. The survey was undertaken at night within the MRS habitat within the Site boundary (MZs 1.1 and 1.2). An ongoing repeatable monitoring program will ensure long term consistency of data to determine the population size.

In accordance with the adopted recovery plan (NPWS 2001), it is recommended that ongoing, long term monitoring be conducted every second year for the life of the Project (construction and operations) to identify any changes in the status of the species. Management objectives, actions, monitoring and compliance for the MRS are provided in the management plan for the MRS (Clark 2019b).

Reporting

As part of the baseline monitoring program, a specialist invertebrate consultant has submitted a pre-construction baseline survey of MRS report (Clark 2019c) outlining; date of survey, personnel, weather, areas surveyed, survey methodology, results, photos, observations, threats and impacts on the MRS, an evaluation of the monitoring program and any recommendations.

Following each monitoring event a specialist invertebrate consultant will submit a report including but not limited to; date, personnel, weather, areas surveyed, survey methodology and results of population size, trends in population size, observations, photos, impacts and threats on the MRS, an evaluation of the monitoring program and any recommendations.

Responsibilities

During construction, the Safety & Environmental Manager at Lendlease will be responsible for commissioning the monitoring and reporting for the MRS. Lendlease will rely upon input from the specialist invertebrate consultant and the bush regeneration subcontractor. Reports will be submitted to the Safety & Environmental Manager at Lendlease and if the results show the population is declining, they will ensure that management actions are implemented to mitigate any population decline.

Post construction, the Manager Capital Assets and Resources (or similar/equivalent role) at LHD) will be responsible for commissioning the ongoing long term monitoring and reporting for the MRS, with input from external specialist subcontractors. Reports will be submitted to the Manager Capital Assets and Resources (or similar/equivalent role) at LHD and if the results show the population is declining, LHD will ensure that management actions are implemented to mitigate any population decline.

The continuity of monitoring is to be reassessed in alignment with each monitoring and reporting cycle.

Summary

Responsibilities for the Mitchell's Rainforest Snail both during and post construction works are summarised in **Table 10** as per SSD 10353 Condition B31(d).

Table 10 Summary of activities relevant to Mitchell's Rainforest Snail

	BMP Reference
Vegetation and Habitat management	
General commitment and objective	**Section 2.1**
Appropriately experienced bush regeneration contractors to demonstrate experience in working with MRS habitat (or similar)	**Table 5 (Item 3)**
Consideration of appropriate planting density relevant to MRS habitat during regeneration works	**Section 2.3.3.5**

	BMP Reference
Implementation of appropriate weed control measures in MRS habitat	**Section 2.4.4**
Management and protection of existing habitat	**Section 3.2.2.2**
Fauna management	
MRS and site context	**Section 3.2.2.1**
Protection of existing populations and habitat	**Section 3.2.2.2**
Pest animal management	**Section 3.4**
Mitigation measures	**Table 11 (Items 33 to 38)**
Ongoing MRS monitoring	**Section 3.2.2.2**

3.2.3 Aquatic fauna

During the development of the BDAR, two pH dependent amphibians were identified by the BAM Calculator as candidate threatened species – Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis* (Greencap 2019b). There are records for these species within the 1,500 m assessment area and within the receiving catchment.

The use of gypsum as a flocculent in the sediment basins to rapidly settle sediment-laden stormwater runoff during construction may have an impact upon pH dependent amphibian species following discharge to the downstream receiving wetland environment. To avoid any potential changes in pH and impacts on these threatened species, other commercially available flocculants that work as effectively as a gypsum replacement yet do not create the large changes in pH will be used on the Site.

As part of a Water Quality Monitoring Program as outlined in the WQMP in **Section 4**, physico-chemical parameters including pH will be monitored in water discharged from sediment basins and in the downstream wetland environment.

The impact of erosion and sedimentation on terrestrial and aquatic flora and fauna during Stage 2 works will be managed in accordance with an Erosion and Sediment Control Plan (ESCP, RBG 2019) and Construction Soil and Water Management Plan (CSWMP, LLB 2020) prepared for the Site to effectively manage erosion and subsequent sediment mobilisations. The ESCP/CSWMP will be implemented prior to the commencement of construction works, especially prior to the onset of each wet season (from late February to late April). The ESCP/CSWMP is reviewed and updated, as required, and at least annually prior to the onset of the wet season to reflect changes in site conditions as construction progresses. An erosion assessment will be conducted on these areas by a Certified Practitioner in Erosion and Sediment Control (CPESC) during the planning phase of the ESCP development. ESC design should be in accordance with the guidelines in the NSW Managing Urban Stormwater "Blue Book" (Landcom 2004).

For management of aquatic fauna during the decommissioning of the existing dam please see **Section 2.3.2.7**.

3.2.4 Flying Fox Camps

Initial desktop assessment determined that there were two flying fox camps located within a 1 km radius of the Site (Greencap, 2018), however, there are no flying fox camps located on the Site. Potential impacts (injury/mortality) from aviation activities on flying foxes during operations of the Project are addressed in **Section 3.8.3**.

3.2.5 Coastal Raptor Nests

Coastal raptors such as the eastern osprey *Pandion cristatus* and white-bellied sea eagle *Haliaeetus leucogaster* have been recorded in the Tweed LGA. No coastal raptor nests were recorded on the Site, however, two known osprey nests have been recorded within the 1500m assessment area (TSC, 2018). The potential impacts of helicopter collision from aviation activities on coastal raptors during operations are addressed in **Section 3.8.3** and indirect impacts on coastal raptors that potentially utilise the paperbark swamp forest (MZ 1.1) are addressed in **Section 3.9**.

3.3 Habitat Connectivity

3.3.1 Fencing

The primary impact on movement of threatened species relates to boundary fencing of the site, noting that species would be able to move around the Project site unless impeded by a boundary fence. In respect of the current fencing on the site, the only existing permanent fencing in proximity to the site is the wildlife fencing along the Turnock St roadside. The Project will not impact this existing fencing.

Temporary boundary fencing was installed around the permitter of the site during the pre-construction works and presents a barrier to the retained vegetation around the site boundary (**Figure 7**). Tree Protection Zones (TPZ) have been installed around native vegetation and specific trees to be retained adjacent to the construction footprint (See VMP **Table 5**, **Section 2.3.1** and **Figure 7**). This temporary fencing will be removed at the conclusion of the construction phase of the development. Temporary boundary fencing has been fitted with a 'post and bridge' system at least every 50 m in accordance with published guidelines (KRS 2009) to facilitate movement of Koala *Phascolarctos cinereus* and other arboreal marsupials. As per the Stage 1 SSD application, there is no intent for a permanent boundary fence to be installed for the operation phase of the Project, thereby allowing movement of threatened species.

3.3.2 Habitat corridors

Habitat connectivity will be maintained across the Site by vegetation management measures as outlined in the VMP (**Section 2.3**), primarily by the installation of TPZ's to protect retained native vegetation during the construction works.

Importantly, to facilitate the movement of fauna, vegetated buffer zones (MZs 6 and 7) will be substantial (10 m and 30 m wide) and representative of forest types being connected by these zones. Vegetated buffer zones will connect to the retained Subtropical Rainforest vegetation in the northern portion of the site and will run north to south in line with the mapped regional fauna corridor (**Figure 9**). This will provide important stepping-stone and refuge habitat for threatened species and will represent an improvement in connectivity from the existing use of the Site. Primary and secondary Koala food tree species, namely; Tallowwood *Eucalyptus microcorys* and Small-fruited grey gum *Eucalyptus propinqua* will be included in the species mix for vegetated buffers (MZ 6 and 7) and in the low maintenance native landscape area (MZ 2.1) (Turf 2019 and 2019e). Revegetation will be undertaken during Stage 2 works and is addressed in **Section 2.3.3.**

Furthermore, stormwater management will incorporate WSUD principles and the make use of landscaped areas for filtering runoff, swale drains and vegetated sediment basins. New plantings in MZ 2.3 as part of Stage 2 works will treat both stormwater quality and contribute to providing a range of native habitat or 'moist corridors' across the Site.

Where possible, landscaping will include habitat features such as rocks that have been salvaged from other areas of the Site (cleared windrows) that will create habitat for ground dwelling species (Turf, 2018).

3.4 Pest animal management

No major pest species have been identified on the Site, except for the black rat *Rattus rattus* which poses a potential impact on MRS populations. A black rat *Rattus rattus* control program will be implemented during Stage 2 of the Project as discussed in **Section 3.2.2.2**.

The introduction of pest species or disease onto the Site will be mitigated by installing an environmental protection area (or TPZ) to protect retained vegetation on the Site during construction. Furthermore, weed control and high density Subtropical Rainforest revegetation across the Site will also provide habitat for specialist rainforest dependent species such as the Mitchell's rainforest snail *Thersites mitchellae* and avoid attracting open habitat generalist species or exotic species.

Cane toad exclusion

In accordance with TSC (2016) and the CSWMP (Lendlease Building 2020) sediment basins on the site will incorporate measures to discourage breeding of cane toads *Rhinella marina* in accordance with published guidelines (BSC 2013).

- Cane toad *Rhinella marina* exclusion fencing will be installed around sediment basins consisting of:
    - Shade cloth or similar material;
    - 900 mm wide cloth provides enough height (at least 700 mm) and depth into the ground (at least 100 mm);
    - Posts should be spaced approximately 1.6 m apart;
    - Dig a trench at least 100 mm deep and drive posts into the trench;
    - Secure the cloth tightly between posts with the base of the cloth in the ground;
    - Backfill the trench to cover the base of the fencing material; and
    - Once the barrier has been erected, check regularly to make sure no toads are trapped inside the fence.

Timing for installation of the cane toad *Rhinella marina* exclusion fencing will follow the conclusion of civil works directly around/involving the sediment basins.

Following the conclusion of civil works directly around/involving the sediment/bio-detention basins, the basin batter and rip rap/overflow areas will be planted out with an edge of *Lomandra longifolia* at a density of three rows, 0.5 to 1 m apart with staggered spacing's of 50cm to exclude Cane toad *Rhinella marina*. Once this dense edge of *Lomandra longifolia* is established the cane toad fencing can be removed (BSC 2013).

3.5 Native fauna management

Documentation of all native fauna injuries and deaths will be recorded in incident registers to monitor species mortality, including fauna mortality resulting from vehicle strikes or entanglement. Should an increase in the frequency of Project related fauna mortality/injury incidents occur, it will trigger investigation and appropriate adaptive management actions will be implemented to mitigate the impacts.

To minimise interactions with fauna, it is recommended that Site Management enforce the following policies on the Site:

- Catching or feeding of native or feral animals on Site is prohibited.
- Site personnel will be prohibited from harming or intentionally killing any wildlife.
- Throughout operation of the Project pets will be permitted on the Site, managed under operational policies, including on-leash control.
- Discarding food wastes on the Site is strictly prohibited.

The following fauna management practices will be implemented on the Site:

- Excavations will exclude fauna entry or allow for fauna egress. Where it is not practical to provide fauna egress, daily checks will be undertaken before work commences.
- All excavations left open overnight will be inspected each morning.
- Uninjured trapped fauna will be released to a predetermined species-relevant nearby area of suitable habitat away from the Site by a suitably qualified and wildlife handler.
- Dead native animals that are found on the Site will be recorded in a fauna incident register, reported, collected and disposed of appropriately so as not to attract predators or scavengers.
- Injured native animals will be collected and taken to nearby veterinary facilities for treatment, as required.
- Personnel will record fauna sightings/encounters during construction activities using a fauna register.

Site inductions will include the following specific components for flora and fauna management:

- Commentary regarding the flora, fauna and ecological values within and in the vicinity of the Site.
- Project commitments specific to how flora and fauna are protected during construction or operation works.
- Procedures in the event that fauna are encountered within the Site.
- Requirement that all clearing/earthworks/construction activities are to be confined within the Site boundary.

3.6 Waste management

Construction activities on the Site during Stage 2 works will be managed in accordance with the approved CEMP CWMSP (LLB 2019).

The following measures will be included to prevent fauna being attracted to Site:

- The 'eliminate, reduce, re-use, recycle' disposal waste management principles will be applied.
- Limit the amount of rubbish and waste onsite through good housekeeping practices.
- Food waste will be disposed of at a designated facility.
- Putrescible wastes will be stored in secure bins with lids or transported offsite daily for disposal.

3.7 Fauna management procedure during vegetation clearing and rock removal

To minimise impacts and ensure the safety of any native ground dwelling and arboreal fauna occupying trees, vegetation and around rocks proposed for removal, a suitably qualified and experienced fauna rescue person shall be present to supervise the clearing activities. A Fauna Management Procedure for vegetation and rock clearing activities on the Site is outlined below in sequential order:

1. A suitably qualified and experienced ecological consultant will be engaged to undertake fauna rescue for native vegetation clearing and rock removal activities. Relevant qualifications/licenses include:
    a. 'Animal Research Authority' as approved by the Animal Care and Ethics Committee (Department of Primary Industries).
    b. A biodiversity conservation licence granted under Part 2 of the BC Act that allows handlers to legally catch and release reptiles (usually snakes) from commercial and residential homes and backyards.
2. A pre-clearing inspection will be done of all areas to be cleared, including around rocks within windrow vegetation being cleared. All trees within 30 metres of those trees to be cleared are to be

inspected for the presence of native fauna. The pre-clearing inspection will assess for presence of any native fauna, tree hollows, bird nests etc.

3. A pre-clearing inspection report will be submitted to TSA Management containing pre-clearing inspection results and any recommendations such as elevated work platform requirements for working at heights.
4. During vegetation and rock clearing works a daily survey will be undertaken before works commence to assess if any fauna has moved into the area overnight or within 30 metres of those trees to be cleared (including construction of bird nests etc.).
5. Fauna spotters / rescue personnel at 1 person per operational machine will be present at all times during clearing works. The fauna rescue personnel must be responsible for identifying fauna present on the site and will remain on site during any clearing works to ensure that any tree occupied by fauna is not accidentally cleared or interfered.
6. If any fauna is found during clearing, where possible, uninjured native fauna detected will be caught by the fauna rescue personnel and released at a predetermined location of appropriate habitat that is nearby, but outside of the Project footprint.
7. Any injured native fauna detected shall be rescued and transferred to a local veterinarian for treatment and/or WIRES for rehabilitation.
8. The Fauna rescue consultant will submit a post-clearing report outlining at a minimum any observations, mortality, injuries, captures and translocations.

If Koalas *Phascolarctos cinereus* are found on the Site during vegetation clearing works and/or earthworks;

- All construction clearing/earthwork activities must be temporarily suspended within a range of 30 metres from any tree which is occupied by a Koala.
- Works are to be avoided in any area between the Koala and the nearest areas of habitat to allow the animal to move to adjacent undisturbed areas.
- Works must not resume until the Koala has moved from the tree of its own volition.

3.8 Traffic management

3.8.1 On site

The following traffic management measures will reduce the risk of impact on wildlife during the construction and/or operations phase of the Project:

- A Preliminary Construction Traffic Management Plan (CTMP) has been produced as part of an approved CEMP and its prescriptions will be implemented during the construction phase of the Project (LLB 2019).
- Construction traffic must maintain low vehicle speeds to 20km/hr on internal roads and access ways (LLB 2019) and operators shall take care and be aware of any wildlife that may be in the area to minimise the risk of fauna injury or mortality. Should wildlife enter the construction footprint, a suitably qualified fauna handler should be notified and actions taken in accordance with the FMP and CEMP (LLB 2019).
- During the 24-hour operation of the hospital, traffic must maintain low vehicle speeds to 20km/hr on internal roads and access ways.
- Documentation of all native fauna injuries and deaths will be recorded in incident registers to monitor species mortality and any direct impacts will trigger investigation and adaptive management actions where possible.
- Any injured native fauna detected shall be rescued and transferred to a local veterinarian for treatment and/or WIRES for rehabilitation.

- Traffic will be mainly restricted to the southern portion of the Site where the project footprint is at least 67 m from the remnant native vegetation. This provides a natural buffer zone.

3.8.2 Off site

At peak of operations in 2033 the Project is estimated to generate an incremental increase in the order of 5,232 to 5,894 trips per day along Cudgen Road and Turnock Street at the peak of operations in 2033 (Bitzios, 2019). Weekday peak visitor numbers have been estimated at 408 visitors per day in year 2026/27 and 448 visitors per day in year 2031/32 (Bitzios, 2019).

There is an existing wildlife fence along Turnock Street owned and managed by TSC that is located adjacent to MZs 1.1, 1.2 and 1.6 (**Figure 1**). The wildlife fence is located adjacent to the Koala habitat on the Site (MZ 1.6).

In general, the wildlife fence is in good condition and affords good protection for small to medium size ground dwelling mammals. However, overgrown vegetation on both sides of the fence allows arboreal mammals such as Koala *Phascolarctos cinereus* to cross the fence and the road. Consequently, this provides connectivity between areas of habitat for arboreal mammals, it also places these species at risk of vehicle strike. Weed control measures that commenced in MZ 1.6 in Stage 1 as outlined in **Section 2.3.1** will improve the function of this fence as a barrier and will provide better protection for risk of vehicle strike to fauna trying to cross Turnock Street.

During Stage 1, the Applicant design plans were submitted to the relevant road authority and obtain necessary permits and approvals to implement measures during Stage 2 on the Turnock Street and/or Cudgen Road to reduce the risk of impact on wildlife. All roads and traffic facilities must be designed to meet the requirements standards/road specifications of Council and/or RMS.

During Stage 2, the road environment adjoining the site will be changed from rural to urban. The road environment will be upgraded to enable Site access as well as install and/or upgrade features associated with urban roads such as street lighting, kerb and channel guttering, signage, lane delineation and line-marking. Along with the increased pedestrian activity and traffic associated with the Project these measures are expected to reduce the existing traffic speeds along Turnock Street and Cudgen Road.

Furthermore, advisory signage will be installed to establish a wildlife crossing to the north-east of the Site where the Turnock Street roadway passes through the remnant vegetation (MZ 1.6) between the two Turnock Street roundabouts. This will mitigate impacts on wildlife (movement and collisions with vehicles) due to the increase in traffic numbers along Cudgen Road and Turnock Street, particularly on the endangered population of Koalas. An example of suitable Koala crossing advisory signage is provided in **Appendix C**.

3.8.3 Aviation

The proposed development includes a Helicopter Landing Site (HLS) on the top of the main building (Level 7), which will result in low level air traffic in the vicinity of the Site. There is a small risk that threatened bird and bat species may fly over the Site in remnant vegetation that is located at the level of the floodplain at the time of aircraft operation.

Flying fox strike with helicopters is classed by Civil Aviation Safety Authority (CASA) as 'birdstrike' and negligible birdstrikes occur with helicopters. In 2015, a total of 32 birdstrikes with helicopters were reported in Australia (Australian Transport Safety Bureau, 2017). Reported birdstrikes were significantly lower for most helicopter weight categories when compared with most aeroplane groups which may be may partly due to helicopters flying at lower speeds and being easier for birds and pilots to see and avoid (Australian Transport Safety Bureau, 2017).

The highest proportion of helicopter birdstrikes recorded is whilst on the ground (standing) and the lower proportion of birdstrikes during landing and take-off, possibly due to the louder and varying noise caused by

helicopter rotor speed and pitch changes during these flight phases (Australian Transport Safety Bureau, 2017). The HLS will be situated on the top of the multiple level hospital facility that is constructed on a ridge above the level of the floodplain. As such this location is considered to be above the flight path altitude of any birds or bats and will therefore not interrupt any local migration or cause death through aircraft strike.

Based on the available data from the northern NSW/SE QLD hospital transfers from NSW Ambulance, it is estimated that aircraft movements at peak operation of the Project would amount to approximately two movements per week, with a typical expected average of six per month. The helicopter movement and 'noise' event associated with arrival and departure is a total estimated time of 6 minutes for each event (i.e. three minutes inbound and three minutes outbound) (Steve Graham, AviPro, 2019, pers. comm. 15 February). The nature of aircraft operation for the site is such that the majority of aviation movements are outbound (i.e. not inbound transport of trauma patients). Consequently, most outbound patient transfers would take place during the day when clinicians are available to make transport decisions. This would therefore minimise if not avoid aircraft movements in the peak periods of flying fox activity in the hours preceding dusk and dawn. As a consequence, the probability of aircraft strike on flying foxes is considered very low.

Obtainable data for birdstrikes comes from helicopter operations in the vicinity of aerodromes and has been considered in the absence of data available for HLS. The Australian Transport Safety Bureau record the risks for birdstrikes and the Civil Aviation Safety Authority (CASA) regulate the requirements for that recording. Given this data limitation, the data does not give as clear a picture for birdstrikes in the vicinity of hospitals and threshold criteria which will trigger adaptive management actions for aircraft strike on flying foxes/birds cannot be easily defined. However, this aerodrome birdstrike data does provide information on the characterisation of the rate of strikes and the times of day they occur and will be used to recommend peak birdstrike times to avoid helicopter operations where practical.

The following mitigation measures implemented to reduce the likelihood of fauna injuries and deaths from aviation operations may include:

- Aviation operations for the development will be conducted in accordance with an approved HLS Operations Manual which will be developed for the Hospital's use. This manual will identify areas of wildlife hazards including Osprey nests and the known Elrond Drive and Kingscliff Library Flying fox camps that are located in close proximity to the Site (Ecosure, 2018, Greencap, 2018). The siting of the HLS and primary considerations in HLS approach and departure path selection included avoidance of ecologically and environmentally sensitive areas and areas sensitive to noise and vibration. The planned flight approach and departure paths to the HLS align almost north-south, avoiding and minimising any impact as helicopters will rarely come close to the Flying fox camps and Osprey nests identified in the BDAR, shown in **Figure 8** (AviPro 2019). Furthermore, helicopter operators have a vested interest in avoiding damage and maintenance down time of their helicopter fleets. The SSD general requirements of preferred flight path directions are detailed in the *Aviation State Significant Development Report: Tweed Valley Hospital SSD-10353* (AviPro 2019).
- Nearer to HLS commissioning, the locations of Flying fox camps and Osprey nesting areas will be described to the Helicopter Emergency Medical Service (HEMS) operators. Procedures will be developed with HEMS operators to provide maximum clearance on each occasion a helicopter approaches or departs the hospital. Locations of sensitive areas may be advised to CASA/ASA for possible inclusion in relevant publications. The means by which the biodiversity-related risks are to be managed by aviation operators is being developed during the construction phase and may include the development of a Fly Neighbourly Agreement (or equivalent) that is governed under CASA (AviPro 2019). This document/procedure, if adopted, is to adequately appreciate the biodiversity-related risks identified in the Stage 2 BDAR and this BMP, primarily relating to potential interaction between flight paths and flying fox activity.

- The HLS Operations Manual will specify data capture expectations. This may include documentation of native fauna injuries and deaths to be recorded in incident registers to monitor species mortality, including fauna mortality resulting from aircraft movement. Should any of the following occur and be considered attributable to the project location, it will trigger investigation and adaptive management actions may be implemented such as auditory repellents, visual deterrents and physical barriers where birds, bats and other animals are an issue:
  - when aircraft experiences an increase in frequency of wildlife strikes;
  - when an aircraft experiences substantial damage following a wildlife strike; and
  - when wildlife is observed on or close to the HLS in size or in numbers that are capable of causing the events described above.

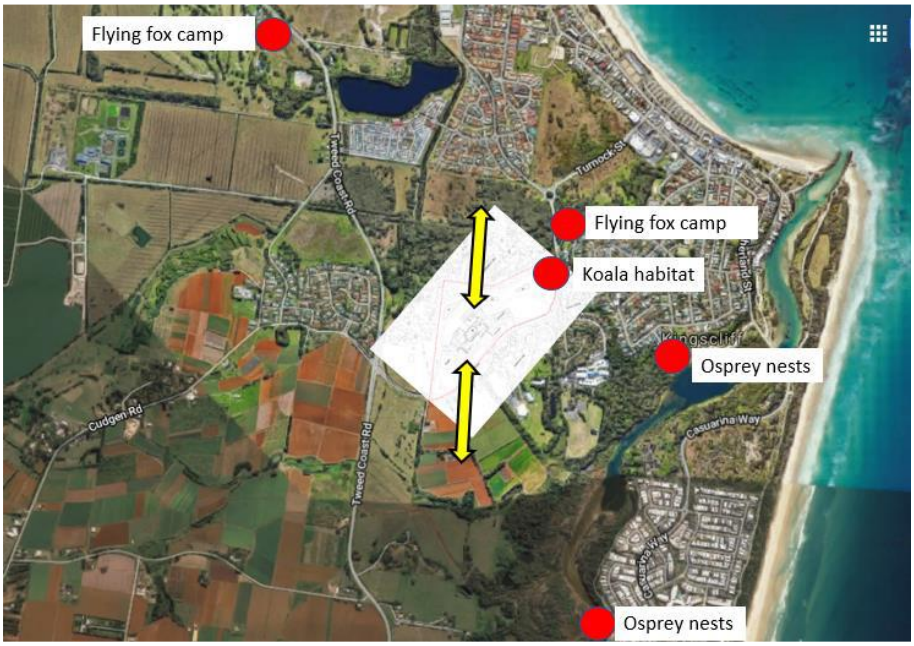


Figure 8 Flight path illustration at TVH HLS (AviPro 2019)

3.9 Managing indirect impacts on fauna

Sensitive environmental receptors relevant to dust, vibration and light spill impacts include vegetation communities and wildlife adjacent to the Project's construction activities. The impact of dust, air quality, vibration and light spill on surrounding flora and fauna will be managed in accordance with management plans including guideline criteria and any prescriptions will be implemented as part of an approved CEMP and sub-plans, including the CAQMDMSP and the CNVMSP.

Where avoidance of light spill, airborne noise, vibration and dust generation is not practicable, key mitigation measures to address residual impacts from light, noise, vibration or dust generated as a result of construction activities will be implemented, as outlined below.

3.9.1 Light spill impacts displacing or disrupting terrestrial fauna

Light sensitive species are presumed unlikely to be present at the Site and impacts of light spill is likely to be negligible. Construction and operational activities will be restricted to the Project footprint in the southern portion of the Site where the project footprint is at least 67 m from the remnant native vegetation. This provides a natural buffer zone to dissipate light spill impacts.

All construction works and associated activities would be delivered in compliance with AS4282 Control of the obtrusive effects of outdoor lighting. As per the CEMP (LLB 2019), the lighting designer will have the appropriate competence in the fields of illuminating engineering and environmental design.

The lighting design will include measures to avoid impacts on ecologically and environmentally sensitive areas. As per the *External Lighting Strategy Report* (LCI 2019), obtrusive lighting will be minimised during the construction and operations of the Project by incorporating the following external lighting design approaches:

- External lighting will be designed with due consideration of lighting spillage to adjacent properties and sensitive receivers.
- External lighting will comply with AS 4282 – Control of the obtrusive effects of outdoor lighting.
- Due to the helicopter activity associated with the hospital, luminaires will generally be low-cut off aeroscreen style to minimise uplight.
- Use of warm white (3000K) LED luminaires to provide lighting with a longer wavelength. Fluorescent lighting, and lights with significant ultraviolet emissions will not be used Mounting heights and luminaires shall be selected to minimise spillage and provide good control over the lighting distribution;
- Quality luminaires will be selected with good glare control;
- Luminaires will be set-back from the property boundary to reduce light spill where possible;
- Luminaires shall feature narrow beams and sharp cut-off angles; and
- Luminaires shall have low vertical aiming angles.
- Lighting shall be positioned in consideration with the local environment and ensure upward waste light ratios do not exceed the standard requirements.
- The local government will be consulted to determine any restrictions on the frequency of use and hours of operation of the external lighting.
- All construction works must be undertaken between the hours of 7.00am and 6.00pm Monday to Friday, between the hours of 8.00am and 1.00pm Saturday. No work will be undertaken on Sunday or Public Holidays.

- Consideration will be given to applicable safeguards and management measures before works commence including daily timing of construction activities such as avoiding night works and directing lights away from remnant vegetation.
- Lighting in and adjacent to the native vegetation areas, will incorporate low impact lighting design considerations where possible, such as:
    - Avoid installing lighting in or around native vegetation areas unless necessary. If lights cannot be avoided, use lower impact globes or lights with protective shields.
    - Install shields on streetlights, to direct illumination downwards, reducing the spill-over into adjacent habitat.
    - Use timers, sensors or motion detectors to switch lights on and off at appropriate times, reducing the length of time native vegetation is exposed to unnatural light levels.
    - Choose light globes that will have the least impact on wildlife.
    - Install lights as low to the ground as possible, reducing the spill-over of light into adjacent areas.

The site is a hospital, operating 24 hours with no curfew lighting period, external lighting will generally operate between dusk and dawn and be controlled by time-clock/light level sensors with a manual override located in central location. Lighting control will be combined into the main building management systems (LCI 2019).

Revegetation commencing around June 2020 will increase tree and shrub cover in bushland and corridors will reduce light penetration and improve the habitat value of these areas over time.

Lighting to the helicopter pad shall be provided in accordance with the External Lighting Strategy Report (LCI 2019) and Civil Aviation Safety Authority requirements.

3.9.2 Airborne noise and vibration impacts displacing or disrupting terrestrial fauna

Noise and vibration during construction and operation including construction works and traffic has the potential to disrupt threatened species or reduce the viability of adjacent habitat. After mitigation measures described below are implemented, it was assessed that there is a very low risk of noise and vibration impacts.

Noise and vibration levels during construction will be managed in accordance with the approved CEMP CNVMP (LLB 2019) and by implementing the control measures listed in the Noise and Vibration Impact Assessment (JHA 2019). Noise during construction will be mitigated by applying appropriate safeguards and management measures before works commence including daily timing of construction activities and restricting works to approved construction hours and identifying acceptable periods when specific 'noisy works' can occur. Whenever possible, equipment will be selected to minimise noise generation, e.g., electric cranes which are quieter and more efficient than traditional diesel cranes or retrofitted with noise silencing devices and the Site Induction will include information about noise and vibration minimisation, management and monitoring (LLB 2019).

Furthermore, construction will be restricted to the southern portion of the Site where the project footprint is at least 67 m from the remnant native vegetation. This provides a natural buffer zone to dissipate noise and vibration impacts.

As a requirement of the SEARs, noise and vibration must be managed in accordance with the following relevant policies and guidelines:

- NSW Noise Policy for Industry 2017 (EPA)
- Interim Construction Noise Guideline (DECC 2009)
- Assessing Vibration: A Technical Guideline 2006
- Development Near Rail Corridors and Busy Roads – Interim Guideline (Department of Planning 2008)
- Australian Standard 2363:1999 Acoustics – Measurement of noise from helicopter operations.

The Noise and Vibration Impact Assessment (JHA 2019) identified noise and vibration sensitive receivers that will potentially be impacted by the operation of the Project, established relevant noise level criteria, carried out noise assessments, determined whether the relevant criteria can be achieved and provided recommendations. Based on the results of the preliminary assessment, the noise associated with the normal construction works is expected to meet the noise limits for standard hours & out-of-hours works in accordance with the Interim Construction Noise Guideline (DECC 2009). Furthermore, the results of the external mechanical plant noise emission assessment indicated that the noise level criteria will be met during operations and traffic generated as a result of the proposed hospital development is not expected to have an adverse noise impact on the surrounding roads (JHA 2019).

Noise and vibration monitors were established during Stage 1 in three different locations on site, covering the areas that are most susceptible to be affected. The sensors will be maintained throughout the duration of construction works. The sensors will trigger a warning (sent to the nominated recipient) when the maximum allowed levels are exceeded (LLB 2019).

Additional assessments may be conducted in response to changes in the work environment, the timing of which will be determined in consultation between the site management, Site Safety Committee and the Principal (LLB 2019).

Potential noise impacts on noise sensitive receivers for helicopter operations are addressed within the *Airservices Australia Principles and Procedures for minimizing the impact of aircraft noise fly Neighbourly Guide* (JHA 2019).

3.9.3 Dust impacting vegetation which is fauna habitat

There are potential dust impacts during construction and operation including inadvertent dust deposition on native vegetation, and the potential disruption to threatened species or reduced viability of adjacent habitat. After the mitigation measures described below are implemented, it was assessed that there is a very low risk of dust impacts. Dust levels during construction will be delivered in accordance with an approved CEMP sub pan Construction Air Quality Management and Dust Management Sub-plan (CAQMADM) (LLB 2019). Site specific controls have been identified in this Sub-plan to prevent or minimise the impacts of construction related air emissions on the environment and community. Air quality monitoring will be undertaken where required, as per project approval, and the effectiveness of management controls periodically reviewed (LLB 2019). Where avoidance of dust-generation is not practicable, mitigation measures to address impacts from dust generated as a result of construction activities will include but are not limited to:

- Dust suppression techniques will be applied where necessary to protect vegetation health. This may include spraying from water trucks, irrigation, or stabilisation and revegetation of cleared areas that are no longer needed as soon as practicable during construction.
- Temporary stockpiles that are not required for imminent use will be stabilised.
- For unpaved roads, the periodic application of water will be used for dust suppression, dependent up on weather conditions and traffic volumes. Additional measures for high-volume traffic areas, such as impermanent gravel cover may also be required. For paved roads, the removal of accrued material from roadways will occur when possible.
- Maximum speed limits (to 20km/hr on internal roads and access ways) will be implemented to limit dust generated on site.
- On-site roads required for the operations phase will be sealed during the construction phase.
- Clear distinction between trafficable and non-trafficable areas with speed limits implemented.
- Multiple handling of soil or rock materials will be minimised.
- Loads in all trucks transporting soil, aggregate or other dust-generating materials to and from the on-site development area will be covered.

- Planning of construction activities will consider dust management requirements where practicable.
- Avoid excavation during high wind and extreme wet weather conditions.
- Periodic inspection of surrounding roads to ensure no construction contamination and initiation of road sweeping if required.
- Dust management and suppression will be undertaken during and following vegetation clearing and earthwork activities.
- No blasting will be performed as part of the proposed construction works program.
- The Site Induction will include information about the risks and potential impacts of dust and emissions on the environment and community.

3.9.4 Fauna management summary

Table 11 provides an overarching summary of the fauna mitigation measures relevant to various vegetation management zones and risks identified. It also includes a general overview of the key objectives, activities and timing and performance indicators.

Table 11 Fauna Mitigation Measures

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
Mitchell's rainforest snail *Thersites mitchellae*						
33	1.1 and 1.2 and 1.4 and 1.5 once vegetation is established and meets performance criteria for weed cover, canopy cover and leaf litter.	Long term monitoring of MRS population size at the Site. Ongoing monitoring will be conducted every second year to identify any changes in the status of the species.	Stage 2 C & O (every two years following the baseline survey)	During construction: Safety & Environmental Manager, Lendlease and Specialist consultant/s Post construction: Manager Capital Assets and Resources (or similar role), LHD and Specialist consultant/s	Long term data on MRS population size	Survey completed every two years
34	1.1 and 1.2 and 1.4 and 1.5 once vegetation is established	Following the monitoring program conducted every two years, a specialist invertebrate consultant will submit a report including but not limited to; date, personnel, weather, areas surveyed, survey methodology and results of population size, trends in population size, observations, photos, impacts on the MRS, an evaluation of the monitoring program and any recommendations.	Stage 2 C & O (every two years following the baseline survey)		Long term reporting on MRS population size	Report submitted every two years Trends in MRS population size or Project impacts which could result in a significant decreasing trend in population size. Population trends will indicate: no change = acceptable, increase = evidence of successful vegetation management, decrease = mitigation / adaptive actions
35	1.1 and 1.2 and 1.3 and 1.4 once vegetation is established	Specialist invertebrate consultant survey/report results indicate a stable or increasing trend in MRS population size	Stage 2 C & O (every two years following the baseline survey)		Conservation of the MRS population	If stable or increasing performance criteria in **Table 7** is met, review of the monitoring program to be undertaken
36	1.1 and 1.2 and 1.3 and 1.4 once vegetation is established	Specialist invertebrate consultant survey/report results indicate a significant decreasing trend in MRS population size or identify potential impacts from Project activities which could results in a significant decreasing trend in population size, in consultation with specialists Project management will undertake an investigation into	Stage 2 C & O (every two years following the baseline survey)		Conservation of the MRS population	If stable or increasing performance criteria in **Table 7** is not met, an investigation will be triggered and adaptive management measures will be implemented

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
		addressing the decreasing population and adaptive measures will be implemented to mitigate any impacts.				
37	1.4 and 1.5	Staged removal of weeds in MZ 1.4 and 1.5 to avoid desiccation of adjacent MRS habitat as per **Section 2.4.4**.	Stage 2 C & O	Management & Bush regeneration contractor	Avoid desiccation of adjacent MRS habitat	Staged removal of weeds in MZ 1.4 and 1.5 is adhered to
38	1.1, 1.2, 1.3,1.4 and 1.5	Vegetation Management to protect MRS populations including weed control as per **Section 2.4.4** and creation of diverse, dense Subtropical Rainforest with a closed canopy suitable with key habitat components: well developed leaf litter, intact canopy.	Stage 2 C & O	Management & Bush regeneration contractor	Conserve and enhance MRS habitat	Maximum 5% weed cover following weed control activities Vegetation condition Monitoring performance criteria as per **Section 2.3.5**
Bushfire Prevention						
39	All areas	A Bushfire Hazard Assessment Report (GeoLINK 2019) has been prepared that addresses the requirements for Special Fire Protection Purpose development as detailed in Planning for Bush Fire Protection (RFS 2006; RFS 2018).	Stage 2 C & O	Management and Specialist consultant	Prevention of bush fires	A bushfire control plan will be developed and be adhered to
40	All areas	Smoking is not permitted onsite.	All times	Management and all contractors	Prevention of bush fires	No smoking requirement will be captured in site inductions during construction phase No smoking signage will be placed throughout the site during and post-construction
Vertebrate Pest Management						
41	All areas	In the event pest species increase in population, spread in area or a new pest species is introduced to Site, corrective actions will be implemented during	Stage 2 C & O	Environmental manager/advisor and contractors	Conservation of native species	Corrective actions implemented to rectify any potential or actual environmental harm

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
		construction and operations phases to rectify any potential or actual environmental harm.				
42	Main building/ within Project footprint	To protect MRS populations, a target-specific Black rat *Rattus rattus* control program will be implemented. In order to avoid impact on non-target native species, control measures are to be undertaken around the ancillary facilities and not within native animal habitat (i.e. MZs 1.1 to 7).	Stage 2 C & O	Management and contractors	Conservation of the MRS population	Target-specific pest control inspections and Black rat *Rattus rattus* control program implemented
Aquatic Fauna Protection						
43	Sediment basins	To avoid any potential changes in pH and impacts on threatened aquatic species (i.e. Wallum froglet and Olongburra frog) other commercially available flocculants that work as effectively as a gypsum replacement yet do not create the large changes in pH will be used on the Site (i.e. Turbiclear).	Stage 2 C	Management and contractors	Threatened aquatic species conservation	No change to pH in receiving environment waters pH meets water quality criteria outlined in the WQMP, **Section 4.4.4**
44	Sediment basins and receiving environment	Physico-chemical parameters including pH will be monitored in water discharged from sediment basins or bio-detention basins and in the downstream wetland environment to protect aquatic wetland fauna.	Stage 2 C & O	Management and contractors	Threatened aquatic species conservation	No change to pH in receiving environment waters pH meets water quality criteria outlined in the WQMP, **Section 4.4.4**
45	All areas	The impact of erosion and sedimentation on terrestrial and aquatic flora and fauna during construction will be managed in accordance with an ESCP/CSWMP. An erosion assessment will be conducted on these areas by a CPESC during the planning phase of the ESCP development.	Stage 2 C	Management and all contractors	Mitigating impacts of erosion and sedimentation on terrestrial and aquatic flora and fauna during construction	Performance criteria as per the approved ESCP/CSWMP

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
Fauna Movement and Habitat Protection/Generation						
46	All areas	Temporary boundary fencing has been installed with a 'post and bridge' system at least every 50 m. Tree Protection Zones (TPZ) will be installed around all native vegetation to be retained adjacent to the construction footprint. This fencing will be removed at the conclusion of the construction phase of the development.	Stage 2 C	Management and contractors	Habitat connectivity/ facilitating movement of threatened species	Temporary fencing installed with features allowing movement of threatened species
47	Vegetated buffer MZs 6 and 7	Habitat connectivity will be maintained across the Site by vegetation management measures as outlined in the VMP (**Section 2.3**). Importantly, to facilitate the movement of fauna, vegetated buffer zones will connect to the retained Subtropical Rainforest vegetation in the northern portion of the site, and will run north to south, in line with the mapped regional fauna corridor.	Stage 2 C & O	Management and vegetation clearing contractors	Habitat connectivity/ facilitating movement of threatened species	Maximum 5% weed cover following weed control activities Clearing of vegetation is only conducted within the surveyed clearing area
48	All landscaped areas	Where possible, landscaping will include habitat features such as rocks that have been salvaged from other areas of the Site (cleared windrows) that will create habitat for ground dwelling species.	Stage 2 C	Management, Landscape designers and bush regeneration contractors	Conserve and enhance habitat quality	Habitat features such as salvaged rocks included in Landscaping
Weed and Pest Management						
49	All areas with trees and native vegetation	The introduction of pest species or disease onto native vegetation areas on the Site will be mitigated by installing an environmental protection area (or TPZ) to protect retained vegetation on the Site during construction.	Stage 2 C	Management, bush regeneration contractors and all Site personnel	Prevent introduction of pest species or disease	Environmental protection area exclusion zone adhered to

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
50	1.1 and 1.2	The introduction of pest species or disease onto the Site will be mitigated by restricting public access in areas of conservation value (in particular MZs 1.1 and 1.2) throughout operation of the Project.	Stage 2 C & O	Management	Prevent introduction of pest species or disease	Maximum 5% weed cover following weed control activities Environmental protection area access restrictions adhered to
Fauna-related Interactions and Incidents						
51	All areas	Documentation of all native fauna injuries and deaths will be recorded in incident registers to monitor species mortality, including fauna mortality resulting from vehicle strikes and entanglement.	Stage 2 C & O	Environmental manager/advisor and all Site personnel	All native fauna injuries and deaths will be recorded in incident registers	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation
52	All areas	Should increases or multiple fauna mortality/injury incidents occur, it will trigger investigation and where practical adaptive management actions implemented.	Stage 2 C & O	Environmental manager/advisor	Reducing impacts on native fauna	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation
53	All areas	To minimise interactions with fauna, Site Management will enforce the following policies on the Site: • Catching or feeding of native or feral animals on Site is prohibited. • Site personnel will be prohibited from harming or intentionally killing any wildlife. • Pets will not be allowed on site during construction. • Pets will be allowed on site once the site is operational; however, they will be restricted by on-leash control during site	Stage 2 C & O	Management, all Site personnel and general public	Nil impacts on native fauna	Adherence to policies Establishment of Pet Visitation Area

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
		access and within the Pet Visitation Area. • No pets are permitted in areas of environmental conservation on the Site (i.e. 'retained undisturbed forest' in MZ's 1.1 to 1.6). • Discarding food wastes on the Site is strictly prohibited.				
54	Project footprint	Excavations will exclude fauna entry or allow for fauna egress. Where it is not practical to provide fauna egress, daily checks will be undertaken before work commences.	Stage 2 C	Management and construction/ earthworks contractors	Nil impacts on native fauna	Excavation exclusion/egress measures undertaken, recorded and checked by Site supervisor Adherence to fauna management policies
55	Project footprint	All excavations left open overnight will be inspected each morning.	Stage 2 C	Management and construction/ earthworks contractors	Nil impacts on native fauna	Daily checks undertaken, recorded and checked by Site supervisor Adherence to fauna management policies
56	All areas	Uninjured trapped fauna will be released to a predetermined nearby area of suitable habitat away from the Site by a suitably qualified and wildlife handler.	Stage 2 C	Management, all Site personnel and suitably qualified and wildlife handler	Nil impacts on native fauna	Adherence to fauna management policies
57	All areas	Injured native animals will be collected and taken to nearby veterinary facilities for treatment, as required.	Stage 2 C & O	Management, all Site personnel and suitably qualified and wildlife handler	Nil impacts on native fauna	Adherence to fauna management policies
58	All areas	Personnel will record fauna sightings/encounters during construction activities using a fauna register.	Stage 2 C & O	Management, all Site personnel and suitably qualified and wildlife handler	Nil impacts on native fauna	Adherence to fauna management policies

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
59	All areas	Dead native animals that are found on the Site will be recorded in a fauna incident register, reported, collected and disposed of appropriately so as not to attract predators or scavengers.	Stage 2 C & O	Management, all Site personnel and suitably qualified and wildlife handler	Nil impacts on native fauna	Adherence to fauna management policies
60	All areas	Site inductions will include but are not limited to the following specific components for flora and fauna management: • The flora, fauna and ecological values within and in the vicinity of the Site, and the Project commitments how flora and fauna are protected during construction or operation works • the procedures in the event that fauna are encountered within the Site • the requirement that all clearing/earthworks/construction activities are to be confined within the Site boundary	Stage 2 C	Environmental manager/advisor, all Site personnel	Site personnel aware of specific components for flora and fauna management	Adherence to fauna management policies
61	All areas	The following measures will be included to prevent fauna being attracted to Site: • The "eliminate, reduce, re-use, recycle" disposal waste management principles will be applied • Limit the amount of rubbish and waste onsite through good housekeeping practices	Stage 2 C & O	Management, all Site personnel	Site personnel aware of waste management policies	Adherence to waste management policies

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
		• Food waste will be disposed of at a designated facility • Putrescible wastes will be stored in secure bins with lids or transported offsite daily for disposal				
62	Project footprint	A suitably qualified and experienced fauna rescue person shall be present to supervise the clearing activities and the Fauna Management Procedure for Clearing native vegetation and rocks will be adhered to.	Stage 2 C – clearing	Management and suitably qualified wildlife rescuer	Protection of native fauna	Adherence to Fauna Management Procedure for Construction- Clearing (**Section 3.7**)
63	Project footprint within a range of 30 metres from any tree which is occupied by a Koala	If Koalas *Phascolarctos cinereus* are found on the Site during vegetation clearing works and/or earthworks: • All construction clearing/ earthwork activities must be temporarily suspended within a range of 30 metres from any tree which is occupied by a Koala. • Works are to be avoided in any area between the Koala and the nearest areas of habitat to allow the animal to move to adjacent undisturbed areas. • Works must not resume until the Koala has moved from the tree of its own volition.	Stage 2 C –if required	Management and suitably qualified wildlife rescuer	Protection of native fauna	Adherence to Fauna Management Procedure for Construction- Clearing (**Section 3.7**)
64	1.6 and 1.1	Weed control measures outlined in **Section 2.3.1** will improve the function of the wildlife fence along Turnock Street and provide better protection for risk of	Stage 2 C & O	Management and bush regeneration contractors	Protection of native fauna	Maximum 5% weed cover following weed control activities

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
		vehicle strike to fauna trying to cross Turnock Street.				
65	All trafficked areas	A CTPMSP and supporting documentation will be produced as part of an approved CEMP and their prescriptions will be implemented.	Stage 2 C	Management and all Site personnel	Site personnel aware of traffic management policies	Adherence to traffic management policies
66	Project footprint	Traffic will be restricted to the southern portion of the Site where the project footprint is approximately 67 m from the intact remnant native vegetation.	Stage 2 C	Management and all Site personnel	Site personnel aware of traffic management policies	Adherence to traffic management policies
67	All trafficked areas	Construction traffic must maintain low vehicle speeds (up to 20km/hour) and operators shall take care and be aware of any wildlife that may be in the area. Should wildlife enter the construction footprint, a suitably qualified fauna handler will be notified and actions taken in accordance with the CEMP.	Stage 2 C	Management and all Site personnel	Site personnel aware of traffic management policies	Adherence to traffic management policies
68	All trafficked areas	Appropriate speed limits for both earthmoving equipment and light vehicles will be implemented, signposted and enforced on all roads throughout the Site to minimise the risk of fauna injury or mortality.	Stage 2 C	Management and all Site personnel	Site personnel aware of traffic management policies	Adherence to traffic management policies
69	Cudgen Road/Turnock Street access road	'Koala crossing' advisory signage will be installed to establish a wildlife crossing to the north-east of the Site where the Turnock Street roadway passes through the remnant vegetation (MZ 1.6) between the two Turnock Street roundabouts.	Stage 2 C	Management	Protection of native fauna	Establish a wildlife crossing Off Site traffic calming measures implemented along the access road

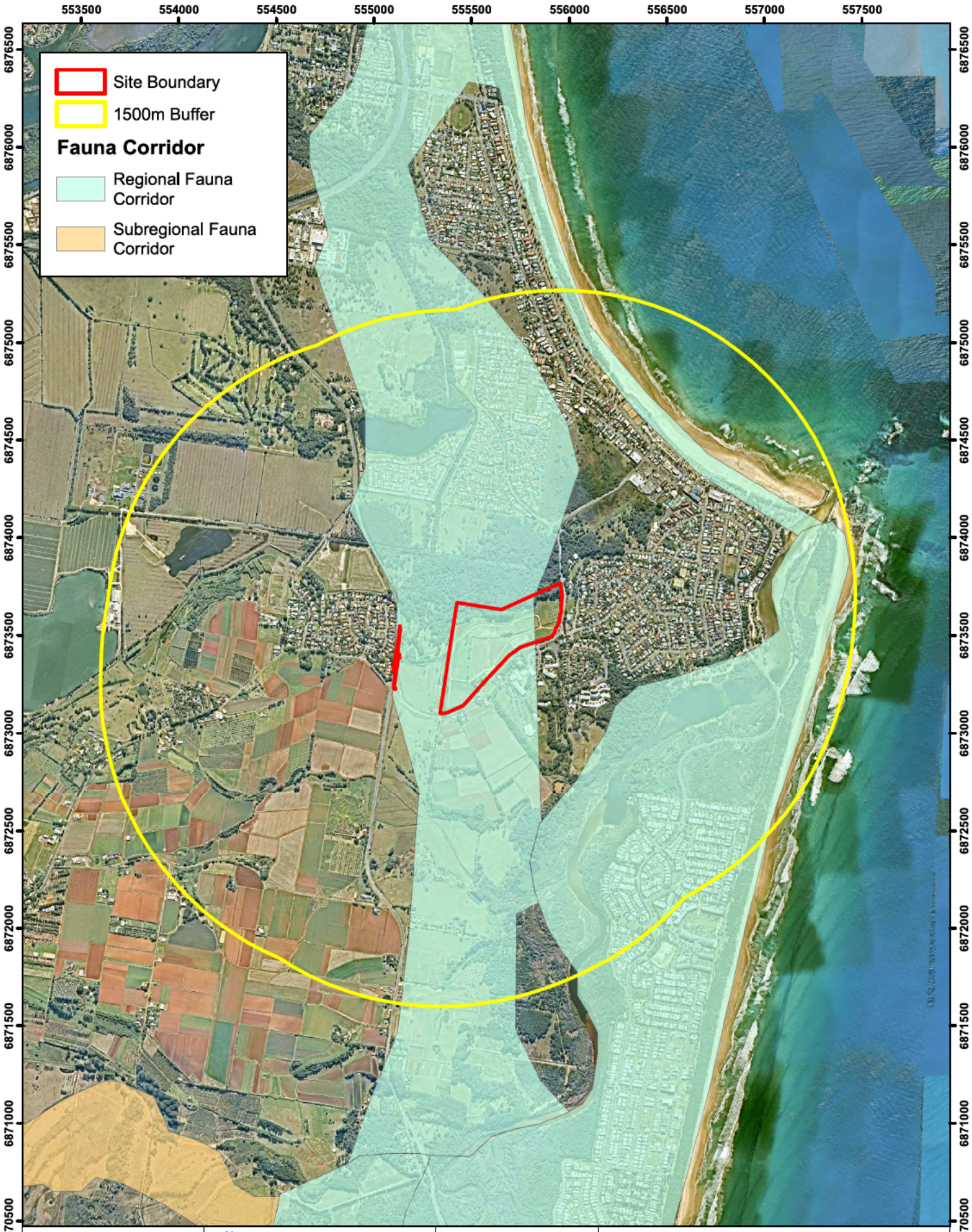
Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
70	Project footprint/ Helicopter Landing Site (HLS)	Aviation procedures will be informed and advised by HLS documentation and start up meetings prior to operation which will cover topics of wildlife hazards in close proximity to the Site. From then, measures will be applied by aviation system documentation such as Aviation company procedures, air services publications and CASA documentation which will be determined post these meetings.	Stage 2 O Upon HLS commissioning	Management (HLS Operations Manual) Avipro (Fly Neighbourly or equivalent) and aviation crew	Protection of native fauna	When an aircraft experiences multiple wildlife strikes When an aircraft experiences substantial damage following a wildlife strike When wildlife are observed on or close to the HLS in size or in numbers that are capable of causing the events described above
71	All areas	Should any performance criteria occur, it will trigger investigation and adaptive management actions may be implemented such as auditory repellents, visual deterrents and physical barriers where birds, bats and other animals are an issue.	Stage 2 O	Management, Avipro and aviation crew	Protection of native fauna	Investigation and adaptive management actions upon performance criteria trigger
72	Project footprint	Light will be restricted to the Project footprint in the southern portion of the Site where the project footprint is at least 67 m from the remnant native vegetation. This provides a natural buffer zone to dissipate light spill impacts.	Stage 2 C & O	Management and all Site personnel	No disruption or dissipation of native fauna	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation
73	Project footprint and all surrounding native vegetation	The impact of dust, air quality, vibration and light spill on surrounding flora and fauna will be managed in accordance with impact assessments, management plans and any prescriptions will be implemented as part of an approved CEMP as detailed in **Sections 3.9.1, 3.9.2** and **3.9.3.**	Stage 2 C & O	Management and construction contractor	No disruption or dissipation of native fauna	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
74	Project footprint and all surrounding native vegetation	Timing of construction activities to avoid night works, work within the approved construction hours as per **Section 3.9.1**.and direct lights away from remnant vegetation.	Stage 2 C	Management and construction contractor	No disruption or dissipation of native fauna	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation
75	Project footprint and all surrounding native vegetation	Limit high-impact noise to daylight hours and work within the approved construction hours as per **Section 3.9.1**.	Stage 2 C	Management and construction contractor	No disruption or dissipation of native fauna	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation
76	Project footprint and all surrounding habitat	Noise levels during operations would be delivered in accordance with an approved CNVMP that details safeguards and management measures in accordance with the relevant guidelines. Noise and vibration monitors established in Stage 1 will be maintained throughout the duration of Stage 2 construction works. The sensors will trigger a warning (sent to the nominated recipient) when the maximum allowed levels are exceeded (LLB 2019).	Stage 2 C	Management and construction contractor	No disruption or dissipation of native fauna	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation Noise and vibration maximum allowed levels as per the CNVMP (LLB 2019).
77	Project footprint and all surrounding native vegetation	Air quality monitoring will be undertaken where required, as per project approval, and the effectiveness of management controls periodically reviewed.	Stage 2 C	Management and construction contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented
78	Project footprint	Dust suppression techniques will be applied where necessary to protect vegetation health. This may include spraying from water trucks, irrigation, or stabilisation and revegetation of cleared	Stage 2 C	Management and construction contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented

Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
		areas that are no longer needed as soon as practicable during construction.				Vegetation Management Criteria in **Section 2.4.4**.
79	Project footprint	For unpaved roads, the periodic application of water will be used for dust suppression, dependent up on weather conditions and traffic volumes. Additional measures for high-volume traffic areas, such as impermanent gravel cover, may also be required. For paved roads, the removal of accrued material from roadways will occur when possible.	Stage 2 C	Management and construction contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented Vegetation Management Criteria in **Section 2.4.4**.
80	Project footprint	Maximum speed limits will be implemented during construction works to 20km/hr to limit dust generated on site.	Stage 2 C	Management and construction contractor	No native fauna vehicle strikes	Statistically significant increases in frequency or multiple fauna mortality/injury incidents will trigger investigation
81	Project footprint	On-site roads required for the operations phase will be sealed during the construction phase.	Stage 2 C	Management and construction contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented Vegetation Management Criteria in **Section 2.4.4**.
82	Project footprint	Multiple handling of soil or rock materials will be minimised.	Stage 2 C	Management and construction contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented

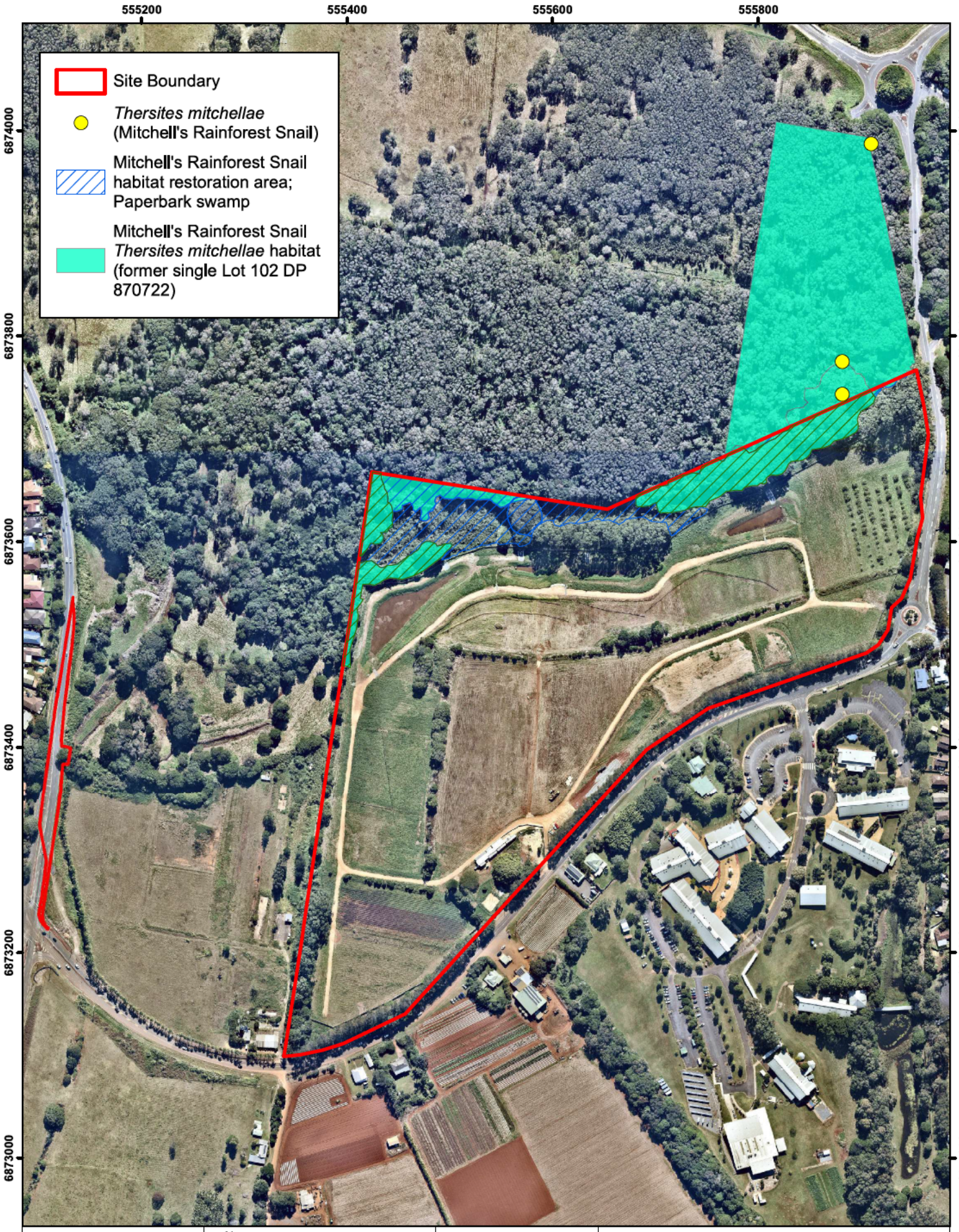
Item	Management Zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance/ Trigger Criteria
83	Project footprint	Loads in all trucks transporting soil, aggregate or other dust-generating materials to and from the Project construction area will be wetted down to reduce dust.	Stage 2 C	Management and construction contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented
84	Project footprint	Planning of construction activities will consider dust management requirements where practicable.	Stage 2 C	Management and construction contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented
85	Project footprint	Dust suppression will be undertaken during and following vegetation clearing and earthwork activities.	Stage 2 C	Management and construction clearing contractor	Avoid or minimise impact in native fauna habitat	Dust suppression managed in accordance with air quality management plans specifying guideline criteria and any prescriptions will be implemented
86	All area	Should monitoring results indicate performance criteria non-compliance or potential impacts from Project activities which could results in an increasing in frequency of non-compliance events, management will undertake an investigation into addressing the issue and adaptive measures will be implemented to mitigate any impacts.	At all times	Management and consultants	Protecting fauna	Non-compliance to performance criteria in **Table 7** will trigger investigation and adaptive management measures will be implemented

[1] [1] Project phases: Stage 2: Construction (C) and Operation (O)



Client: C107778	N 0 350 700 m	Scale (@A4): 1:25,000	**Habitat Corridors – Stage 2**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checked [redacted]	*Imagery 15th July 2019 (1.2 m) © Nearmap 2019* *Fauna corridors for NE NSW © Office of Environment and Heritage (OEH) 2010.*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 9**
Date: 1/08/2019			
GREENCAP			

Doc Path: R:_Projects\C107778_Health Infrastructure\J156455_Tweed Valley Hospital\3. Job Folder\GIS\J156455_13_TVHs2\BMPs2\mxd\J156455_13_BMPs2_F09_connectivity_location_190801.mxd



Client: C107778	N 0 50 100 m	Scale (@A4): 1:4,750	**Mitchells Rainforest Snail Habitat and Survey Results – Stage 2**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke	*Imagery 15th July 2019 (7.5 m) Nearmap 2019* *Vegetation mapping: Greencap (2018)*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 10**
Date: 8/08/2019			
GREENCAP			

Doc Path: \\ser2bne1\Brisbane_Projects\C107778_Health Infrastructure\J156455_Tweed Valley Hospital\3. Job Folder\GIS\J156455_13_TVHs2\BMPs2\mxd\J156455_13_BMPs2_F10_species_polygons_fauna_190801.mxd

4. WATER QUALITY MANAGEMENT PLAN

4.1 Water quality management aims and objectives

The aim of this WQMP is to avoid or mitigate any impacts from Stage 2 of the Project on water quality, water bodies and hydrological process that sustain threatened species and threatened ecological communities (TECs). Particular attention is drawn to the downstream forested wetlands and pH dependent amphibians, namely; Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis*. Notably, the northern section of the Site is part of an important wetland mapped under the Coastal Management SEPP (**Figure 11**). In order to achieve this, several activities will be undertaken at different phases of the Project during Stages 1 and 2 as outlined in **Table 14**.

These measures will mitigate the residual impacts of the Project as outlined in the BDAR (Greencap 2019b; Appendix I, J). Based on the civil design for stormwater and the application of erosion and sediment controls, the Project is likely to result in improved water quality as the previous land use was agricultural with no stormwater management system. This WQMP refers to the MZ as shown in **Figure 6**Error! Reference source not found..The previous land use was agricultural, site observations indicated that the cultivated fields were ploughed across the topographic contours (Greencap 2019). Under this cultivation regime, sediment-laden stormwater was encouraged to run downhill through ploughed furrows. Observations during site inspections also indicated frequent use of pesticides on the crops. Apart from a bund that has been constructed along the western boundary of the Site which adjoins an open drain, there is currently no stormwater management system in place. In the western section of the Site the aspect of the land is roughly west to north-west and the bund currently directs untreated stormwater flows to three discharge points that have been bulldozed through the bund wall. The aspect of the rest of the Site is roughly north and the ploughing regime directs sediment-laden stormwater to discharge directly into the receiving catchment and wetland located to the north of the Site. Furthermore, a Council owned drain carrying untreated stormwater flows from Turnock Street discharges directly into the receiving catchment.

4.1.1 Proposed stormwater management

The proposed stormwater measures will collect stormwater from the new impermeable areas of the site, including buildings, roads, car parks and other hard standings. Treated water will be discharged at a controlled rate to the existing wetland (ecological receptor) to the north of the site (RBG 2019).

As described in the SWMP (RBG 2019), the Project's stormwater detention measures have been designed in accordance with the relevant guidelines (OEH 2013 and TSC 2016). The storage volumes of the converted basins were modelled to ensure that the combined post development discharge from the basins is no greater that the pre-development flow. The preliminary DRAINS model confirms that there is no increase in the total site discharge rate in the 5 year and 100 year ARI storm events. For details of how soil and stormwater quality will be managed refer to the SWMP (RBG 2019).

4.1.1.1 Stormwater Quality Model

Stormwater quality outcomes were modelled by RBG using MUSIC Version 6.2.1 software, the results of which are included in the SWMP (RBG 2019).

The Projects SWMP (RBG 2019) summarises the results of the MUSIC model that demonstrate compliance of the system with the WSUD objectives developed for the site, including the relevant guidelines (OEH 2013; TSC 2016).

The MUSIC model assesses water quantity and water quality under the existing land use, across the following parameters:

- Flow;
- Total suspended solids;
- Total phosphorus;
- Total nitrogen; and
- Gross pollutants.

In summary, based on the SWMP (RBG 2019), predicted stormwater discharge water quality parameters will meet the water quality objectives in **Table 12**. These will be achieved by employing WSUD features that are described in more detail in **Section 4.1.2.2.**

Table 12 Water quality objectives

Pollutant	Minimum reductions in mean annual load from unmitigated development
Total Suspended Solids (TSS)	80% reduction
Total Phosphorous (TP)	60% reduction
Total Nitrogen	45% reduction
Gross pollutants .5mm (GP)	90% reduction

4.1.2 Stormwater Quality Mitigation

Mitigation measures to manage stormwater discharge quality during the construction phase will be in the form of Erosion and Sediment Control (ESC) and surface water management measures in accordance with the relevant guidelines (Landcom 2004; TSC 2016). The Sites SWMP (RBG 2019), ESCP (RBG 2019), CEMP and associated CSWMP (LLB 2020) provides strategies and mitigation measures to manage disturbed areas of the site and ensure that activities including excavated soil, stormwater, erosion, and sedimentation are managed appropriately during construction of the project. These plans set out the key items to manage stormwater runoff, as follows:

- Installation of four adequately sized sediment basins with a total capacity of 7,562 m^3 volume were constructed as part of Preliminary Works package to capture flows (Bonacci 2019). The receiving catchment will be protected by providing diversion stormwater drainage lines that bypass the construction site. Sediment basins will be appropriately monitored and managed in accordance with an ESCP/CSWMP as outlined in **Section 4.1.2.1**.
- Regular inspections of basins.
- Retained capacity in detention basins
- Test, treat and discharge collected stormwater off-site if it cannot be reused on site.
- No discharge of non-compliant water or off-site pollution.

The Site's CEMP will incorporate all relevant safeguards and mitigation measures detailed in the EIS and any requirements detailed in the development consent conditions. All construction staff and site personnel will be made aware of their environmental responsibilities and safeguard measures within the CEMP to avoid and minimise environmental impacts. The CEMP will be submitted to the DPIE for review and approval prior to commencement of works.

4.1.2.1 Sediment basins

Sediment basins will minimise the impact of any change in water quality and protect the TEC in the wetland area. Sediment basins (MZ 2.3) have been constructed as part of preliminary works which will capture and treat stormwater on the Site during the pre-construction and construction phases of the project.

Sediment basins were constructed as part of preliminary works which will capture and treat stormwater on the Site during the pre-construction and construction phases of the project. Sediment basins will minimise the impact of any change in water quality and protect the TEC in the wetland area.

A series of bunds and swales will be installed to direct runoff from the majority of the earthwork areas to the four existing basins in the northern portion of the site. Any runoff from areas or earthworks which cannot be directed to the sediment basins will be treated by means of grass buffer strips and sediment fences (RBG 2019).

The sediment basins function by providing a large, standing body of water such that stormwater runoff entering the basins, which is laden with sediments, has a chance to settle to the base of the basin before it overflows via the weir into the receiving watercourse. The weir and headwalls have been constructed with rock scour protection which will dissipate the water via sheet flow across the land to mitigate any direct impact on native vegetation directly within the discharge area. The size of the sediment basins has been designed in accordance with the NSW Managing Urban Stormwater "Blue Book" (Landcom 2004). The basins have been designed for five-day rainfall, and adequate settling is required four days from the conclusion of each storm event. Sediment basins will be designed and managed in accordance with the SWMP (RBG 2019), as described below;

- Each sediment basin is lined so water should only be able to escape by overtopping the weir or through evaporation or pumping following flocking and testing pH and TSS (Total Soluble Solids);
- Each basin will be dosed with flocculent per rain event and the sediment will typically settle and water quality will be confirmed by site specific testing prior to being pumped out within five days from the conclusion of a rainfall event; and
- In the event of an uncontrolled discharge, a monitoring event will be triggered to assess potential impacts resulting from surface water discharges on the receiving environment as described in **Section 4.1.1**.

The sediment basins will be converted to bio-detention basins during Stage 2 works, once the site excavation works and roads have been completed and all surfaces have been stabilised with appropriate ground cover.

Management of Cane toad *Rhinella marina* around sediment basins is addressed in the FMP, **Section 3.4.**

Monitoring the sediment basins for aquatic weeds in (particularly salvinia *Salvinia molesta*) must be undertaken and is addressed in **Section 2.3.2.6.**

Plant selection for revegetation around the basins should consider the different species which are suitable for growing in different zones of the sediment and bio-detention basins. Plant selection for the sediment and bio-detention basins is addressed in **Section 2.3.3.3** and **Section 2.4.2.**

4.1.2.2 Bio-detention basins

The WSUD measures proposed for the final development are designed to provide a reduction in nutrient levels of stormwater discharged from the Site which would potentially be beneficial to ecological receptors in the wetlands.

Bio-detention systems improve stormwater water quality via nutrient uptake and denitrification. The bioretention system will be made up of three sub-surface layers: filtration, transition and drainage layer. The

stormwater pools on the surface which is densely planted with grasses, sedges and select shrub or tree species, and filters down through the soil filter media (RBG 2019).

The compactly vegetated surface of bioretention systems physically controls the flows across the filter media. Beneath this, the root zone of the plants is very biologically effective as sediments and nutrients in stormwater are caught or utilised by the plants, bacteria and fungi. As part of an integrated living system, the plant life cycle maintains the soil structure and hydraulic conductivity of the natural filter (RBG 2019).

Bio-detention systems require regular routine maintenance, including inspections every three to six months or after heavy rain, cleaning and inspections and replacement of filter media every five to seven years. The proprietary pit filter baskets (i.e. enviropods) in the stormwater pits also require routine monitoring and cleaning. An indicative maintenance plan for the bio-detention systems is provided in the SWMP (RBG 2019). As healthy vegetation is vital to the effective functioning of bio-detention basins, regular inspections and maintenance of vegetation is required as per **Sections 2.4.2, 2.3.4** and **2.3.5**.

Post development, the Manager Capital Assets and Resources (or similar role) at LHD will be responsible for managing the regular routine maintenance of the bio-detention systems undertaken by external subcontractor/s.

4.1.2.3 Erosion and sediment controls

During construction, mitigation measures will be undertaken to minimise the risk of erosion and of sediment-laden stormwater being discharged into the receiving catchment and wetland located to the north of the site. The impact of erosion and sedimentation during the construction phase will be managed in accordance with an ESCP/CSWMP (RGB 2019; LLB 2020). Measures include a sediment fence/catch drain (or diversion bund) around the Site and around stockpile areas. Stockpiles will be located out of water flow paths and will be protected by earth banks/drains as required.

The impact of erosion and sedimentation during the construction phase will be managed in accordance with an ESCP/CSWMP prepared for the Site to effectively manage erosion and subsequent sediment mobilisations. The ESCP/CSWMP will be implemented prior to the commencement of construction works, especially prior to the onset of each wet season (from late February to late April). The ESCP/CSWMP is reviewed and updated as required, and at least annually prior to the onset of the wet season to reflect changes in site conditions as construction progresses.

An erosion assessment will be conducted on these areas by a CPESC during the planning phase of the ESCP development. ESC design should be in accordance with the guidelines in Best practice erosion and sediment control (IECA 2008), the NSW Managing Urban Stormwater "Blue Book" (Landcom 2004) and the *Tweed Shire Council Development Design Specification - D7* (TSC 2016). The Site ESCP is to be submitted to and approved by the consent authority on the advice of an independent suitably qualified expert in accordance with any conditions of approval.

The ESC management strategy aims to minimise offsite impacts by diverting overland surface flows to sediment controls, and to manage any active discharge so that it meets the applicable water-quality criteria, such as the *Tweed Shire Council Development Design Specification - D7* (TSC 2016). Key erosion and sediment control activities are outlined in **Table 14**.

4.1.3 Wetland hydrology

In respect of the TECs located within the wetland area, it is noted that these species are generally located in areas subject to periodic inundation (NSW Scientific Committee, 2004). The sediment basins will function to allow the wetland area to continue to occur in line with the pre-construction land use. The quality of the water entering the downstream wetland environment will be managed under the approved CEMP, SWMP, ESCP and CSWMP as described in **Section 4.1.1**.

The location of the development footprint on the Site seeks to minimise interference with hydrological flows through the wetlands, including contributions from groundwater. As described in **Section 4.2.1**, due to the construction design, it is not anticipated that piles will create a barrier to any shallow or perched groundwater flow that currently occurs within the Project footprint, minimising the potential for the development to impact groundwater contributions to the wetlands.

The storage volumes of the converted basins were modelled to ensure that the combined post development discharge from the basins is no greater than the pre-development flow. The DRAINS model comparing pre-development and post-development flow confirms that there is no increase in the total site discharge rate in the 5-year and 100-year ARI storm events (RBG 2019). However, the discharge from the bio-detention basins will be via four surface headwalls, which would therefore not produce an exact match to the existing flow regime. This may result in an amount of concentrated flow rather than the existing sheet flows (RBG 2019). However, rock scour protection which will dissipate the water via sheet flow across the land to mitigate any direct impact on native vegetation directly within the discharge area.

An assessment of the potential ecological impact on the coastal wetlands to the north of the site as a result of any changes to hydrology (flow regimes) caused by the Project was undertaken by SMEC (2019). The assessment considered EECs, TECs, threatened species and the overall biophysical, hydrological and ecological integrity. The modelling conducted as part of the assessments predicts a mean total annual flow from site to increase by almost 50% from 90.6 ML/yr pre-development to 140 ML/yr post development. This volume increase is due to: a predicted greater frequency of minor runoff events into the wetland, more frequent than the 20% AEP; approximately 10 to 20mm of additional inflow from the developed site during significant events for parts of the wetland; and 10 to 50mm within the dam. Modelling results indicated that the Project will have minimal impact on the coastal wetland estimated water levels. For detailed results on the hydrology (flow regimes) modelling please refer to SMEC 2019.

The potential impacts of these additional flows on the EEC's identified on the Site, MRS and two pH dependent threatened species (i.e. Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis*) were assessed by Jon Alexander, an ecologist and suitably qualified professional (SMEC 2019). In summary, the assessment found that the predicted minor increases in flow are unlikely to result in any apparent or significant impacts due to;

- The coastal wetlands to the north of the site are dominated by Broad-leaved Paperbark *Melaleuca quinquenervia*. Although this species cannot survive permanent inundation, it has adaptations such as fibrous roots around their lower trunk that are understood to allow the plant to respire during long periods of submersion. Furthermore, the mid- and understory species such as rushes, sedges, ferns and grasses are also adapted to periodic inundation.
- Predicted change in flood level from the Projects outflows is expected to be very small (<50mm). When compared to the existing flooding from the Tweed River (BMT 2018) which indicates inundation depths for the wetland of approximately 2m for the 5% AEP event and 3m for the 1% AEP event. Suggesting that the Paperbark swamp forest present are naturally resilient to large scale flood events in excess of the inflows likely to be a result of the Project;
- White Booyong – Fig subtropical rainforest community appears to be limited to the slightly elevated fringes of the Paperbark swamp forest and therefore is unlikely to be materially impacted by the additional inflows expected;
- The available information on MRS habitat suggests the species is dependent on high moisture levels, low fire frequency, and a well-developed leaf litter layer and are typically found on somewhat elevated ground around the edges of wetlands (DEE 2019; OEH 2019). It was assessed that the predicted change in inflow levels is unlikely to negatively impact or reduce the existing MRS habitat to the north of the site through permanent inundation;

- The Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis* prefer areas of generally different habitat such as inundated habitat with emergent sedge species. If present, there is no apparent likelihood that the additional inflows expected would negatively impact these species; and
- Additionally, if the above species are present, the expected improvement in water quality as a result of the Projects stormwater management system could potentially be of benefit. However, additional data from long term monitoring of these species would be required to assess any potential impacts as a result of the Project in greater detail.

To reduce the modelled higher frequency flows (more frequent than the 20% AEP), mitigation measures recommended by SMEC (2019) will further minimise the impact on the coastal wetland, including additional assessment to be carried out to inform potential modification(s) in the basin outflow design, such as staging the basin outlets to reduce peak discharges and by removing the proposed bio-basin lining and providing additional infiltration downstream of the basins.

4.1.4 Aquatic fauna

During the development of the BDAR, two pH dependent amphibians were identified by the BAM Calculator as candidate threatened species, namely, Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis* (Greencap 2019b). There are records for these species within the 1,500 m assessment area and within the receiving catchment. The use of gypsum as a flocculent in the sediment basins to quickly settle sediment-laden stormwater runoff during construction may impact the threatened amphibian species Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis* upon discharge from basins to the downstream receiving wetland environment. To avoid any potential changes in pH and impacts on these threatened species, other commercially available flocculants (i.e. Turbiclear) that work as effectively as a gypsum replacement yet do not create the large changes in pH will be used to treat stormwater prior to discharge.

Greencap has reviewed information provided by the supplier of the proposed flocculent (Turbiclear), including the product's Safety Data Sheet (SDS), ecological reports and emails provided by the supplier verifying the product's history of use on other projects with similar ecological constraints. Based on the information that has been provided, when used in accordance with both the manufacturer's recommendations and in accordance with the proposed ESCP/CSWMP the use of Turbiclear as a flocculant in the onsite sediment basins during construction works is not expected to be detrimental to downstream ecological receptors in the wetlands.

As part of the surface water quality monitoring program as outlined in the WQMP in **Section 4.4**, physico-chemical parameters including pH will be monitored in water discharged from sediment basins and in the downstream wetland environment.

4.1.5 Cane toad *Rhinella marina* management

Sediment basins and WSUD features have the potential to attract cane toads *Rhinella marina* and provide breeding habitat which could impact native fauna species, in particular the Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis* or other reptiles and birds that prey on cane toad *Rhinella marina*. Measures to mitigate the impacts of cane toad *Rhinella marina* on the Project Site are described in the FMP, **Section 3.4.**

4.1.6 Sediment basin discharge criteria

Assessment of the relevant discharge parameters will be carried out prior to active discharge offsite from sediment detention basins, excavations or other areas of collected water. Monitoring of the parameters will be conducted using calibrated hand-held monitoring devices and/or sample collection for laboratory analysis. Active discharge of water from a sediment basin into the off Site receiving environment will require approval from a Project Environmental Representative/Manager.

At a minimum, stormwater actively discharged from a controlled sediment basin to receiving waters must comply with Tweed Shire Council stormwater discharge criteria (TSC 2016), the Sites approved ESCP and CEMP.

The Tweed Shire Council specifications (TSC 2016) require that stormwater discharge monitoring must take place at all surface water locations leaving the Site for the following parameters:

- suspended solids and non-filterable residue (NFR) – monthly or during a discharge event (defined as >25mm in any 24 hour period);
- pH – monthly or during a controlled discharge event; and
- Total phosphorus and Total nitrogen – every three months.

Furthermore, a monthly water quality monitoring program will monitor water quality at sediment basin discharge points (near the outlet) and in the wetland received environment as described in **Section 4.4.**

4.2 Contamination pathways

As per Condition 3 B25, all Stage 2 works and associated activities are to be delivered in accordance with an approved groundwater management plan including measures to prevent groundwater contamination in order to avoid any impacts on groundwater, particularly during piling and excavation activities. Contamination risk mitigation will be managed under the SWMP (RBG 2019) and CEMP Sub-plans (CAQMADM , CTPMSP and CSWMSP).

Contaminated land investigations in the form of a Preliminary Site Investigation (PSI) and Detailed Site investigation (DSI) were undertaken at the Site as described in the Stage 1 BMP (Octief 2018). The investigations concluded that based on the conceptual site model presented in the report, exposure pathways of identified soil and groundwater contamination to ecological receptors were unlikely to be complete.

Furthermore, for the additional Soil and Groundwater Investigation Report, required by condition B10 of Schedule 3, a groundwater and intrusive soil investigation was undertaken by Cavvanba Consulting Pty Ltd (Cavvanba) in November and December 2018, and July (Cavvanba 2019) focusing on specific areas of the site including the Farm Dump, Farm Pit (dip), Residential Home and Farm Shed, Farm Dam (all of which are anecdotal descriptions only) and groundwater at the site. These investigations determined that:

- Exceedances of ecological criteria in soil samples were reported, however, these were noted as likely to be localised and not considered to be significant. This is consistent with the previous assessment (Octief 2018) which found no widespread contamination-related ecological issues on the Site.
- The Cudgen Creek off-site environmental receptor and associated creeks are unlikely to be exposed to contamination as the contamination pathways are unlikely to act as a conduit, i.e. extensive distance between the source area and receptor; and depth of the groundwater. These conclusions are consistent with the previous report.

Remediation works are currently underway and will be completed during Stage 1. It is understood that JBS&G have been engaged to provide a Site Audit Report and Site Audit Statement to support the Stage 2 SSD Application.

4.2.1 Groundwater

The location of the Project's development footprint on the Site seeks to minimise interference with hydrological flows, including contributions from groundwater.

Other than what may be required for piling, subsurface excavations will be at a shallower depth than measured depth to groundwater on the Site. The geotechnical investigations undertaken by Morrison Geotechnical (2018) identified that the water table sits at approximately RL 11.0.

Many of the piles will not extend below RL 11.0. The proposed less intrusive method of pile construction using a continuous flight auger (CFA) or Bore Pile type should remove the requirement to de-water from groundwater table during piling activities (Darren Chow, Lendlease Building Pty Ltd, pers. comm. 25 June 2019). Piles will be between 600 mm and 1,200 mm in diameter (generally 900 mm) and will typically be spaced 8.4 m apart. As the piles are not continuous it is not anticipated that they will create a barrier to any shallow or perched groundwater flow that currently occurs within the Project footprint, therefore the design will not have any significant impacts to groundwater flow or on groundwater contributions to base flow in the wetlands.

While no site specific groundwater modelling data is currently available for the Site, the level that groundwater has been encountered in the bores which are situated upslope from the wetlands is at a higher elevation that the wetlands, indicating that there is potential for groundwater to influence the wetlands and provide some base flow. However, the extent to which groundwater influences flows and water quality within the wetlands is unknown based on available site information.

There is a very low risk of any reduction of groundwater recharge during Stage 2 works.

4.3 Spill management

A spill prevention and response management plan along with supporting documentation will be produced as part of the Project's CEMP and sub-plans and their prescriptions will be implemented to minimise the risk of surface water or groundwater contamination.

Material safety data sheets (MSDS) will be available on all chemical products brought onto Site to aid in the identification of appropriate spill clean-up and disposal methods.

Chemicals and hazardous substances used during all phases of the Project will be selected and managed to minimise the potential adverse environmental impact associated with their transport, transfer, storage, use and disposal.

Spill response materials and equipment (including personal protective equipment) will be available during all project phases and will contain equipment to remediate or contain both chemical and hydrocarbon spills. All spills will be reported to management and recorded in the incident register as per the Project's CEMP procedures.

4.4 Surface water quality monitoring program

The surface water monitoring objectives for the Site are to detect changes during construction and operations in receiving water quality resulting from the Project, with stormwater discharges potentially containing increased sediment loads, nutrients, total and dissolved metals, hydrocarbons or other contaminants such as pesticides.

Surface water monitoring results and trends will be reported in monthly factual report and an annual interpretative report. Water quality results shall be compared against water quality guidelines for ecosystem health. Monitoring parameter exceedances which indicate increasing trends and/or results that are not generally consistent with background data will trigger investigation and adaptive management actions.

As part of the adaptive management approach, the water quality monitoring program will be reviewed periodically once sufficient data is available to ensure alignment with any changes in Site activities and potential impact pathways and determine whether any parameters should be excluded from further monitoring rounds. Based on the seasonality of rainfall in the region, it is anticipated that 12 months of monitoring data would be required to adequately assess all parameters, as such it is proposed that this is undertaken as part of the annual reporting process with recommendations for any change in parameters included in the report.

4.4.1 Background data

Water quality monitoring

In addition to the modelling undertaken by Bonacci (2019) as described above, Greencap conducted three surface water sampling events on 19 and 26 November and 19 December 2018 to record water quality conditions under the existing land use. The intention of this sampling was to create some indicative background data to enable detection of potential changes during construction and operation in receiving water quality resulting from the Project. The water quality monitoring program collected water quality data over two sampling events on existing stormwater which flows into the downstream forested wetland and the east-flowing floodplain drain receiving environment. Sample locations were selected to allow a best possible indication of stormwater runoff quality upstream and downstream of the Site and the receiving environment (wetland).

Given the objective for detection of changes to water quality in receiving water bodies during construction and operation of the Project, specific contaminants of concern were selected as listed above. Organochlorine Pesticides (OCP) and Organophosphorus Pesticides (OPP) as a result of the historic and current agricultural land-use. Physico-chemical parameters were also monitored for pH dependent threatened species such as the Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis*.

4.4.2 Sampling locations

Sample locations have been selected to allow a best possible indication of stormwater runoff quality upstream and downstream of the Site and the receiving environment (wetland). It is noted that under pre-construction conditions the majority of stormwater run-off from the site would be sheet flow heading in a northerly direction. As sheet flow cannot be readily sampled, the locations detailed below are considered the most appropriate to obtain relevant site data.

To effectively assess the water quality of stormwater discharge and its impact on the receiving environment, particularly the wetlands, five sampling locations are proposed (**Figure 12**) for monthly sampling:

- Dam and Dam Drain:
  - Dam drain: to assess water entering the dam - upstream/paddock run off*
  - Dam: catchment for on Site/off Site drains, water diverted from wetland*

    *These locations will only be monitored in the pre-construction and early stages of construction works in the event the dam is decommissioned during the construction phase. This is further detailed in the Vegetation Management Plan (**Section 2.3**) as a control measure for the *Salvinia molesta* infestation.
- Upstream and Receiving Environment:
  - Downstream West: downstream of the wetland stream/drain to the west, along Tweed Coast Rd (background quality).
  - Upstream East: upstream of the wetland stream/drain, to the east along Turnock street (background quality).
  - North West: variable flow direction, water flowing through the wetland stream/drain from the river and urban catchment.
- In addition to the nine sampling locations listed above, event-based sampling will also include three drains around the perimeter of the site:
  - Cudgen Road Drain - to assess stormwater runoff entering the Site (upstream, background quality).
  - Lowest paddock drain - to assess runoff from the site.
  - Turnock St Drain - assess upstream water entering the wetland.

- Prior to a discharge event, the four sediment basin will be sampled at the discharge points (near the outlet) to ensure the quality of water released is consistent with the water quality objectives.

4.4.3 Sampling frequency

Ongoing monitoring will be undertaken during Stage 2 construction and operations in accordance with the following regime:

- Monthly.
- Controlled Event-based – prior to controlled discharge from one or more of the existing sediment basins.
- Uncontrolled Event-based – in the event of an uncontrolled release from one or more of the existing sediment basins (within 24-48hrs of notification).

4.4.4 Sampling parameters and performance criteria

The list of proposed sampling analytes, field parameters and the trigger criteria they will be assessed against are based on the following guidelines:

1. NSW Water Quality Objectives for the Tweed River Catchment for Aquatic Ecosystems (Tweed 2006);
2. Australian and New Zealand guidelines for fresh and marine water quality (ANZECC 2000).

A summary of the proposed sampling analytes is provided in **Table 13.**

Table 13 Surface Water Quality Monitoring Parameters

Analyte	Trigger Criteria		
In-Field	Unit	Tweed (2006)	ANZECC (2000) 95% species protection
pH	pH Units	7.0 - 8.5	6.5 - 8.5
Turbidity	NTU	0.5 - 10	6.0 - 50
Electrical Conductivity (EC)	mS/cm	30 - 2,200	N/A
Dissolved Oxygen (DO)	%	80 - 110	85 - 110
Temperature	^{o}C	N/A	N/A
Oxidation Reduction Potential (ORP)	mV	N/A	N/A
Oil and grease	Visual observation	N/A	N/A
Laboratory			
Total Suspended Solids (TSS)	mg/L	N/A	N/A
Total Dissolved Solids (TDS)	mg/L	N/A	N/A
Ammonia	µg/L	15	20
Chlorine	mg/L	N/A	N/A
Chlorophyll-a	µg/L	4	5
Filterable Reactive Phosphorus	µg/L	N/A	20
Nitrate	µg/L	N/A	N/A
Oxides of Nitrogen	µg/L	15	40
Total Nitrogen	µg/L	300	350
Total Phosphorus	µg/L	30	25

Analyte		Trigger Criteria	
Aluminium (pH >6.5)	µg/L	N/A	55
Arsenic (filtered)[2]	µg/L	N/A	24
Boron (filtered)	µg/L	N/A	370
Cadmium (filtered)	µg/L	5.5	0.2
Chromium (filtered)[2]	µg/L	4.4	1.0
Copper (filtered)	µg/L	1.3	1.4
Cobalt (filtered)	µg/L	1.0	N/A
Lead (filtered)	µg/L	4.4	3.4
Manganese (filtered)	µg/L	N/A	1,900
Mercury (filtered)	µg/L	0.4	0.6
Nickel (filtered)	µg/L	70	11
Selenium (filtered)	µg/L	5	11
Silver (filtered)	µg/L	1.4	0.05
Zinc (filtered)	µg/L	15	8.0
Benzene	mg/L	N/A	0.95
Toluene	mg/L	N/A	N/A
Ethylbenzene	mg/L	N/A	N/A
Xylene - Total	mg/L	N/A	0.95
Naphthalene	mg/L	N/A	0.016
Total Recoverable Hydrocarbons (TRH)	mg/L	N/A	N/A
TRH Silica-gel Clean-up[1]	mg/L	N/A	N/A
Organochlorine Pesticides (OCP)			
4.4'-DDE	µg/L	N/A	0.03
4.4'-DDT	µg/L	N/A	0.01
Aldrin	µg/L	N/A	0.001
g-BHC (Lindane)	µg/L	N/A	0.2
Chlordane	µg/L	N/A	0.08
Dieldrin	µg/L	N/A	0.01
Endosulfan	µg/L	0.01	0.2
Endrin	µg/L	0.02	0.02
Heptachlor	µg/L	N/A	0.09
Toxaphene	µg/L	N/A	0.2
Organophosphorus Pesticides (OPP)			
Azinphos-methyl	µg/L	N/A	0.02
Chlorpyrifos	µg/L	0.009	0.01
Demeton-S	µg/L	N/A	0.04

Analyte	Trigger Criteria		
Diazinon	µg/L	N/A	0.01
Dimethoate	µg/L	N/A	0.15
Fenitrothion	µg/L	N/A	0.2
Malathion	µg/L	N/A	0.05

[1]TRH silica gel clean-up provides an indication of whether reported hydrocarbons are petroleum based or non-petroleum based.

[2] If a sample returns detectable concentrations of these analytes, additional analyses (speciation) may be required to enable comparison against additional trigger criteria or trace potential sources of contaminants.

4.4.5 A suitable number of QA/ Quality control

QC samples will be collected in accordance with AS4482.1-2005 which stipulates a minimum of one duplicate sample, as well as a field and trip blank.

Surface water samples will be collected using industry standard practices for surface water sampling and in general accordance with:

- AS/NZS 5667.1:1998 Water Quality – Sampling Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples (AS/NZS 5667.1);
- AS/NZS 5667.4:1998 Water Quality – Sampling Part 4: Guidance on sampling from lakes, natural and man-made (AS/NZS 5667.4); and
- AS/NZS 5667.6:1998 Water Quality – Sampling Part 6: Guidance on sampling of rivers and streams (AS/NZS 5667.6).

4.4.6 Report and review

A brief summary letter report will be prepared for each monthly and event-based sampling round that will include:

- Site details;
- Sampling objective and monitoring methodology; and
- Sample and monitoring results, exceedances of the adopted trigger values will be highlighted.

An annual report will be submitted providing interpretation of water quality data, evaluating water quality exceedances and trends and a review of the water quality monitoring program following the completion of the 12-month period of monitoring. The report may include recommendations for any future monitoring parameters and frequencies based on the previous 12 months monitoring results, or changes in site conditions.

4.5 Summary of water quality mitigation measures

Table 14 summaries the various activities, timing and responsibilities required to achieve the water quality management aims and objectives.

Table 14 Water quality mitigation measures

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
Stormwater Management - Construction						
87	All areas	All construction works will be delivered in accordance with a CEMP including an ESCP/CSWMP.	Stage 2 C	Management, all construction staff and site personnel	Mitigate any impacts from the Project on water quality/ hydrological processes that sustains threatened species and TECs	As per approved CEMP and ESCP/CSWMP
88	All areas	All construction staff and site personnel will be made aware of their environmental responsibilities and safeguard measures within the CEMP to avoid and minimise environmental impacts. The CEMP will be submitted to the DPE for review and approval prior to commencement of works.	Stage 2 C	Management, all construction staff and site personnel	Mitigate any impacts from the Project on water quality/ hydrological processes that sustains threatened species and TECs	Adherence to water quality management policies
89	All areas	The CEMP will be submitted to the DPIE for review and approval prior to commencement of Stage 2 construction works.	Stage 2 C (planning)	Management	Mitigate any impacts from the Project on water quality/ hydrological processes that sustains threatened species and TECs	Approved Project CEMP
90	All areas	The ESCP/CSWMP will be implemented prior to the commencement of construction works, especially prior to the onset of each wet season (from late February to late April).	Stage 2 C	Management and all contractors	Mitigate any impacts from the Project on water quality/ hydrological processes that sustains threatened species and TECs	Project ESCP/CSWMP approved and implementation commenced prior to construction
91	All areas	The ESCP/CSWMP is reviewed and updated, as required, and at least annually prior to the onset of the wet season to reflect changes in site conditions as construction progresses.	Annually / Stage 2 C	Management	ESCP/CSWMP will reflect changes in site conditions as construction progresses	CSWMP reviewed and updated as required on a quarterly basis

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
92	All areas	An erosion assessment will be conducted by a CPESC during the planning phase of the ESCP development.	Stage 2 C (planning)	Management and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	CPESC erosion assessment undertaken
93	All areas	ESC design should be in accordance with the guidelines in Best practice erosion and sediment control (IECA 2008), the Tweed Shire Council Development Design Specification - D7 (TSC 2016), guidelines for development adjoining land and water managed by DECCW (OEH, 2013) and the Managing Urban Stormwater "Blue Book" (Landcom 2004).	Stage 2 C	Management and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Project ESCP/CSWMP approved by appropriately licenced/accredited practitioner
94	All areas	The ESCP/CSWMP will include a sediment barrier (or diversion bund) around the Site and sediment ponds to control the quality of water released from the Site into the receiving environment.	Stage 2 C	Management and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Barrier/bund established and effective
95	All areas	Erosion and sediment control management of stockpiles is to be consistent with relevant guidelines and the most recent ESCP/CSWMP.	Stage 2 C	Management and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Project ESCP/CSWMP approved by appropriately licenced/accredited practitioner
96	All areas	Erosion and sediment control measures including sealed areas will be inspected regularly to check for compliance and that they are maintained and are in good working order.	Surveillance – daily; Inspections - weekly/ Stage 2 C	Project Environmental Representative	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Inspection records are retained and readily available
97	All areas	ESC compliance inspection reports shall be provided to Project Management (TSA).	Monthly/ Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Reporting of all ESCP non-compliances

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
98	All areas	In the event that an ESCP/CSWMP non-compliance is identified, Management shall be notified as soon as practical.	As required/ Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	As per Section 5.3 of CEMP
99	All areas	All erosion and sediment controls must be maintained, e.g. restoring capacity of the sedimentation basins and rock filter dams through desilting as necessary after rainfall events, subject to daily inspections and when weather conditions permit, in accordance with the Managing Urban Stormwater "Blue Book" (Landcom 2004). Temporary sediment traps will be retained until after the lands they are protecting are completely rehabilitated.	Stage 2 C	Management and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Inspection and maintenance records are retained and readily available
100	All areas	If soil erosion is evident, exposed surfaces at the affected area will be stabilised with whatever means is considered practicable and satisfactory (e.g. matting, soil stabiliser, mulching) to mitigate and stabilise the area in accordance with the relevant ESCP/CSWMP and guidelines.	Stage 2 C	Management and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Inspection and maintenance records are retained and readily available
101	All areas	The Site manager will keep a logbook making entries at least weekly, immediately before forecast rain or after rainfall. Entries will include: Volume and intensity of rainfall events, the condition of any soil and water management works, the condition of vegetation and any need to irrigate, the need for dust prevention strategies any remedial works to be undertaken.	Stage 2 C	Site manager and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Logbook maintained and up-to-date

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
102	Project footprint and sediment basins (MZ 2.3)	The following events must be reported to Project Management (TSA); ESC measures have not been fully implemented prior to the commencement of earthworks/construction, inspections not conducted at the required frequency, failed ESC during a rain event that it was design to withstand and sediment controls have not been restored in accordance with IECA guidance timeframes following rain events.	Stage 2 C	Construction contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Maintenance/incident report completed, evidence of remedial actions implemented.
103	Project footprint and sediment basins (MZ 2.3)	Personnel who are involved in maintenance of erosion and sediment controls, and dewatering activities will be suitably trained in the appropriate installation and operation of controls, discharge water-quality requirements, treatment processes and incident reporting procedures.	Stage 2 C	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Qualification review of suitably qualified contractors engaged to undertake activities
104	All areas	Contaminated soils (i.e. sediment removed from basins that could potentially be contaminated) will be managed in accordance with the Sites CWMSP (LLB 2019). The WMP will outline the waste management strategies including the process for waste identification, characterisation, storage, labelling, inspection, transport onsite and transfer to the appropriate waste vendor, including completion of all required waste disposal documentation.	Stage 2 C	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Adherence to all Site Waste Management Procedures
105	Sediment basins (MZ 2.3)	Assessment of the relevant discharge parameters will be carried out prior to active discharge offsite from sediment detention basins, excavations or other areas of collected water.	Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Water quality meets specific water quality as specified in CSWMP Appendix G
106	Sediment basins (MZ 2.3)	Active discharge of water from a sediment basin into the off site receiving environment will require approval from a Project Environmental Representative/ Manager.	Stage 2 C	Project Environmental Representative/ Manager and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Waste Discharge Permit (refer CSWMP Appendix N) approved prior to discharge event

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
107	Sediment basins (MZ 2.3)	Stormwater actively discharged from a controlled sediment basin, excavations or other areas of collected water to off Site receiving waters must comply with the *Tweed Shire Council Development Design Specification - D7* (TSC 2016) stormwater discharge criteria and the guidelines for development adjoining land and water managed by DECCW (OEH, 2013).	Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Compliance with approved Project ESCP/CSWMP discharge water criteria and TSC D7 Criteria: pH monthly or during a controlled discharge event and Total Phosphorus and Total nitrogen every three months (TSC 2016) as per **Section 4.4.4.**
Stormwater Management - Operation						
108	Project footprint and receiving environment	The stormwater management system for operation of the Project will be designed in accordance with the locally appropriate standard (TSC 2016) and guidelines for development adjoining land and water managed by DECCW (OEH, 2013) as per the SWMP (RBG 2019).	Stage 2 (design phase)	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Maintain or improve the quality of stormwater that is discharged from the Site.
109	Project footprint and receiving environment	The stormwater design for the site is designed on the basis of ensuring that the post development discharge rate does not exceed the pre-development rate in the 100 year and 5 year ARI storms (RBG 2019). In regards to water quality, the system will also be designed to meet water quality performance criteria detailed in **Section 4.4.4.**	Stage 2 (design phase)	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	No decrease in the quality of stormwater that is discharged from the Site.
Water Sensitive Urban Design Measures						
110	Farm dam in MZ 1.4	The management of the farm dam located at the north of the site will be decommissioned to control the current infestation of *Salvinia molesta* as described in **Section 2.3.2.7.**	Stage 2 C	Manager and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Maximum 5% weed cover following weed control activities Vegetation condition Monitoring performance criteria as per **Section 2.3.5.**

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
						As per the water quality criteria outlined in the **Section 4.4.4.**
111	MZ 2.3	As part of the SWMP (RBG 2019), a transition plan will be developed outlining the stages of activities and timing for converting the sediment basins into bio-detention basins.	Stage 2 C	Management, Wetland design Contractor	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Sediment basin/ Bio-detention basin transition plan
112	Project footprint, MZ 2.3 and 5	WSUD measures (i.e. swales, bioretention basins and extended detention basins) will maintain flows to the wetlands and maintain or improve water quality.	Stage 2 O	Management, Project Environmental Representative and all contractors	Maintain natural flows to the wetlands and maintain or improve water quality.	As per the water quality criteria outlined in the **Section 4.4.4.**
113	Project footprint	The roof runoff will be directed into the bio-detention basin by a pit and pipe system while hardstand runoff will be first treated by enviropods, and then either swales that discharge to the bioretention system or directly into the bioretention systems.	Stage 2 O	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	As per approved CSWMP.
114	Project footprint, MZ 2.3 and 5	The bulk of the stormwater will end up in bio-retention basins and then discharge to the receiving catchment in a controlled manner.	Stage 2 O	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	As per approved CSWMP.
115	MZ 2.3	A bio-detention basin hydrodynamic design will be created by suitably qualified and experienced environmental engineers with experience in wetland design. The design will outline technical specifications for the bioretention basins, including; zonal design (i.e. inlet zone, macrophyte zone and embankment (littoral) zone), cane toad and mosquito deterrents, weed control, vegetation types and planting densities for each zone within the basin.	Stage 2 O	Management, Wetland design Contractor	Functional and effective bioretention basins that meet hydrological and stormwater quality requirements	As per the approved CSWMP.

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
116	MZ 2.3	Bio-detention basin operational management planning includes maintenance procedures.	Stage 2 O	Management, Wetland design Contractor	Functional and effective bioretention basins that meet hydrological and stormwater quality requirements	Bioretention basin operational plan. As per the approved SWMP/CSWMP and water quality criteria outlined in the **Section 4.4.4.**
117	MZ 2.3	Bioretention basin routine maintenance.	Monthly Stage 2 O	Manager Capital Assets and Resources (or similar role), LHD with works undertaken by external subcontractor/s.	Functional and effective bioretention basins that meet hydrological and stormwater quality requirements	As per the approved SWMP and water quality criteria outlined in the **Section 4.4.4.**
Groundwater						
118	Project footprint	Other than what may be required for piling, subsurface excavations will be at a shallower depth than measured groundwater depths on the Site. Piles will be between 600 mm and 1200 mm in diameter and will typically be spaced 8.4 m apart, except under lift and/or stairwell cores where they will be not less than 2 m apart. As the piles are not continuous, it is not anticipated that they will create a barrier to any shallow or perched groundwater flow that currently occurs within the Project footprint.	Stage 2 (design phase)	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Maintain shallow or perched groundwater flow that currently occurs within the Project footprint.
119	Project footprint	Any reduction of groundwater recharge due to the Project footprint will be mitigated through recharge that will occur through the proposed WSUD measures such as: swales and car park plantings to reduce impervious surfaces.	Stage 2 O	Management, Project Environmental Representative and all contractors	Maintain natural flows to the wetlands and maintain or improve water quality.	WSUD measures installed and maintained.

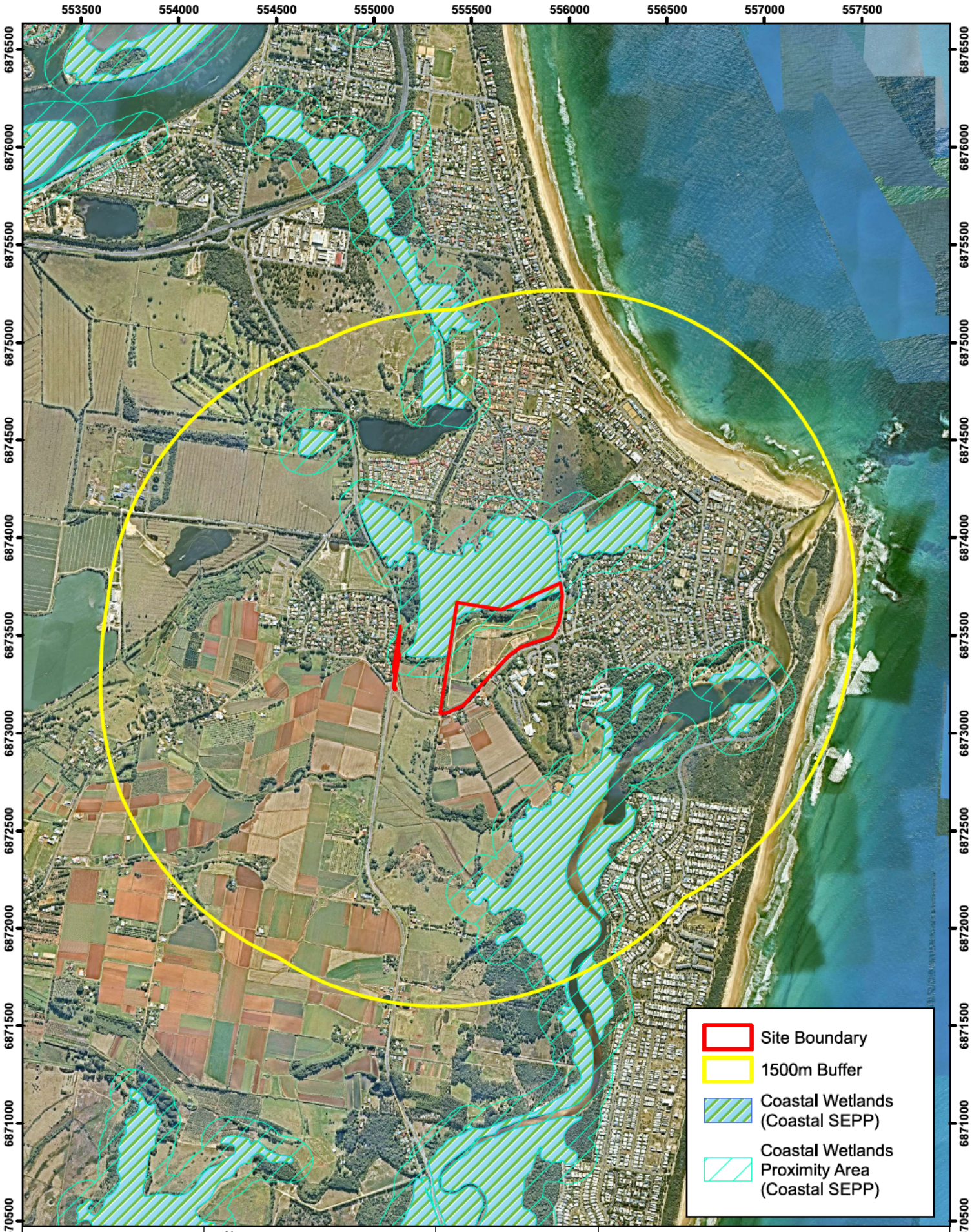
Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
Wildlife						
120	MZ 2.3	To avoid any potential changes in pH and impacts on threatened aquatic species, other commercially available flocculants that work as effectively as a gypsum replacement yet do not create the large changes in pH will be used on the Site.	Stage 2 C	Management and contractors	Threatened aquatic species conservation	No change to pH in receiving environment waters. pH meets water quality criteria outlined in the approved Site ESCP and **Section 4.4.4.**
121	MZ 2.3	A cane toad *Rhinella marina* exclusion fencing will be installed around sediment basins and bio-detention basins.	Stage 2 C	Manager and contractors	Mitigate any impacts from the Project that sustains threatened species and TECs	Cane toad *Rhinella marina* exclusion fencing installed.
122	MZ 2.3	Bio-detention/sediment basin perimeters will be planted out with an edge of *Lomandra longifolia* at a density of three rows, 0.5 to 1 m apart with staggered spacing's of 50cm to exclude cane toad Rhinella marina. Once this dense edge *of Lomandra longifolia* is established the cane toad fencing will be removed.	Stage 2 C	Manager and contractors	Mitigate any impacts from the Project that sustains threatened species and TECs	As per the VMP Performance criteria for revegetation in **Section 2.3.5**. No more than 5% weed cover following weed control activities. A minimum of 90% survival rate of all revegetation.
Spill prevention and response management						
123	All areas	A spill prevention and response management plan and supporting documentation will be produced as part of the Projects CEMP and their prescriptions will be implemented to minimise the risk of surface water or groundwater contamination.	Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Adherence to spill prevention and response management procedures. Water quality criteria outlined in the approved Site ESCP and **Section 4.4.4**

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
124	Project footprint	MSDSs will be available on all chemical products brought onto Site to aid in the identification of appropriate spill clean-up and disposal methods. Chemicals and hazardous substances used during all phases of the Project will be selected and managed to minimise the potential adverse environmental impact associated with their transport, transfer, storage, use and disposal.	Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Adherence to spill prevention and response management procedures.
125	Project footprint	Spill response materials and equipment (including personal protective equipment) will be available during all project phases and will contain equipment to remediate or contain both chemical and hydrocarbon spills.	Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Adherence to spill prevention and response management procedures.
126	Project footprint	All spills will be reported to management and recorded in the incident register as per the Projects CEMP procedure.	Stage 2 C	Management, Project Environmental Representative and all contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Adherence to spill prevention and response management procedures. All spills recorded in the incident register.
Surface Water Quality Monitoring						
127	Receiving environment (wetland) and sediment basins	The surface water monitoring objectives for the Site are to detect changes in receiving water quality resulting from the Site activities and discharges offsite of water potentially containing nutrients, dissolved metals, hydrocarbons or other contaminants such as Organochlorine Pesticides (OCP) and Organophosphorus Pesticides (OPP).	Stage 2 C & O Monthly NB: this monitoring program will be reviewed to be in line with any conditions of approval.	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	NSW Water Quality Objectives for the Tweed River Catchment for Aquatic Ecosystems (Tweed 2006). Australian and New Zealand guidelines for fresh and marine water quality (ANZECC 2000). Water quality criteria outlined in **Section 4.4.4.**

Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
128	Receiving environment (wetland) and sediment basins	Surface water monitoring results will be reported in monthly factual report and an annual interpretative report evaluating water quality exceedances and trends and a review of the water quality monitoring program.	Monthly/Annual Stage 2 C & O	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Monthly/ Annual water quality reports submitted. Water quality criteria outlined in **Section 4.4.4.**
129	Receiving environment (wetland) and sediment basins	Monitoring parameter exceedances which indicate increasing trends and are not generally consistent with background data will trigger investigation and adaptive management actions.	Stage 2 C & O	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Water quality criteria outlined in **Section 4.4.4.**
130	Receiving environment (wetland) and sediment basins	A suitable number of QA/QC samples will be collected in accordance with AS4482.1-2005 which stipulates a minimum of 1 duplicate sample, as well as a field and trip blank.	Stage 2 C & O	Contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Adherence to industry standard practices for sampling QA/QC.
131	Receiving environment (wetland) and sediment basins	Surface water samples will be collected using industry standard practices for surface water sampling and in general accordance with: • AS/NZS 5667.1:1998 • AS/NZS 5667.4:1998; and • AS/NZS 5667.6:1998	Stage 2 C & O	Contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Adherence to industry standard practices for surface water sampling.
132	Receiving environment (wetland) and sediment basins	Physico-chemical parameters including pH will be monitored in water discharged from sediment basins and in the downstream wetland environment to protect aquatic wetland fauna.	Stage 2 C & O	Management and contractors	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	No change to pH in receiving environment waters. Water quality criteria outlined in **Section 4.4.4.**
133	All areas	Should water quality monitoring results indicate performance criteria non-compliance, increasing trends in metals/nutrient concentrations and results are not generally consistent with background data, or impacts from Project activities are identified which could result in an increase in frequency of non-compliance it will trigger investigation and	At all times	Management and consultants	Mitigate any impacts from the Project on water quality that sustains threatened species and TECs	Non-compliance to performance criteria will trigger investigation and adaptive management measures will be implemented.

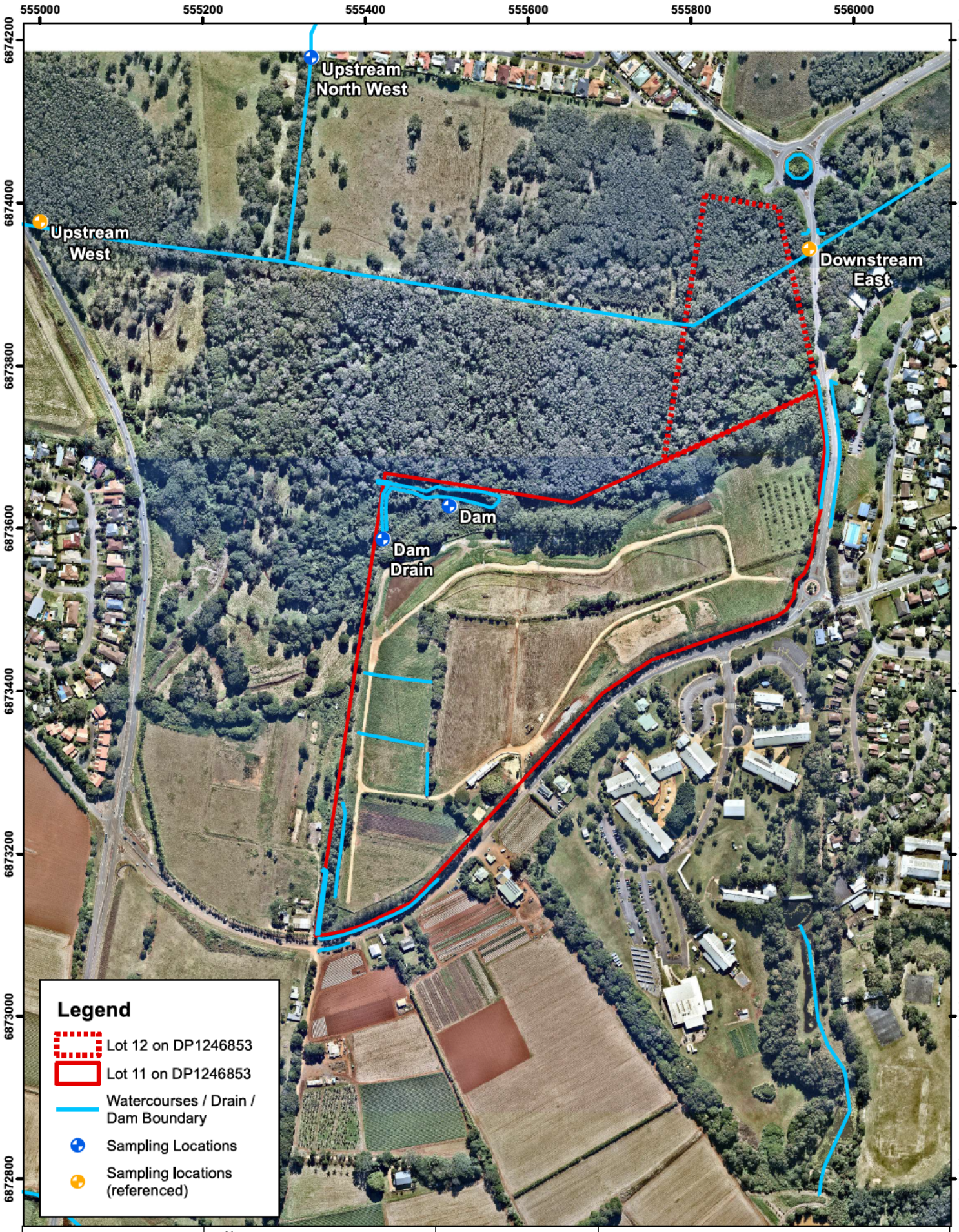
Item #	Management zone	Activity Description	Project Phase[1]	Responsibility	Outcome	Performance criteria
		adaptive measures will be implemented to mitigate any impacts.				

[1] [1] Project phases: Stage 2: Construction (C) and Operation (O)



Client: C107778	N 0 350 700 m	Scale (@A4): 1:25,000	**Wetlands – Stage 2**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke	*Imagery 15th July 2019 (1.2 m) © Nearmap 2019* *Coastal SEPP mapping © Department of Planning and Environment (DPE) 2018*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 11**
Date: 1/08/2019			
GREENCAP	*No warranty is given in relation to the data (including accuracy, reliability, completeness or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of or reliance upon the data. Data must not be used for direct marketing or be used in breach of privacy laws.*		

Doc Path: R:_Projects\C107778_Health Infrastructure\J156455_Tweed Valley Hospital\3. Job Folder\GIS\J156455_13_TVHs2\BMPs2\mxd\J156455_13_BMPs2_F11_wetlands_location_190801.mxd



Client: C107778	N 0 70 140 m	Scale (@A4): 1:6,000	**Surface Water Sampling Locations – Stage 2**
Job #: J156455-13			
Author: [redacted]	Coordinate System: GDA 1994 MGA Zone 56		
Checke[redacted]	*Note: All data is approx only & subject to survey.* *Imagery 15th July 2019 (7.5 cm) @ Nearmap 2019* *Hydrolines and Hydroarea (NSW Hydrography) © Department of Finance, Services and Innovation (2018)*	Tweed Valley Hospital BMP 771 Cudgen Road Cudgen NSW	**Figure 12**
Date: 1/08/2019			
GREENCAP	*No warranty is given in relation to the data (including accuracy, reliability, completeness or suitability) and accept no liability (including without limitation, liability in negligence) for any loss, damage or costs (including consequential damage) relating to any use of or reliance upon the data. Data must not be used for direct marketing or be used in breach of privacy laws.*		

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5. REVIEW AND EVALUTATE

This Stage 2 BMP will be reviewed on an annual basis to assess whether objectives are being been achieved and in accordance with changes in conditions. If required, revisions will be made to this Stage 2 BMP to improve proficiency the following year. In the long term, it is important to keep track of control efforts and ensure that the activities being undertaken are contributing to the objectives of this Stage 2 BMP.

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Stage 2 Biodiversity Management Plan

NSW Health Infrastructure Tweed Valley Hospital

ATTACHMENT 1 TWEED VALLEY HOSPITAL MITIGATION MEASURES

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	
					BMP Stage 1	BMP Stage 2
Revegetation	1	Regeneration and revegetation of areas detailed in the Landscape Masterplan documentation (Turf 2019) will enhance connectivity within the site when compared to the existing land use.	Stage 1 BDAR Table 8, Design - Point 4 Stage 2 BDAR - Table 9 - Point 4	BMP Stage 2	-	VMP Section 2.3.3; FMP Section 3.3; Figure 6 (MZ 6 and 7)
Native vegetation clearing	2	No remnant native vegetation will be cleared.	Stage 1 BDAR Table 8, Design - Point 5 Stage 2 BDAR - Table 9 - Point 5	Both	Table 4 items 1, 2, 15, 12, 16	VMP Section 2.3; Table 5 items 1, 2, 10, 12, 13
Ecological restoration, rehabilitation and ongoing maintenance of retained native vegetation on Site	3	All remnant native vegetation outside of the development footprint will be protected and maintained	Stage 1 BDAR Table 8, Design - Point 10 Stage 2 BDAR Table 9 - Point 10	Both	VMP Section 2.3	VMP Section 2.3; Table 5 items 1, 2, 10, 12, 13
Ecological restoration, rehabilitation and ongoing maintenance of retained native vegetation on Site	4	All areas of intact remnant native vegetation on Site and remaining areas of planted or self-sown windrow vegetation at the Site will be retained and managed in accordance with the vegetation management performance criteria to be set out in the Biodiversity Management Plan to preserve and enhance current biodiversity values.	Stage 1 BDAR Table 8, Design - Point 11 Stage 2 BDAR - Table 9 - Point 11	Both	VMP Section 2.3.1; Section 2.4	VMP Section 2.3
Vegetation clearance	5	In accordance with section 9.4.2 of the BAM, a Biodiversity Management Plan will incorporate a Vegetation Management Plan with measures to monitor vegetation at the Site, including objectives and thresholds which, in the event of exceedances, will trigger investigation and adaptive management actions.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Both	VMP Section 2.5	VMP Section 2.3.5
Vegetation clearance	6	<u>Landscape plan Zone 2</u> Low maintenance native landscape including detention basins and vegetation buffer that provide stepping stone habitats to include: • Locally indigenous native rainforest trees, shrubs and groundcovers • Inclusion of habitat features such as rocks that have been salvaged from other areas of the Site (cleared windrows) that will create habitat for ground dwelling species	Stage 1 BDAR S2.3.7 and Appendix I. Prescribed Impact Assessment Stage 2 BDAR S2.3.7 and Appendix J. Prescribed Impact Assessment	BMP Stage 2	-	VMP Section 2.3
	7	<u>Landscape plan Zone 5</u> • New plantings within rain gardens that both treat stormwater quality and contribute to providing a range of native habitat across the site • Locally indigenous native trees along roadways • Water adapted ground covers (e.g. from the Cyperaceae, Juncaceae and Poaceae families) are to be planted in rain gardens				
	8	<u>Landscape plan Zone 6 and 7</u> Retention and enhancement of established windrows (vegetation buffers): • 10m wide vegetated buffer for Zone 6 and 30m wide vegetated buffer for Zone 7 • Augment existing vegetation buffers to increase biodiversity values, including habitat connectivity • Removal of High Threat Exotic weeds that have self-sown within the windrows (e.g. camphor laurel Cinnamomum camphora, small leaved privet Ligustrum sinense, umbrella tree Schefflera actinophylla) • Staged removal of slash pine Pinus elliottii				
Habitat	9	In accordance with section 9.4.2 of the BAM, a Biodiversity Management Plan will set out provisions for the ecological restoration, rehabilitation and/or ongoing maintenance of native vegetation habitat on or adjacent to the development Site. Actions will be undertaken in both construction (see above) and operations phases.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Both	VMP Section 2.3	VMP Section 2.3
Habitat	10	Weed removal shall be undertaken to preserve biodiversity values in the remnant native vegetation areas on Site, in particular areas of remnant White Booyong - Fig subtropical rainforest, Paperbark swamp and Flooded Gum forest. Weed removal will include: •Removal of an exotic grassland monoculture composed of barner grass Pennisetum purpureum located amongst remnant native vegetation in the northern section of the Site (Zone 9) and revegetation with native rainforest species •Decommissioning of the dam located in the central northern section of the Site that contains a Salvinia molesta infestation •Removal of weeds such as alexandra palms Archontophoenix alexandrae, morning glory Ipomea caerica and Singapore daisy Sphagneticola trilobata in the remnant native vegetation.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Both	VMP Section 2.3.1	VMP Section 2.3.2
Prescribed Impacts on Connectivity of Different Areas of Habitat of Threatened Species	11	In response to the removal of stepping stone habitat in the southern portion of site the following action will be undertaken: •A 10m wide vegetation buffer will be established along the western boundary of the site. This buffer will connect to the retained vegetation in the northern portion of site, and will run north to south, in line with the mapped regional fauna corridor. This will be an improvement in connectivity from the existing use of the site. •The stepping stone habitats removed from the southern portion of the site will be replaced with new stepping stone habitats in the form of rain gardens (identified in the Landscaping Plan for the project). These will provide habitat for threatened species within the cleared areas of the site.	Stage 1 BDAR S3.2.6 Stage 2 BDAR S3.2.5	BMP Stage 2	-	VMP Sections 2.4.2, 2.6 and FMP Section 3.2.2; Table 9 items 20, 21

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	
Unplanned loss of habitat	12	All native vegetation not identified for removal shall be protected from damage during construction work. This protection shall consist of: • Establishment of a Tree Protection Zone in accordance with AS 4970-2009 (Protection of trees on development sites) around vegetation adjacent to the construction footprint • Installation of temporary protective fencing (1800mm high), securely installed beneath the outer canopy of any tree to be retained • Trees and vegetation may be fenced off in clusters where it is not practical to fence off individual trees • No stockpiling, storing materials, parking machinery, washing machinery or changes to existing soil levels within the fenced areas • Retention of Ficus obliqua tree located at the existing Site entry	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	Table 4 items 1, 2, 15, 12, 16	VMP Section 2.3.1; Table 5 items 1, 2, 13 FMP Section 3.2.1
Weeds	13	Implement weed hygiene practices in accordance with an approved CEMP and sub plans, including a Biodiversity Management Plan to avoid the introduction or spread of weeds on the Site.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	VMP Section 2.3 Table 4 items 5 to 11; Section 2.3.1	VMP Section 2.3 Table 5 items 5-9, 11; Section 2.3.2
Weeds	14	Mulch generated from exotic trees and/or other weed species that have been cleared shall not be used on site. The mulch shall be removed from the site and disposed of in accordance with legislative requirements.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	VMP Section 2.3 Table 4 item 10; Section 2.3.1	VMP Sections 2.3, 2.4.2 and 2.6 Table 14 item 100
Weeds	15	Weeds present on site will be managed in accoradance with the Biodiversity Management Plans.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	VMP Section 2.3.1	VMP Section 2.3.2
Weeds	16	Salvinia molesta weed control measures are to be implemented in accordance with the Biodiveristy Management Plans.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	VMP Section 2.6	VMP Section 2.3.2.6

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	
					BMP Stage 1	BMP Stage 2
Hydrogeology	17	In accordance with section 9.4.2 of the BAM, a Biodiversity Management Plan will include measures to monitor groundwater quality on the Site and will include water quality objectives which in the event of exceedances will trigger investigation and adaptive management actions.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	BMP Stage 2	-	WQMP Section 4.4
Water quality	18	Water quality impacts to the wetlands will be avoided by employing erosion and sediment control measures prior to the commencement of construction. This will include the following: - Implementation of swales, enviropods, bioretention basins and extended detention basins - Roof runoff will be directed into the bioretention basin by a pit and pipe system while hardstand runoff will be first treated by enviropods, and then either swales that discharge to the bioretention system or directly into the bioretention systems. - A sediment fence/catch drain (or diversion bund) around the Site. - Most stormwater will end up in an extended detention basin where it will settle and discharge to the receiving waters in a controlled manner, resulting in a net improvement in the quality of stormwater that is discharged from the Site.	Stage 1 BDAR Table 8, Project Planning - Point 7 Stage 2 BDAR Table 9 - Point 17	Both	WQMP Section 4.2, Table 8 and VMP Section 2.8	WQMP Section 4.1
Stormwater Management	19	Impacts to water quality and hydrological processes will be minimised through the use of Water Sensitive Urban Design (WSUD) measures that maintain flows to the wetlands and maintain or improve water quality. The development footprint of the Site has been located to minimise interference with hydrological flows to wetlands, including contributions from groundwater. Subsurface excavations will be shallower than measured groundwater depths on site, with the exception of those required for piling. Piles will be between 800 mm and 1200 mm in diameter and will be spaced 8.4 m apart, except under lift and/or stairwell cores where they will be not less than 2m apart. As piles are not continuous, they are unlikely to create barriers to shallow or perched groundwater flows within the development footprint.	Stage 1 BDAR Table 8, Project Planning - Point 7 Stage 2 BDAR Table 9 - Point 17	Both	WQMP Section 4.2, Table 8, VMP Section 2.8 and WQMP Section 4.3 and 4.4	WQMP Sections 4.1 - 4.3
		Impacts to wetland water quality will be minimised by employing erosion and sediment control measures prior to the commencement of construction activities. The stormwater management system for operation of the Project will be designed in accordance with the locally appropriate standard (TSC 2016).	Stage 1 BDAR Table 8, Project Planning - Point 7 Stage 2 BDAR Table 9 - Point 17	Both	WQMP Section 4.2.2.1	WQMP Sections 4.1 and 4.5; Table 14 items 87-107
Stormwater Management	20	Nine sampling locations have been selected to monitor water quality across the Site. These locations have been selected to allow a best possible indication of stormwater runoff quality upstream and downstream of the Site and the receiving environment (wetland). The objective of the water monitoring program is to detect changes during construction and operation in receiving water quality resulting from the Project.	Stage 1 BDAR S3.2.5 Stage 2 BDAR S3.2.4	Both	WQMP Section 4.6	WQMP Section 4.4
		Analytical parameters selected for testing include sediment, nutrients, dissolved metals, hydrocarbons and other contaminants such as pesticides. Organochlorine Pesticides (OCP) and Organophosphorus Pesticides (OPP) have been included for testing as these contaminants are likely present due to current agricultural land use. Physico-chemical parameters will be monitored due to the presence of pH dependent threatened species such as the wallum froglet Crinia tinnula and olongburra frog Litoria olongburensis				

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	
Stormwater Management	21	Soil erosion and stormwater quality will be managed during construction of the Project in accordance with current industry standards (Landcom 2004).	Stage 1 BDAR S3.2.5 Stage 2 BDAR S3.2.4	Both	Section 1.3, WQMP Section 4.2 & Table 8	WQMP Sections 4.1 and 4.5; Table 14 items 87-107
		Mitigation measures will be undertaken during construction to minimise the risk of erosion and of sediment-laden stormwater being discharged into the receiving catchment located to the north of the site. These measures will include: - A sediment fence/catch drain (or diversion bund) around the Site; - Temporary access to Site with shaker pad; - Sediment fencing around stockpile areas. Stockpiles will be located out of water flow paths and will be protected by earth banks/drains as required; and - A sediment basin of minimum 7126 m3 volume will be constructed to capture flows.				
		The receiving catchment will be protected by providing diversion stormwater drainage lines that bypass the construction site. For further details refer to Bonacci 2018 (drawings C0005 Soil and Water Management Plan, C0006 Soil and Water Management Details and C0007 Soil and Water Management Calculations).				
		Construction works will be delivered in accordance with a Construction Environmental Management Plan (CEMP) and will incorporate the Soil and Water Management Plan. The CEMP will incorporate mitigation measures detailed in the Environmental Impact Statement and the development consent. Construction staff and site personnel will be made aware of their environmental responsibilities within the CEMP.				
		The CEMP will be submitted to the Department of Environment and Planning for review and approval prior to commencement of works.				
Stormwater Management	22	An integrated stormwater management system will be implemented during project operation to carry stormwater runoff from buildings, roads, carparks and landscape areas. The stormwater management system will be designed to mimic natural flows to minimise impacts to the receiving catchment and wetland located to the north of the Site.	Stage 1 BDAR S3.2.5 Stage 2 BDAR S3.2.4	Both	WQMP Section 4 & Table 8	WQMP Section 4.1
		The farm dam located at the north of the site will be filled to return the catchment to a more natural flow regime.				
		The stormwater management system design will cater for a variety of potential water volume discharges, including 100-year ARI (1% AEP) storm events as detailed in local development design specifications (TSC 2016).				
		The stormwater management system will be designed to meet water quality performance criteria detailed in TSC 2016, namely: - Reduction of Mean Annual Load of Gross Pollutants – 90% (greater than 5mm). - Reduction of Mean Annual Load of Total Suspended Solids – 80%. - Reduction of Mean Annual Load of Total Phosphorous – 60%. - Reduction of Mean Annual Load of Total Nitrogen – 45%.				
Stormwater Management	23	Soil erosion and stormwater quality will be managed during construction of the development in accordance with current industry standards (Landcom, 2004) and in accordance with an approved CEMP.	Stage 1 BDAR S3.2.5 Stage 2 BDAR S3.2.4	Both	WQMP Section 4.2, Table 8 and FMP Section 4.2.4	WQMP Section 4.1; Table 14 items 87-107; VMP Section 3.2.3
		Two pH dependent amphibians have been identified by the BAM Calculator as candidate threatened species (Wallum froglet Crinia tinnula and Olongburra frog Litoria olongburensis). Standard industry practice of using gypsum as a flocculant to settle sediment-laden stormwater runoff will not be conducted due to the potential to raise the pH of water. Other commercially available flocculants will be investigated for potential use.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment			
Stormwater Management	24	TECs within the wetland generally occur in areas subject to periodic inundation (NSW Scientific Committee, 2004). Modelling demonstrates that inundation of the wetland area will continue to occur with implementation of the stormwater management system. The quality of water entering wetlands from Site is expected to improve. There is no requirement to offset the residual impact of the development on water quality, water bodies and hydrological processes.	Stage 1 BDAR S3.2.5 Stage 2 BDAR S3.2.4	Stage 2	-	WQMP Section 4.1
Stormwater Management	25	Erosion and sediment measures, including sediment barriers and sediment ponds, will be implemented as per the construction phase Erosion and Sediment Control Plan (ESCP). Construction phase erosion and sediment control measures will achieve water quality objectives outlined in the Tweed Shire Council Development Design Specification - D7.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Both	WQMP Section 4.2.1 & Table 8	WQMP Section 4.1; Table 14 items 87-107; VMP Section 3.2.3

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	
Stormwater Management	26	A stormwater drainage system will be constructed to convey stormwater runoff from Site. The system will be designed to minimise impacts to the endangered ecological community in the receiving wetland. The water quality standards of discharged water will be determined at design stage, guided by advice from a qualified ecologist. The water quality strategy for the Site is outlined in the Tweed Valley Hospital Development Design Report (Bonacci 2018). In accordance with the CEMP, stormwater management will incorporate Water Sensitive Urban Design (WSUD) principles, including the use of landscaped areas for filtering runoff, swale drains, vegetated sediment basins and planting vegetation within rain gardens that treat stormwater and provide native habitat, or 'moist corridors', across the site (Turf 2018).	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Stage 2	-	WQMP Section 4.1; VMP Section 2.4.2; FMP Section 3.2.2
Hydrogeology	27	Construction is to be delivered in accordance with an approved CEMP and sub plans, including a Soil and Water Management Plan, to avoid impacts to groundwater, particularly during piling and excavation activities.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Both	Section 1.3 and WQMP Section 4.3 and 4.4	Section 1.4; WQMP Section 4.1 - 4.3
Hydrogeology	28	Potential reduction in groundwater recharge due to development will be mitigated by WSUD measures such as: rain gardens, swales, car park plantings, and managing stormwater and ground water recharge through landscaping.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact	Stage 2	-	WQMP Section 4.1; VMP Section 2.4.2
Drainage, Stormwater and Water Resources	29	All fuels, chemicals, and liquids will be stored at least 50 m away from any drainage line or waterways as far as is practicable and will be stored in an impervious bunded and covered area within the compound site. Visual monitoring of local water quality (i.e. turbidity, sheen, oil and grease) will be undertaken regularly to identify any potential water quality issues.	EIS Mitigation methods: Draft Condition Appendix 2	Both	WQMP Sections 4.5, 4.6 and Table 8	WQMP Section 4.3

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	
					BMP Stage 1	BMP Stage 2
Fauna Management	30	Where possible structures will be provided to enable connectivity for species - It is recommended that a wildlife crossing is established to the north-east of the Site where the Turnock Street roadway passes through the remnant vegetation. Fauna management guidelines will be detailed in the Biodiversity Management Plan.	Stage 1 BDAR Table 8, Design - Point 9; Planning - Point 9 Stage 2 BDAR Table 9 - Points 9 and 19	Stage 2	-	FMP Section 3.3.2 and 3.8
Movement of threatended species	31	For construction of the development, the temporary boundary will be fitted with a post and bridge system to facilitate movement of koala.	Stage 1 BDAR Table 8, Project Planning - Point 6 and S3.2.7 Stage 2 BDAR Table 9 - Point 16 and S3.2.6	Both	FMP Section 3.3.1 & Figure 7	FMP Section 3.3.1; Figure 7
Movement of threatended species	32	For operation of the development, a boundary fence will not be installed, thereby facilitating movement of threatened species.	Stage 1 BDAR Table 8, Project Planning - Point 6 Stage 2 BDAR Table 9 - Point 16	Stage 2	-	FMP Section 3.3.1
Movement of threatended species	33	Locating the project development area away from threatened species habitat areas and establishing a vegetated buffer will minimise impacts on the movement of threatened species.	Stage 1 BDAR Table 8, Project Planning - Point 6 Stage 2 BDAR Table 9 - Point 16	Stage 1	FMP Section 3.3.2 & Table 9	-
Traffic/ vehicle strikes	34	All works and associated activities are to be delivered in accordance with an approved CEMP and sub plans, including a Biodiversity Management Plan, Traffic Control Plan and Access and Movement Plan.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Both	Section 1.3; FMP Section 3.8 & Table 6	Section 1.5; FMP Section 3.8
		In accordance with section 9.4.2 of the BAM, a Biodiversity Management Plan will incorporate a Fauna Management Plan, including measures to monitor fauna mortality. Where necessary, thresholds for threatened species mortality will be outlined based on current literature. Exceedance of these thresholds will trigger investigation and adaptive management actions.				
		Traffic will be restricted to the southern portion of the Site where the project footprint is which is approximately 67m from the intact remnant native vegetation.				
		Construction traffic must maintain low vehicle speeds and operators shall take be aware of wildlife that may be in the area. Should wildlife enter the construction footprint, a suitable qualified fauna handler should be notified and actions taken in accordance with the construction EMP				
		The following traffic calming measures on the access road are recommended to reduce the risk of vehicle strike on wildlife: •Installation of roadside street lighting in accordance with design standards •Installation of two 50 kilometre an hour speed limit signs and two wildlife warning signs (e.g. Wildlife Dawn to Dusk sign or similar) on the uphill and downhill approaches to the road (or two signs that combine both messages). •Installation of two permanent radar speed signs that display vehicle speed on approach or display a warning when the vehicle speed on approach is greater than the speed limit.				
Habitat - Removal of wood or rocks along the windrows, particularly in Zone 4.	35	During vegetation clearing works, a suitably qualified and experienced person shall be present as a fauna spotter-catcher to supervise tree removal.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment and S3.2.9 Stage 2 BDAR Appendix J. Prescribed Impact Assessment and S3.2.8	Both	FMP Section 3.7	FMP Section 3.7
		Prior to vegetation clearing, all trees within 30 metres of trees to be cleared are to be inspected for the presence of native fauna by an experienced fauna spotter-catcher. During tree removal and major earth works a fauna spotter-catcher needs to be used at a minimum of one operator per machine.				
		The fauna spotter-catcher must not be involved in the vegetation clearing works and will remain on site during any vegetation clearing works to ensure that trees occupied by a fauna are protected.				
		Uninjured native fauna detected during the tree removal shall be rescued and relocated into an area of appropriate habitat that is nearby, but outside of the development footprint.				
		Injured native fauna detected shall be rescued and transferred to a local veterinarian for treatment and/or WIRES for rehabilitation.				
		Should koalas be found on the Site during vegetation clearing works and/or earthworks, tree clearing works and/or earthworks must be temporarily suspended within a range of 30 metres from any tree occupied by a koala. Works are to be avoided in areas between the koala and the nearest habitat to allow the animal to move to adjacent undisturbed areas. Works must not resume until the koala has moved from the tree of its own volition.				
		To minimise direct impacts on ground dwelling and arboreal fauna, earthworks conducted to clear rocks and trees along the windrows (zone 4) shall have a suitably qualified fauna spotter-catcher.				
Impacts of vehicle strikes on threatened species or animals that are part of a TEC	36	Minimise impacts to threatened species by locating the main site entrances on routes that are not adjacent to TECs.	Stage 1 BDAR Table 8, Project Planning prescribed impacts - Point 9 Stage 2 BDAR Table 9 - Point 19	Stage 2	-	FMP Section 3.8
		Main site entrance will be located off Cudgen Road				
		Where possible impacts will be minimised by installing structures that enable species to avoid crossing roads.				
		It is recommended that a wildlife crossing is established to the north-east of the Site where the Turnock Street roadway passes through the remnant vegetation.				

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	
Prescribed Impacts on Movement of Threatened Species that Maintains their Lifecycle	37	Threatened species movement will be facilitated by the establishment of a 10m vegetation along the western boundary of the site, as well as a series of stepping stone habitats across the cleared parts of the site.	Stage 1 BDAR S3.2.7 Stage 2 BDAR S3.2.6	Stage 2	-	FMP Section 3.3.2; VMP 2.3.3
Adaptive Management for Uncertain Impacts	38	Biodiversity Management Plan will set out the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain in accordance with section 9.4 of the BAM. Uncertain impacts include impacts related to vehicle and aircraft strikes. Adaptive management actions may include actions such as auditory repellents, visual deterrents and physical barriers where for habitat containing birds, bats and other animals.	Stage 1 BDAR S3.3 and Appendix I. Prescribed Impact Assessment Stage 1 BDAR S3.3 and Appendix J. Prescribed Impact Assessment	Stage 2	-	FMP Section 3.8
Aircraft strikes	39	Aviation operations for the development will be conducted in accordance with an approved Aviation Operations Manual. This manual will identify areas of bird and flying fox activity such as the Elrond Drive and Kingscliff Library flying fox camps that are located within 1km of the Site (Ecosure 2018, Greencap 2018). Details of the Aviation Operations Manual will be incorporated into the Enroute Supplement Australia (ERSA) published by Airservices Australia. This publication contains information vital for planning a flight and for in flight operations for the aircraft pilot. The location of known flying fox camps will be identified as an 'avoid area' or a 'fly neighbourly' area. In accordance with section 9.4.2 of the BAM, a Biodiversity Management Plan will incorporate a Fauna Management Plan with measures to monitor fauna at the Site, including species mortality resulting from aircraft movement. The plan will outline objectives and thresholds for threatened species mortality which in the event of exceedances will trigger investigation and adaptive management actions.	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Stage 2	-	FMP Section 3.8.3
Threatened species Habitat *Cryptocarya foetida*	40	The Project aims to support recovery of the species by retaining the key habitat of remnant lowland subtropical rainforest vegetation in Zones 2 and 3 and to preserve and enhance current biodiversity values, including the management of invasive species which may be harmful to threatened species.	Matter of National Environmental Significance Report (MNES) - Table 3	Both	FMP Section 3.4 & Table 5	VMP Section 2.3; Table 5 items 1 and 12; Figure 4; App D - HMP
Threatened species Habitat Grey-headed Flying Fox	41	Grey-headed Flying Fox may use the relatively undisturbed remnant forest (Zone 2 and 3) and paperbark swamp (Zone 1) on site. These areas will be retained for biodiversity values and managed under a Biodiversity Management Plan	MNES Report - Table 4	Both	VMP Section 2; FMP Section 3; WQMP Section 4	VMP Section 2.3; FMP Section 3.2.4; App D - HMP
Threatened species Habitat Mitchell's Snail	42	Known Mitchell s snail habitat in Zone 1 and 2 and potential habitat in Zone 3 will be retained and managed to preserve and enhance current biodiversity values and managed under a Biodiversity Management Plan (BMP).	MNES Report - Table 5	Both	FMP Section 3.2.2	FMP Section 3.2.2; Table 11 items 33-38; VMP Section 2.4.4; App D - HMP
Threatened species Habitat Pink Underwing Moth	43	Potential breeding habitat in subtropical rainforest in Zone 2 and 3 will be retained and managed to preserve and enhance current biodiversity values under a Biodiversity Management Plan (BMP).	MNES Report - Table 8	Both	VMP Section 2; FMP Section 3; WQMP Section 4; Figure 5	FMP Section 3, VMP Section 2; App D - HMP
Threatened Species Habitat Southern Black-throated Finch	44	Potential habitat in paperbark swamp forest in Zone 1 and flooded gum forest in Zone 6 and 7 will be retained and managed to preserve and enhance current biodiversity values and managed under a BMP.	MNES Report - Table 9	Both	VMP Section 2; FMP Section 3; WQMP Section 4; Figure 5	FMP Section 3, VMP Section 2; App D - HMP

Aspect	Item #	Commitment	Original Document Reference	BMP	BMP Sub-plan and reference	
					BMP Stage 1	BMP Stage 2
All Summary and recommendations	45	The Project will monitor and manage potential impacts which shall be outlined in a Biodiversity Management Plan (BMP) and its sub plans, including the following: •Vegetation Management Plan (VMP) that incorporates revegetation of the exotic grassland in Zone 9 with rainforest species, regeneration and weed management of rremnant vegetation in the north of the Site. This plan will be linked to the Landscape Masterplan which focuses on the regeneration of windrows and native landscape plantings; •Water Quality Management Plan; and •Fauna Management Plan (FMP).	Stage 1 BDAR S3.5 3.5 Summary of Recommendations Stage 2 BDAR S3.4	Both	VMP Section 2; FMP Section 3; WQMP Section 4	VMP Section 2; FMP Section 3; WQMP Section 4
		The BMP will include adaptive management for impacts on biodiversity that are uncertain in accordance with section 9.4.2 of the BAM. The BMP will detail measures to monitor impacts, guidelines, and thresholds that will trigger adaptive management actions.				
		The BMP will address proposed measures that will contribute to the recovery of the Mitchell's rainforest snail Thersites mitchellae that are consistent with the published recovery plan (NPWS 2011). Revegetation of the exotic grassland in Zone 9 (0 95 ha) to rainforest will increase the area of potential habitat available to the snail and will be outlined in the VMP and FMP				
Light spill - Potential disruption of threatened species or reduced viability of adjacent habitat	46	Light sensitive species are unlikely to be present at the Site. Night-time construction activities will be avoided, if possible. If night construction is conducted then light will be directed away from remnant vegetation on Site.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	FMP Section 3.9.1; Table 6	FMP Section 3.9.1, Table 11 items 72, 73
Light spill - Potential disruption of threatened species or reduced viability of adjacent habitat	47	The Site does not contain habitat for threatened species that are drawn to light (i.e. turtles) that could be adversely impacted by light spill. The development will be located at least 67m (the width of the APZ) from vegetation (Zones 1,2,3). Provision of lighting will be delivered in accordance with an approved CEMP, which will include relevant standards and guidelines.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	Section 1.3; FMP Section 3.9.1; Table 6	FMP Section 3.9.1, Table 11 items 72, 73
Rubbish and waste retained onsite attracting native fauna.	48	Activities on Site will be managed in accordance with the approved CEMP/OEMP, and designed to limit the amount of rubbish and waste onsite through good housekeeping practices.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	Section 1.3; FMP Section 3.6; Table 6 BMP Stage 2 Intro Section 1.5, FMP Section 3.6 and Table 9	Section 1.5; FMP Section 3.6; Table 11 item 61
Dust - Potential disruption of threatened species or reduced viability of adjacent habitat	49	Dust levels during operations would be managed in accordance with an approved CEMP that details management measures in accordance with relevant construction site guidelines including: •Daily monitoring of dust generated by construction activities; •Dust suppression measures such as setting maximum speed limits and application of dust suppressants; and •Commence revegetation as soon as practicable to minimise areas likely to create dust.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	Section 1.3; FMP Section 3.9.3; Table 6	Section 1.5; FMP Section 3.9.3; Table 11 items 73, 77-85
Dust - Potential disruption of threatened species or reduced viability of adjacent habitat	50	Adaptive dust monitoring programs to control air quality, in accordance with the approved OEMP.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Stage 2	-	Section 1.5; FMP Section 3.9.3; Table 11 items 73, 77-85
Air Quality and Dust	51	Should such visible dust emissions occur at any time, the contractor shall identify and implement all feasible and reasonable dust mitigation measures, including cessation of relevant works if no alternative available.	EIS Mitigation methods: Draft Condition Appendix 2	Both	FMP Section 3.9.3; Table 6	FMP Section 3.9.3; Table 11 items 73, 77-85
		An Air Quality and Dust Management Plan as a sub-plan of the Construction CEMP will be prepared by the contractor. The objective of the Management Plan would be to ensure that impacts on air quality are minimised.	EIS Mitigation methods: Draft Condition Appendix 3	Stage 1	Section 1.4; FMP Section 3.9.3; Table 9	-

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	BMP Sub-plan and reference
					BMP Stage 1	BMP Stage 2
Habitat - Increased fire risk	52	Landscaping within Landscape Zone 2 (Turf 2018) largely coincides with the mandatory 67 m Asset Protection Zone (APZ) for the development. Consequently, all plantings will be designed and maintained in accordance with current published guidelines (RFS 2006, 2007) and in consultation with the NSW Rural Fire Services, as detailed in the Tweed Valley Hospital Landscape Masterplan Report (Turf 2018).	Stage 1 BDAR Appendix I. Prescribed Impact Assessment Stage 2 BDAR Appendix J. Prescribed Impact Assessment	Stage 2	-	VMP Section 2.4.1; Table 11 items 39,40
Habitat - Increased fire risk	53	Construction will be restricted to the southern portion of the Site where the project footprint is at least 67 m (the width of the proposed Asset Protection Zone for bushfire protection) from the remnant native vegetation.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	FMP Table 6 Item 56	VMP Section 2.4.1; Table 11 items 39,40
Changing Fire Regimes	54	Bushfire impacts will be identified and managed through bushfire impact assessment and associated management plan	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	FMP Table 6 Item 56	VMP Section 2.4.1; Table 11 items 39,40

Aspect	Item #	Commitment	Original Document Reference	BMP Document	BMP Sub-plan and reference	BMP Sub-plan and reference
					BMP Stage 1	BMP Stage 2
Noise - Potential disruption of threatened species or reduced viability of adjacent habitat	55	All construction is to be delivered in accordance with an approved Construction Environmental Management Plan (CEMP) and sub plans, including a Noise Mitigation Plan. Mitigation measures will include avoiding construction during night.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	Section 1.3; FMP Section 3.9.2; Table 6	Section 1.4; FMP Section 3.9; Table 11 items 75, 76
Noise - Potential disruption of threatened species or reduced viability of adjacent habitat	56	Noise levels during operations will adhere to criteria outlined in the Operational Environmental Management Plan (OEMP) that details safeguards and management measures in accordance with the POEO (Noise Control) Regulation 2017 or any other relevant Tweed Shire Council noise regulation.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Stage 2	-	Section 1.4; FMP Section 3.9.2; Table 11 items 75, 76
Vibration - Potential disruption of threatened species or reduced viability of adjacent habitat	57	Construction is to be delivered in accordance with an approved CEMP and sub plans, including a Vibration Mitigation Plan. Construction during the night will be avoided, where possible, to minimise vibration impacts.	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Both	Section 1.3; FMP Section 3.9.2; Table 6	Section 1.4; FMP Section 3.9.2; Table 11 items 73, 76
Vibration - Potential disruption of threatened species or reduced viability of adjacent habitat	58	Vibration levels (if any) during operations will adhere to criteria outlined in the Operational Environmental Management Plan (OEMP).	Stage 1 BDAR Appendix J. Indirect Impact Assessment Stage 2 BDAR Appendix I. Indirect Impact Assessment	Stage 2	-	Section 1.4; FMP Section 3.9.2; Table 11 items 73, 76
Noise and vibration	59	Limiting more intensive works, such as excavator hammering to the least sensitive times of the day (i.e. avoid early morning, early evening where practical).	EIS Mitigation methods: Draft Condition Appendix 2	Both	FMP Section 3.9.2; Table 6	Section 1.4; FMP Section 3.9; Table 11 items 73, 75, 76
		Including Respite Periods where activities are found to exceed the 75 dB(A) Highly Affected Noise Level at receivers, such as 3 hours on 1 hour off.				
		Consideration of localised screening or barriers for high noise level / isolated works				
		Consider implementing equipment-specific temporary screening for noisy equipment, or other noise control measures recommended in Appendix E of AS2436. This is most likely to apply to noisier items such as jackhammers				
		Locate specific activities such as carpentry areas (use of circular saws etc) to internal spaces or where shielding is provided by existing structures or temporary screening				
		Limit the number of trucks and heavy vehicles on site at any given time (through scheduling deliveries at different times).				

APPENDIX A. PLOT-BASED FLORISTIC SURVEY PLANT SPECIES

Scientific Name	Common Name	BAM Growth Form Group	BAM Species Type	Weeds of National Significance (WONS)
Acmena smithii	Lilly Pilly	Tree	Native	
Ageratina riparia	Mistflower	N/A	Hight Threat Exotic	
Ageratum conyzoides subsp. Conyzoides	Goatweed	N/A	Exotic	
Alocasia brisbanensis	Cunjevoi	Forb	Native	
Alpinia caerulea	Native Ginger	Forb	Native	
Ambrosia Artemisiaefolia	Common Ragweed	N/A	Exotic	
Amylotheca dictyophleba	Brush Mistletoe	Other	Native	
Archontophoenix alexandrae	Alexandra Palm	N/A	Exotic	
Archontophoenix cunninghamiana	Bangalow Palm	Other	Native	
Asparagus aethiopicus	Ground Asparagus	N/A	Hight Threat Exotic	x
Baumea rubiginosa	Soft twigrush	Grass or grass like	Native	
Bidens pilosa	Cobblers Pegs	N/A	Hight Threat Exotic	
Blechnum indicum	Swamp Water Fern	Fern	Native	
Callistemon viminalis	Weeping Bottlebrush	Tree	Native	
Capparis arborea	Native Pomegranate	Shrub	Native	
Carex appressa	Tall Sedge	Grass or grass like	Native	
Casuarina glauca	Swamp Oak	Tree	Native	
Cenchrus purpureus	Barner Grass	N/A	Exotic	
Cestrum nocturnum	Lady of the Night	N/A	Exotic	
Cestrum sp.	Cestrum	N/A	Exotic	
Chloris gayana	Rhodes Grass	N/A	Hight Threat Exotic	
Christella dentata	Binung	Fern	Native	
Chrysanthemoides monilifera	Bitou Bush	N/A	Hight Threat Exotic	x
Cinnamomum camphora	Camphor Laurel	N/A	Hight Threat Exotic	
Commersonia bartramia	Brown Kurrajong	Tree	Native	
Conyza bonariensis	Flaxleaf Fleabane	N/A	Exotic	
Cordyline congesta	Narrow-leaved Palm Lily	Other	Native	
Crinum pedunculatum	Swamp Lily	Forb	Native	
Cryptocarya triplinervis	Three-veined laurel	Tree	Native	
Cryptocarya triplinervis var. triplinervis	Three-veined laurel	Tree	Native	
Cupaniopsis anacardioides	Tuckeroo	Tree	Native	
Desmodium intortum	Green-leaved Desmodium	N/A	Exotic	
Diospyros fasciculosa	Grey Ebony	Tree	Native	
Diplocyclos palmatus	Native bryony	Other	Native	
Eragrostis tenuifolia	Elastic Grass	N/A	Exotic	
Eucalyptus grandis	Flooded Gum	Tree	Native	
Eucalyptus microcorys	Tallowwood	Tree	Native	
Eupomatia bennettii	Small Bolwarra	Shrub	Native	
Ficus coronata	Creek Sandpaper Fig	Shrub	Native	
Ficus fraseri	Sandpaper Fig	Tree	Native	
Ficus macrophylla	Moreton Bay Fig	Tree	Native	
Ficus obliqua	Small-leaved Fig	Tree	Native	
Flagellaria indica	Whip Vine	Other	Native	
Geitonoplesium cymosum	Scrambling Lily	Other	Native	
Glochidion ferdinandi	Cheese Tree	Tree	Native	
Glochidion ferdinandi var.pubens	Cheese Tree	Tree	Native	
Glochidion sumatranum	Umbrella Cheese Tree	Tree	Native	
Guioa semiglauca	Guioa	Tree	Native	
Hibbertia scandens	Climbing Guinea Flower	Other	Native	
Hibiscus diversifolius	Swamp Hibiscus	Shrub	Native	
Hypochaeris glabra	Smooth Catsear	N/A	Exotic	
Hypolepis muelleri	Harsh Ground Fern	Fern	Native	
Ipomoea cairica	Coastal Morning Glory	N/A	Hight Threat Exotic	
Ipomoea indica	Morning Glory	N/A	Hight Threat Exotic	
Ipomoea purpurea	Common Morning Glory	N/A	Hight Threat Exotic	
Lantana camara	Lantana	N/A	Hight Threat Exotic	x
Leersia hexandra	Swamp Ricegrass	Grass or grass like	Native	
Lepironia articulata	Grey Rush	Grass or grass like	Native	
Ligustrum sinense	Small-leaved Privet	N/A	Hight Threat Exotic	
Lygodium microphyllum	Climbing Snake Fern	Fern	Native	
Macadamia integrifolia x tetraphylla (hybrid)	Macadamia	Tree	Native	
Macaranga tanarius	Blush Macaranga	Tree	Native	
Maclura cochinchinensis	Cockspur Thorn	Other	Native	
Macroptilium atropurpureum	Siratro	N/A	Exotic	
Mallotus discolor	White Kamala	Tree	Native	
Mallotus philippensis	Red Kamala	Tree	Native	
Marsdenia rostrata	Milk Vine	Other	Native	
Megathyrsus maximus var. coloratus	Guinea Grass	N/A	Exotic	
Melaleuca quinquenervia	Broad-leaved Paperbark	Tree	Native	
Melicope elleryana	Pink-flowered Doughwood	Tree	Native	
Melinis minutiflora	Molasses Grass	N/A	Hight Threat Exotic	
Melinis repens	Red Natal Grass	N/A	Exotic	
Monstera deliciosa	Fruit Salad Plant	N/A	Exotic	
Mucuna gigantea subsp. gigantea	Burny Bean	Other	Native	
Murraya paniculata	Murraya	N/A	Exotic	
Myrsine Howittiana	Brush Muttonwood	Shrub	Native	
Myrsine variabilis	Muttonwood	Shrub	Native	
Notelaea longifolia	Large Mock-olive	Tree	Native	
Ochna serrulata	Mickey Mouse Plant	N/A	Hight Threat Exotic	
Oplismenus aemulus	Australian Basket Grass	Grass or grass like	Native	
Oxalis Sp.	Oxalis	Forb	Native	
Parsonsia straminea	Common Silkpod	Other	Native	
Paspalum conjugatum	Sour Grass	N/A	Exotic	
Paspalum mandiocanum	Broadleaf Paspalum	N/A	Exotic	
Passiflora edulis	Common Passionfruit	N/A	Exotic	
Passiflora suberosa	Cork Passionflower	N/A	Exotic	
Passiflora subpeltata	White Passionflower	N/A	Exotic	
Persea americana	Avocado	N/A	Exotic	

Scientific Name	Common Name	BAM Growth Form Group	BAM Species Type	Weeds of National Significance (WONS)
Persicaria dichotoma	Blume	Forb	Native	
Persicaria sp.	Persicaria	Forb	Native	
Persicaria strigosa	Spotted Knotweed	Forb	Native	
Phragmites australis	Common Reed	Grass or grass like	Native	
Pinus elliottii	Slash Pine	N/A	Hight Threat Exotic	
Rhaphiolepis indica	Indian Hawthorn	N/A	Exotic	
Ricinus communis	Castor Oil Plant	N/A	Hight Threat Exotic	
Rivina humilis	Coral Berry	N/A	Exotic	
Schefflera actinophylla	Umbrella Tree	N/A	Hight Threat Exotic	
Senna pendula	Senna	N/A	Hight Threat Exotic	
Setaria sphacelata	Setaria	N/A	Exotic	
Smilax australis	Lawyer Vine	Other	Native	
Solanum americanum	Glossy Nightshade	Forb	Native	
Solanum chrysotrichum	Devil's Fig	N/A	Exotic	
Solanum mauritianum	Wild Tobacco Bush	N/A	Exotic	
Solanum nigrum	Black-berry Nightshade	N/A	Exotic	
Sonchus asper	Prickly Sowthistle	N/A	Exotic	
Stephania japonica	Snake Vine	Other	Native	
Strelizia Sp.	Strelizia	N/A	Exotic	
Syagrus romanzoffiana	Cocos Palm	N/A	Exotic	
Tabernaemontana pandacaqui	Banana Bush	Shrub	Native	
Tagetes minuta	Stinking Roger	N/A	Exotic	
Tradescantia fluminensis	Trad	N/A	Hight Threat Exotic	
Triumfetta rhomboidea	Chinese Bur	N/A	Exotic	
Trophis scandens	Burny Vine	Other	Native	
Vicia tetrasperma	Slender Vetch	N/A	Exotic	

APPENDIX B. RECOMMENDED PLANT SPECIES

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Successional Phase	Edge planting	Height	Flower Colour
Araucaria cunninghamii	Hoop Pine	Araucariaceae	Large Tree	Medium		Yes	8 0m - 20.0m (Typical Mature Height)	Green
Ficus macrophylla	Moreton Bay Fig	Moraceae	Large Tree	Slow	Mature	Yes	20.0m - 50 0m (Typical Mature Height)	-
Ficus obliqua	Small-leaved Fig	Moraceae	Large Tree	Slow	Mature	Yes	20.0m - 50 0m (Typical Mature Height)	-
Ficus superba var. henneana	Deciduous Fig	Moraceae	Large Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	-
Ficus virens var. virens	White Fig	Moraceae	Large Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	-
Ficus watkinsiana	Strangling Fig	Moraceae	Large Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	-
Podocarpus elatus	Plum Pine	Podocarpaceae	Large Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	Green/Brown
Sarcopteryx stipata	Steelwood	Sapindaceae	Large Tree	Slow	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	Red/Pink
Archontophoenix cunninghamiana	Bangalow Palm	Arecaceae	Palm	Medium	Mature		5 0m - 8 0m (Typical Mature Height)	Pink/Purple
Linospadix monostachyos	Walking-stick Palm	Arecaceae	Palm	Slow			0 5m - 1 0m (Typical Mature Height)	Yellow/Brown
Livistona australis	Cabbage Palm	Arecaceae	Palm	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Alocasia brisbanensis	Cunjevoi	Araceae	Shrub	Fast			0 5m - 1 0m (Typical Mature Height)	Green/Yellow
Alpinia caerulea	Native Ginger	Zingiberaceae	Shrub	Fast			0 5m - 1 0m (Typical Mature Height)	White
Alyxia ruscifolia	Prickly Alyxia	Apocynaceae	Shrub	Slow			0 5m - 1 0m (Typical Mature Height)	White
Atractocarpus chartaceus	Thin-leaved Gardenia	Rubiaceae	Shrub	Slow			1 0m - 2 0m (Typical Mature Height)	White
Breynia oblongifolia	Coffee Bush	Phyllanthaceae	Shrub	Medium	Pioneer		0 5m - 1 0m (Typical Mature Height)	Green
Carissa spinarum	Currant Bush	Apocynaceae	Shrub	Slow			0 5m - 1 0m (Typical Mature Height)	White
Citrus australasica	Finger Lime	Rutaceae	Shrub	Slow			1 0m - 2 0m (Typical Mature Height)	White
Clerodendrum inerme	Scrambling Clerodendrum	Lamiaceae	Shrub	Medium			1 0m - 2 0m (Typical Mature Height)	White
Cordyline congesta	Tooth-leaved Palm Lily	Asteliaceae	Shrub	Medium			1 0m - 2 0m (Typical Mature Height)	Purple/White
Cordyline petiolaris	Broad-leaved Palm Lily	Asteliaceae	Shrub	Medium			1 0m - 2 0m (Typical Mature Height)	Purple/White
Cordyline rubra	Palm-Lily	Asteliaceae	Shrub	Medium			1 0m - 2 0m (Typical Mature Height)	Blue/Purple
Crinum pedunculatum	Swamp Lily	Amaryllidaceae	Shrub	Fast			< 0.5m (Typical Mature Height)	White
Cryptocarya laevigata	Red-fruited Laurel	Lauraceae	Shrub	Slow			1 0m - 2 0m (Typical Mature Height)	Yellow
Hedraianthera porphyropetala	Hedraianthera	Celastraceae	Shrub	Slow			1 0m - 2 0m (Typical Mature Height)	Red
Lomandra longifolia	Spiny headed Mat-rush	Xanthorrhoeaceae	Grass	Fast	RA: Rainforest Asso	Yes	0 5m - 1 0m (Typical Mature Height)	Brown
Meiogyne stenopetala subsp. stenopetala		Annonaceae	Shrub	Medium			1 0m - 2 0m (Typical Mature Height)	White
Melastoma affine	Blue Tongue	Melastomataceae	Shrub	Medium			0 5m - 1 0m (Typical Mature Height)	Purple
Myrsine subsessilis subsp. subsessilis	Red Muttonwood	Myrsinaceae	Shrub	Medium			1 0m - 2 0m (Typical Mature Height)	White/Green
Pilidiostigma glabrum	Plum Myrtle	Myrtaceae	Shrub	Medium	Secondary	Yes	1 0m - 2 0m (Typical Mature Height)	White/Pink
Pittosporum multiflorum	Orange Thorn	Pittosporaceae	Shrub	Slow			0 5m - 1 0m (Typical Mature Height)	White
Pittosporum revolutum	Rough Fruit Pittosporum	Pittosporaceae	Shrub	Medium	Pioneer	Yes	0 5m - 1 0m (Typical Mature Height)	Yellow
Psychotria loniceroides	Hairy Psychotria	Rubiaceae	Shrub	Slow			1 0m - 2 0m (Typical Mature Height)	White
Rubus parvifolius	Native Raspberry	Rosaceae	Shrub	Medium			< 0.5m (Typical Mature Height)	Red/Pink
Rubus rosifolius	Rose-leaf Bramble	Rosaceae	Shrub	Fast			< 0.5m (Typical Mature Height)	White
Tabernaemontana pandacaqui	Banana Bush	Apocynaceae	Shrub	Slow	Secondary		0 5m - 1 0m (Typical Mature Height)	White
Tasmannia insipida	Brush Pepperbush	Winteraceae	Shrub	Slow			0 5m - 1 0m (Typical Mature Height)	White/Yellow
Atractocarpus benthamianus subsp. benthamianus	Native Gardenia	Rubiaceae	Small Tree	Medium			2 0m - 5 0m (Typical Mature Height)	White
Cupaniopsis newmanii	Long-leaved Tuckeroo	Sapindaceae	Small Tree	Medium			1 0m - 2 0m (Typical Mature Height)	Pink
Cyathea leichhardtiana	Prickly Treefern	Cyatheaceae	Small Tree	Slow			1 0m - 2 0m (Typical Mature Height)	-
Dendrocnide moroides	Gympie Stinger	Urticaceae	Small Tree	Fast			1 0m - 2 0m (Typical Mature Height)	White/Green
Eupomatia laurina	Bolwarra	Eupomatiaceae	Small Tree	Medium			2 0m - 5 0m (Typical Mature Height)	White
Excoecaria agallocha	Milky Mangrove	Euphorbiaceae	Small Tree	Medium			2 0m - 5 0m (Typical Mature Height)	Green
Hibiscus tiliaceus	Cottonwood Hibiscus	Malvaceae	Small Tree	Fast		Yes	2 0m - 5 0m (Typical Mature Height)	Yellow
Homalanthus populifolius	Bleeding Heart, Native Poplar	Euphorbiaceae	Small Tree	Fast	Pioneer		2 0m - 5 0m (Typical Mature Height)	Yellow/Green
Ixora beckleri	Native Ixora	Rubiaceae	Small Tree	Slow	Mature		2 0m - 5 0m (Typical Mature Height)	White
Macaranga tanarius	Blush Macaranga	Euphorbiaceae	Small Tree	Fast	Pioneer	Yes	2 0m - 5 0m (Typical Mature Height)	White/Green
Myoporum acuminatum	Boobialla	Myoporaceae	Small Tree	Medium			2 0m - 5 0m (Typical Mature Height)	White
Randia moorei	Spiny Gardenia	Rubiaceae	Small Tree	Medium			0 5m - 1 0m (Typical Mature Height)	White
Scolopia braunii	Flintwood	Flacourtiaceae	Small Tree	Slow	Mature		2 0m - 5 0m (Typical Mature Height)	Green
Wilkiea huegeliana	Veiny Wilkiea	Monimiaceae	Small Tree	Slow			2 0m - 5 0m (Typical Mature Height)	Yellow
Acacia bakeri	Marblewood	Fabaceae (Mimosoideae)	Tree	Slow	Secondary		2 0m - 5 0m (Typical Mature Height)	Yellow
Acacia maidenii	Maiden's Wattle	Fabaceae (Mimosoideae)	Tree	Fast	Pioneer		2 0m - 5 0m (Typical Mature Height)	Yellow/White
Acacia melanoxylon	Blackwood	Fabaceae (Mimosoideae)	Tree	Fast	Pioneer	Yes	2 0m - 5 0m (Typical Mature Height)	Yellow/White
Ackama paniculata	Rose Marara	Cunoniaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White
Acronychia baeuerlenii	Byron Bay Acronychia	Rutaceae	Tree	Medium	Mature		2 0m - 5 0m (Typical Mature Height)	White
Acronychia imperforata	Logan Apple	Rutaceae	Tree	Medium	Secondary	Yes	5 0m - 8 0m (Typical Mature Height)	Yellow
Acronychia oblongifolia	White Aspen	Rutaceae	Tree	Medium	Secondary	Yes	5 0m - 8 0m (Typical Mature Height)	White

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Successional Phase	Edge planting	Height	Flower Colour
Acronychia wilcoxiana	Silver Aspen	Rutaceae	Tree	Medium	Secondary	Yes	2 0m - 5 0m (Typical Mature Height)	White
Actephila lindleyi	Actephila	Phyllanthaceae	Tree	Slow			1 0m - 2 0m (Typical Mature Height)	White/Yellow
Ailanthus triphysa	White Bean	Simaroubaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	White/Green
Akania bidwillii	Turnipwood	Akaniaceae	Tree	Slow	Mature		5 0m - 8 0m (Typical Mature Height)	White/Pink
Alangium villosum subsp. polyosmoides	Muskwood	Cornaceae	Tree	Medium	Mature		5 0m - 8 0m (Typical Mature Height)	Yellow
Alchornea ilicifolia	Native Holly	Euphorbiaceae	Tree	Slow	Secondary		2 0m - 5 0m (Typical Mature Height)	Green
Alectryon coriaceus	Beach Alectryon	Sapindaceae	Tree	Medium	Secondary		2 0m - 5 0m (Typical Mature Height)	Yellow
Alectryon subcinereus	Wild Quince	Sapindaceae	Tree	Medium	Secondary	Yes	5 0m - 8 0m (Typical Mature Height)	White
Alphitonia excelsa	Red Ash	Rhamnaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	Yellow/White
Anthocarapa nitidula	Incense Cedar	Meliaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Aphananthe philippinensis	Rough-leaved Elm	Ulmaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	Pink
Archidendron grandiflorum	Pink Lace Flower	Fabaceae (Mimosoideae)	Tree	Medium	Mature		5 0m - 8 0m (Typical Mature Height)	Pink
Archidendron hendersonii	White Lace Flower	Fabaceae (Mimosoideae)	Tree	Medium	Mature		5 0m - 8 0m (Typical Mature Height)	White
Archidendron muellerianum	Veiny Lace Flower	Fabaceae (Mimosoideae)	Tree	Slow	Secondary		5 0m - 8 0m (Typical Mature Height)	White
Argyrodendron actinophyllum subsp. actinophyllum	Black Booyong	Sterculiaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White/Yellow
Argyrodendron trifoliolatum	White Booyong	Sterculiaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Arytera distylis	Twin-leaved Coogera	Sapindaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	Yellow/White
Arytera divaricata	Coogera	Sapindaceae	Tree	Slow	Mature	Yes	2 0m - 5 0m (Typical Mature Height)	Yellow/White
Baloghia inophylla	Brush Bloodwood	Euphorbiaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Beilschmiedia elliptica	Grey Walnut	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Beilschmiedia obtusifolia	Blush Walnut	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Brachychiton acerifolius	Illawarra Flame Tree	Sterculiaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	Red/Pink
Bridelia exaltata	Brush Ironbark	Phyllanthaceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	White/Green
Callistemon salignus	Willow Bottlebrush	Myrtaceae	Tree	Fast		Yes	2 0m - 5 0m (Typical Mature Height)	Yellow
Canarium australasicum	Mango Bark	Burseraceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	Red
Capparis arborea	Native Pomegranate	Capparaceae	Tree	Slow	Secondary		2 0m - 5 0m (Typical Mature Height)	White
Cassia marksiana	Brush Cassia	Fabaceae (Caesalpinioideae)	Tree	Medium	Secondary		5 0m - 8 0m (Typical Mature Height)	Yellow
Castanospermum australe	Black Bean	Fabaceae (Faboideae)	Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	Orange/Red
Casuarina glauca	Swamp Oak	Casuarinaceae	Tree	Medium		Yes	5 0m - 8 0m (Typical Mature Height)	Yellow/Brown
Celtis paniculata	Native Celtis	Ulmaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	White/Green
Choricarpia leptopetala	Brush Turpentine	Myrtaceae	Tree	Slow			5 0m - 8 0m (Typical Mature Height)	White
Choricarpia subargentea	Giant Ironwood	Myrtaceae	Tree	Slow			2 0m - 5 0m (Typical Mature Height)	White
Cinnamomum oliveri	Oliver's Sassafras	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Cleistanthus cunninghamii	Cleistanthus	Phyllanthaceae	Tree	Slow	Secondary		2 0m - 5 0m (Typical Mature Height)	Yellow
Commersonia bartramia	Brown Kurrajong	Sterculiaceae	Tree	Fast	Pioneer		2 0m - 5 0m (Typical Mature Height)	White
Corymbia intermedia	Pink Bloodwood	Myrtaceae	Tree	Fast			8 0m - 20.0m (Typical Mature Height)	White
Croton verreauxii	Green Native Cascarilla	Euphorbiaceae	Tree	Slow	Secondary		2 0m - 5 0m (Typical Mature Height)	Yellow/Green
Cryptocarya foetida	Stinking Cryptocarya	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White/Green
Cryptocarya glaucescens	Jackwood	Lauraceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	Yellow
Cryptocarya obovata	Pepperberry	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Cryptocarya triplinervis	Three-veined Cryptocarya	Lauraceae	Tree	Slow	Mature	Yes	5 0m - 8 0m (Typical Mature Height)	Yellow
Cryptocarya triplinervis var. triplinervis	Three-veined Cryptocarya	Lauraceae	Tree	Slow	Mature	Yes	2 0m - 5 0m (Typical Mature Height)	White/Green
Cupaniopsis anacardioides	Tuckeroo	Sapindaceae	Tree	Medium	Secondary	Yes	5 0m - 8 0m (Typical Mature Height)	Yellow/Pink
Cupaniopsis parvifolia	Small-leaved Tuckeroo	Sapindaceae	Tree	Medium	Secondary	Yes	5 0m - 8 0m (Typical Mature Height)	Yellow/Green
Cyathea cooperi	Straw Treefern	Cyatheaceae	Tree	Medium	Secondary		5 0m - 8 0m (Typical Mature Height)	-
Cyclophyllum longipetalum	Coast Canthium	Rubiaceae	Tree	Medium			5 0m - 8 0m (Typical Mature Height)	White/Orange
Daphnandra micrantha		Monimiaceae	Tree	Medium			5 0m - 8 0m (Typical Mature Height)	Green/Yellow
Dendrocnide excelsa	Giant Stinging Tree	Urticaceae	Tree	Fast	Secondary		8 0m - 20.0m (Typical Mature Height)	Green/White
Dendrocnide photinophylla	Shiny-leaved Stinging Tree	Urticaceae	Tree	Medium			8 0m - 20.0m (Typical Mature Height)	Yellow/Green
Diospyros australis	Black Plum	Ebenaceae	Tree	Slow	Mature		2 0m - 5 0m (Typical Mature Height)	White
Diospyros fasciculosa	Grey Ebony	Ebenaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Diospyros mabacea	Red-fruited Ebony	Ebenaceae	Tree	Slow			5 0m - 8 0m (Typical Mature Height)	White
Diospyros pentamera	Myrtle Ebony	Ebenaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Diospyros yandina	Shiny-leaved Ebony	Ebenaceae	Tree	Slow			5 0m - 8 0m (Typical Mature Height)	White
Diploglottis australis	Native Tamarind	Sapindaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	White
Drypetes deplanchei	Yellow Tulipwood	Putranjivaceae	Tree	Slow	Secondary		8 0m - 20.0m (Typical Mature Height)	Yellow/Green
Duboisia myoporoides	Corkwood	Solanaceae	Tree	Fast	Pioneer	Yes	2 0m - 5 0m (Typical Mature Height)	White
Dysoxylum fraserianum	Rosewood	Meliaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White

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Dysoxylum mollissimum subsp. molle	Red Bean	Meliaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White
Dysoxylum rufum	Hairy Rosewood	Meliaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Ehretia acuminata var. acuminata	Koda	Boraginaceae	Tree	Fast	Mature		8 0m - 20.0m (Typical Mature Height)	White
Elaeocarpus grandis	Blue Quandong	Elaeocarpaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	Green/White
Elaeocarpus kirtonii	Silver Quandong	Elaeocarpaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White
Elaeocarpus obovatus	Hard Quandong	Elaeocarpaceae	Tree	Medium	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	White
Elaeocarpus reticulatus	Blueberry Ash	Elaeocarpaceae	Tree	Medium	Secondary	Yes	2 0m - 5 0m (Typical Mature Height)	White/Pink
Elaeodendron australe var. australe	Red Olive Plum	Celastraceae	Tree	Medium			2 0m - 5 0m (Typical Mature Height)	White/Green
Elattostachys nervosa	Beetroot Tree	Sapindaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	Pink/White
Endiandra discolor	Rose Walnut	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	Green
Endiandra globosa	Black Walnut	Lauraceae	Tree	Slow	Mature		5 0m - 8 0m (Typical Mature Height)	White
Endiandra hayesii	Rusty Rose Walnut	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White/Green
Endiandra muelleri	Green-leaved Rose Walnut	Lauraceae	Tree	Slow			8 0m - 20.0m (Typical Mature Height)	Yellow
Endiandra pubens	Hairy Walnut	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White/Green
Endiandra sieberi	Hard Corkwood	Lauraceae	Tree	Slow	Secondary		8 0m - 20.0m (Typical Mature Height)	White/Pink
Eucalyptus microcorys	Tallowwood	Myrtaceae	Tree	Fast			20.0m - 50 0m (Typical Mature Height)	White/Yellow
Eucalyptus propinqua	Small-fruited Grey Gum	Myrtaceae	Tree	Fast			8 0m - 20.0m (Typical Mature Height)	White/Yellow
Eucalyptus robusta	Swamp Mahogany	Myrtaceae	Tree	Fast			8 0m - 20.0m (Typical Mature Height)	White/Yellow
Euroschinus falcatus var. falcatus	Ribbonwood	Anacardiaceae	Tree	Slow			8 0m - 20.0m (Typical Mature Height)	White/Pink
Ficus coronata	Creek Sandpaper Fig	Moraceae	Tree	Medium	Secondary	Yes	2 0m - 5 0m (Typical Mature Height)	-
Ficus fraseri	Sandpaper Fig	Moraceae	Tree	Medium	Secondary		2 0m - 5 0m (Typical Mature Height)	-
Flindersia australis	Crow's Ash	Rutaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Flindersia bennettiana	Bennett's Ash	Rutaceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	White
Flindersia schottiana	Cudgerie	Rutaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	White
Flindersia xanthoxyla	Yellowwood	Rutaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	White
Glochidion ferdinandi	Cheese Tree	Phyllanthaceae	Tree	Fast		Yes	8 0m - 20.0m (Typical Mature Height)	Green
Glochidion ferdinandi var. ferdinandi	Cheese Tree	Phyllanthaceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	Green
Glochidion sumatranum	Umbrella Cheese Tree	Phyllanthaceae	Tree	Fast	Secondary		8 0m - 20.0m (Typical Mature Height)	Yellow
Gmelina leichhardtii	White Beech	Lamiaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White/Yellow
Gossia acmenoides	Scrub Ironwood	Myrtaceae	Tree	Slow			2 0m - 5 0m (Typical Mature Height)	White
Gossia bidwillii	Python Tree	Myrtaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Grevillea robusta	Silky Oak	Proteaceae	Tree	Fast	Secondary		5 0m - 8 0m (Typical Mature Height)	Yellow/Red
Guioa semiglauca	Guioa	Sapindaceae	Tree	Medium	Secondary	Yes	2 0m - 5 0m (Typical Mature Height)	Red/Pink
Harpullia hillii	Blunt-leaved Tulip	Sapindaceae	Tree	Medium	Secondary		2 0m - 5 0m (Typical Mature Height)	White
Harpullia pendula	Tulipwood	Sapindaceae	Tree	Slow		Yes	2 0m - 5 0m (Typical Mature Height)	Green/Yellow
Hodgkinsonia ovatiflora	Hodgkinsonia	Rubiaceae	Tree	Slow			8 0m - 20.0m (Typical Mature Height)	Yellow/Green
Jagera pseudorhus var. pseudorhus	Foambark Tree	Sapindaceae	Tree	Medium	Pioneer	Yes	8 0m - 20.0m (Typical Mature Height)	Yellow/Green
Lepiderema pulchella	Fine-leaved Tuckeroo	Sapindaceae	Tree	Medium	Mature		5 0m - 8 0m (Typical Mature Height)	Yellow/Orange
Litsea australis	Brown Bolly Gum	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Litsea reticulata	Bolly Gum	Lauraceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White/Green
Lophostemon confertus	Brush Box	Myrtaceae	Tree	Fast			8 0m - 20.0m (Typical Mature Height)	White
Lophostemon suaveolens	Swamp Box, Swamp Turpentine	Myrtaceae	Tree	Fast			8 0m - 20.0m (Typical Mature Height)	White
Mallotus discolor	White Kamala	Euphorbiaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	White/Green
Mallotus philippensis	Red Kamala	Euphorbiaceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	Yellow
Melaleuca quinquenervia	Broad-leaved Paperbark	Myrtaceae	Tree	Fast			8 0m - 20.0m (Typical Mature Height)	White
Melia azedarach	White Cedar	Meliaceae	Tree	Fast	Secondary		8 0m - 20.0m (Typical Mature Height)	Purple
Melicope elleryana	Pink-flowered Doughwood	Rutaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	Pink
Mischocarpus anodontus	Veiny Pear-fruit	Sapindaceae	Tree	Slow			5 0m - 8 0m (Typical Mature Height)	White
Mischocarpus pyriformis subsp. pyriformis	Yellow Pear-fruit	Sapindaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	Yellow/Green
Myrsine howittiana	Brush Muttonwood	Myrsinaceae	Tree	Slow	Secondary		2 0m - 5 0m (Typical Mature Height)	White/Green
Myrsine variabilis	Muttonwood	Myrsinaceae	Tree	Medium	Secondary		2 0m - 5 0m (Typical Mature Height)	White/Yellow
Neolitsea dealbata	Hairy-leaved Bolly Gum	Lauraceae	Tree	Slow			5 0m - 8 0m (Typical Mature Height)	Yellow
Notelaea longifolia	Large Mock-olive	Oleaceae	Tree	Slow	Secondary		2 0m - 5 0m (Typical Mature Height)	White/Green
Ochrosia moorei	Southern Ochrosia	Apocynaceae	Tree	Slow			2 0m - 5 0m (Typical Mature Height)	White
Pararchidendron pruinosum var. pruinosum	Snow Wood	Fabaceae (Mimosoideae)	Tree	Medium	Secondary		2 0m - 5 0m (Typical Mature Height)	White/Yellow
Pennantia cunninghamii	Brown Beech	Pennantiaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White
Pentaceras australis	Bastard's Crow Ash	Rutaceae	Tree	Medium	Secondary		8 0m - 20.0m (Typical Mature Height)	White
Planchonella australis	Black Apple	Sapotaceae	Tree	Slow	Secondary		8 0m - 20.0m (Typical Mature Height)	Green

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Planchonella chartacea	Thin-leaved Coondoo	Sapotaceae	Tree	Slow	Mature		2 0m - 5 0m (Typical Mature Height)	White/Pink
Planchonella myrsinifolia	Blunt-leaved Coondoo	Sapotaceae	Tree	Slow			5 0m - 8 0m (Typical Mature Height)	Green
Polyscias elegans	Celery Wood	Araliaceae	Tree	Fast	Secondary		8 0m - 20.0m (Typical Mature Height)	Purple
Pouteria queenslandica	Blush Coondoo	Sapotaceae	Tree	Slow			8 0m - 20.0m (Typical Mature Height)	Green/White
Psydrax lamprophylla f. lamprophylla	Large-leaved Canthium	Rubiaceae	Tree	Medium			2 0m - 5 0m (Typical Mature Height)	White
Psydrax odorata	Shiny-leaved Canthium	Rubiaceae	Tree	Medium			2 0m - 5 0m (Typical Mature Height)	White
Rhodamnia argentea	Silver Myrtle	Myrtaceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	White
Rhodamnia rubescens	Scrub Turpentine	Myrtaceae	Tree	Medium	Secondary	Yes	2 0m - 5 0m (Typical Mature Height)	White
Rhodomyrtus psidioides	Native Guava	Myrtaceae	Tree	Medium	Secondary	Yes	1 0m - 2 0m (Typical Mature Height)	White/Pink
Sarcomelicope simplicifolia subsp. simplicifolia	Big Yellow Wood	Rutaceae	Tree	Medium	Mature	Yes	2 0m - 5 0m (Typical Mature Height)	Yellow
Sloanea australis	Maiden's Blush	Elaeocarpaceae	Tree	Slow	Mature		8 0m - 20.0m (Typical Mature Height)	White
Sloanea woollsii	Yellow Carabeen	Elaeocarpaceae	Tree	Medium	Mature		20.0m - 50 0m (Typical Mature Height)	White
Stenocarpus sinuatus	Firewheel Tree	Proteaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	Red
Sterculia quadrifida	Red-fruited Kurrajong	Sterculiaceae	Tree	Medium	Secondary		5 0m - 8 0m (Typical Mature Height)	White/Green
Streblus brunonianus	Whalebone Tree	Moraceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	White
Symplocos thwaitesii	Buff Hazelwood	Symplocaceae	Tree	Medium	Mature		2 0m - 5 0m (Typical Mature Height)	White
Syzygium australe	Brush Cherry	Myrtaceae	Tree	Medium	Secondary	Yes	5 0m - 8 0m (Typical Mature Height)	White
Syzygium corynanthum	Sour Cherry	Myrtaceae	Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	White
Syzygium francisii	Giant Water Gum	Myrtaceae	Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	White
Syzygium hemilamprum subsp. hemilamprum	Broad-leaved Lilly Pilly	Myrtaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White
Syzygium hodgkinsoniae	Red Lilly Pilly	Myrtaceae	Tree	Slow	Mature	Yes	2 0m - 5 0m (Typical Mature Height)	White
Syzygium ingens	Red Apple	Myrtaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White
Syzygium luehmannii	Small-leaved Lilly Pilly	Myrtaceae	Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	White
Syzygium moorei	Durobby	Myrtaceae	Tree	Slow	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	Pink/Red
Syzygium oleosum	Blue Lilly Pilly	Myrtaceae	Tree	Medium	Mature	Yes	2 0m - 5 0m (Typical Mature Height)	White
Syzygium smithii	Lilly Pilly	Myrtaceae	Tree	Medium			8 0m - 20.0m (Typical Mature Height)	Yellow/White
Toechima tenax	Pitted-leaf Steelwood	Sapindaceae	Tree	Slow	Secondary	Yes	5 0m - 8 0m (Typical Mature Height)	White/Green
Toona ciliata	Red Cedar	Meliaceae	Tree	Medium	Mature		8 0m - 20.0m (Typical Mature Height)	White
Tristaniopsis laurina	Kanooka	Myrtaceae	Tree	Medium	Secondary	Yes	8 0m - 20.0m (Typical Mature Height)	Yellow
Trochocarpa laurina	Tree Heath	Ericaceae	Tree	Slow	Secondary	Yes	2 0m - 5 0m (Typical Mature Height)	Yellow
Waterhousea floribunda	Weeping Lilly Pilly	Myrtaceae	Tree	Medium	Mature	Yes	8 0m - 20.0m (Typical Mature Height)	White

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Macrophyte and Groundcover Plant Species for Sedimentation Basins (MZ2.3)	Groundcover Plant Species for Bioretention Basins (MZ2.3 and MZ5)	Shrub and Tree Plant Species for Rain Gardens (MZ5)	Height	Flower Colour
Carex fascicularis	Tassel Sedge	Cyperaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Brown
Cycnogeton procerum	Water Ribbons	Juncaginaceae	Aquatic Plants	Medium				< 0 5m (Typical Mature Height)	Yellow
Ludwigia octovalvis	Willow Primrose	Onagraceae	Aquatic Plants	Fast				0.5m - 1.0m (Typical Mature Heigh	Yellow
Ludwigia peploides subsp. montevidensis	Water Primrose	Onagraceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Yellow
Ottelia ovalifolia subsp. ovalifolia	Swamp Lily	Hydrocharitaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	White
Persicaria dichotoma	A Smartweed	Polygonaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Pink
Persicaria hydropiper	Water Pepper	Polygonaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Pink
Persicaria orientalis	Princes Feathers	Polygonaceae	Aquatic Plants	Fast				0.5m - 1.0m (Typical Mature Heigh	Pink/White
Persicaria strigosa	A Smartweed	Polygonaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Pink/White
Philydrum lanuginosum	Frogsmouth	Philydraceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Yellow
Ranunculus inundatus	River Buttercup	Ranunculaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Yellow
Triglochin striata	Streaked Arrowgrass	Juncaginaceae	Aquatic Plants	Medium				< 0 5m (Typical Mature Height)	White
Typha orientalis	Broad-leaved Cumbungi	Typhaceae	Aquatic Plants	Fast				0.5m - 1.0m (Typical Mature Heigh	Brown
Utricularia aurea	Golden Bladderwort	Lentibulariaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Yellow
Utricularia gibba	Floating Bladderwort	Lentibulariaceae	Aquatic Plants	Fast				< 0 5m (Typical Mature Height)	Yellow
Baloskion pallens	A Rush	Restionaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown/Orange
Baloskion tetraphyllum subsp. meiostachyum	Plume Rush	Restionaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown/Purple
Baumea articulata	Jointed Twig-rush	Cyperaceae	Grass-like Plant	Fast	Yes			0.5m - 1.0m (Typical Mature Heigh	Red
Baumea juncea	Bare Twigrush	Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	Brown/Yellow
Baumea rubiginosa	Soft Twigrush	Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	Red/Brown
Baumea teretifolia	A Twigrush	Cyperaceae	Grass-like Plant	Fast		Yes		< 0 5m (Typical Mature Height)	Red/Brown
Carex appressa	Tall Sedge	Cyperaceae	Grass-like Plant	Fast		Yes		< 0 5m (Typical Mature Height)	Yellow/Brown
Carex polyantha	A Sedge	Cyperaceae	Grass-like Plant	Fast		Yes		< 0 5m (Typical Mature Height)	Red/Brown
Cenchrus purpurascens	Swamp Foxtail	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Red
Cladium procerum	Leafy Twigrush	Cyperaceae	Grass-like Plant	Fast				0.5m - 1.0m (Typical Mature Heigh	Red/Brown
Cyperus exaltatus	Tall Flatsedge	Cyperaceae	Grass-like Plant	Fast	Yes			0.5m - 1.0m (Typical Mature Heigh	Green/Brown
Cyperus haspan subsp. juncoides	A Sedge	Cyperaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Yellow/Brown
Cyperus laevigatus	A Sedge	Cyperaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Yellow/Brown
Cyperus lucidus	Leafy Flat Sedge	Cyperaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Red/Brown
Cyperus polystachyos	A Sedge	Cyperaceae	Grass-like Plant	Fast	Yes	Yes		< 0 5m (Typical Mature Height)	Yellow/Brown
Cyperus subulatus	Pointed Flat-sedge	Cyperaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown/Green
Digitaria didactyla	Queensland Blue Couch	Poaceae	Grass-like Plant	Fast		Yes		< 0 5m (Typical Mature Height)	Green/Purple
Digitaria parviflora	Small-flowered Finger Grass	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Pink
Diplachne fusca	Brown Beetle Grass	Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Green/Yellow
Eleocharis acuta		Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	Red/Brown
Eleocharis equisetina	A Spikerush	Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	Red/Brown
Eleocharis sphacelata	Tall Spike Rush	Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	Red/Brown
Entolasia stricta	Wiry Panic	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Green/Pink
Eragrostis brownii	Brown's Lovegrass	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Pink/Brown
Eragrostis interrupta	A Lovegrass	Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Pink/Brown
Eriochloa procera	Spring Grass	Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Green/Brown
Ficinia nodosa	Knobby Club-rush	Cyperaceae	Grass-like Plant	Medium	Yes	Yes		< 0 5m (Typical Mature Height)	Red/Brown
Gahnia clarkei	Tall Saw-sedge	Cyperaceae	Grass-like Plant	Medium	Yes			< 0 5m (Typical Mature Height)	White/Brown
Gahnia sieberiana	Red-fruit Saw-sedge	Cyperaceae	Grass-like Plant	Fast		Yes		< 0 5m (Typical Mature Height)	Brown
Hemarthria uncinata	Matgrass	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Red/Brown
Imperata cylindrica	Blady Grass	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	White
Ischaemum australe		Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown/Green
Ischaemum australe var. australe		Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown/Green
Juncus continuus	A Rush	Juncaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown
Juncus kraussii subsp. australiensis	Sea Rush	Juncaceae	Grass-like Plant	Medium		Yes		< 0 5m (Typical Mature Height)	Red/Brown
Juncus mollis	A Rush	Juncaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown
Juncus polyanthemus	A Rush	Juncaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Brown
Juncus prismatocarpus	Branching Rush	Juncaceae	Grass-like Plant	Medium	Yes			< 0 5m (Typical Mature Height)	Red/Brown

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Macrophyte and Groundcover Plant Species for Sedimentation Basins (MZ2.3)	Groundcover Plant Species for Bioretention Basins (MZ2.3 and MZ5)	Shrub and Tree Plant Species for Rain Gardens (MZ5)	Height	Flower Colour
Juncus usitatus	Common Rush	Juncaceae	Grass-like Plant	Fast	Yes	Yes		< 0 5m (Typical Mature Height)	Red/Brown
Lachnagrostis filiformis	A Bent Grass	Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Yellow/Green
Leersia hexandra	Swamp Ricegrass	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Green/Brown
Lepironia articulata	A Rush	Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	White/Pink
Lomandra longifolia	Spiny-headed Mat-rush	Lomandraceae	Grass-like Plant	Fast	Yes	Yes		< 0 5m (Typical Mature Height)	White/Yellow
Panicum simile	Two-colour Panic	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Purple
Paspalidium distans		Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Pink/Green
Paspalum distichum	Water Couch	Poaceae	Grass-like Plant	Fast		Yes		< 0 5m (Typical Mature Height)	Brown/Green
Paspalum longifolium	Scrobic	Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Brown/Green
Paspalum orbiculare	Ditch Millet	Poaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	White/Yellow
Phragmites australis	Common Reed	Poaceae	Grass-like Plant	Fast				1.0m - 2.0m (Typical Mature Heigh	Purple/Brown
Rhynchospora brownii	Grassy Beak-sedge	Cyperaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Yellow/Brown
Rhynchospora corymbosa	A Rush	Cyperaceae	Grass-like Plant	Fast				< 0 5m (Typical Mature Height)	Red/Brown
Schoenoplectiella mucronata	A Rush	Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	Red/Brown
Schoenoplectus subulatus	A Rush	Cyperaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Red/Brown
Schoenoplectus validus	A Rush	Cyperaceae	Grass-like Plant	Fast	Yes			< 0 5m (Typical Mature Height)	Red/Brown
Schoenus brevifolius	A Rush	Cyperaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Red/Brown
Schoenus pachylepis	A Rush	Cyperaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Red/Brown
Sporadanthus interruptus	A Rush	Restionaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	Yellow/Brown
Sporobolus virginicus	Sand Couch	Poaceae	Grass-like Plant	Medium		Yes		< 0 5m (Typical Mature Height)	Red/Brown
Themeda australis	Kangaroo Grass	Poaceae	Grass-like Plant	Fast		Yes		< 0 5m (Typical Mature Height)	Pink/Yellow
Zoysia macrantha	Prickly Couch	Poaceae	Grass-like Plant	Medium				< 0 5m (Typical Mature Height)	White/Pink
Atractocarpus benthamianus subsp. benthamianu	Native Gardenia	Rubiaceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Avicennia marina subsp. australasica	Grey Mangrove	Acanthaceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Yellow/Brown
Banksia aemula	Wallum Banksia	Proteaceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Yellow/Green
Bruguiera gymnorhiza	Black Mangrove	Rhizophoraceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Yellow/Brown
Cupaniopsis newmanii	Long-leaved Tuckeroo	Sapindaceae	Small Tree	Medium				1.0m - 2.0m (Typical Mature Heigh	Pink
Eupomatia laurina	Bolwarra	Eupomatiaceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Excoecaria agallocha	Milky Mangrove	Euphorbiaceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Green
Hibiscus heterophyllus subsp. heterophyllus	Native Rosella	Malvaceae	Small Tree	Fast				1.0m - 2.0m (Typical Mature Heigh	White/Pink
Hibiscus splendens	Pink Hibiscus	Malvaceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Pink
Hibiscus tiliaceus	Cottonwood Hibiscus	Malvaceae	Small Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Yellow
Homalanthus populifolius	Bleeding Heart, Native Poplar	Euphorbiaceae	Small Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Yellow/Green
Leptospermum polygalifolium subsp. polygalifoliur	A Teatree	Myrtaceae	Small Tree	Fast			Yes	0.5m - 1.0m (Typical Mature Heigh	White
Leptospermum whitei	A Teatree	Myrtaceae	Small Tree	Medium				1.0m - 2.0m (Typical Mature Heigh	White
Macaranga tanarius	Blush Macaranga	Euphorbiaceae	Small Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	White/Green
Myoporum acuminatum	Boobialla	Myoporaceae	Small Tree	Medium			Yes	2.0m - 5.0m (Typical Mature Heigh	White
Trema tomentosa var. aspera	Native Peach	Ulmaceae	Small Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White/Green
Acacia disparrima subsp. disparrima	Brush Ironbark Wattle	Fabaceae (Mimosoideae)	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Yellow
Acacia maidenii	Maiden's Wattle	Fabaceae (Mimosoideae)	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Yellow/White
Acacia melanoxylon	Blackwood	Fabaceae (Mimosoideae)	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Yellow/White
Acacia orites	Mountain Wattle	Fabaceae (Mimosoideae)	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Yellow
Ackama paniculata	Rose Marara	Cunoniaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Acronychia imperforata	Logan Apple	Rutaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow
Acronychia littoralis	Scented Acronychia	Rutaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Yellow
Acronychia oblongifolia	White Aspen	Rutaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	White
Acronychia pubescens	Hairy Acronychia	Rutaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	White
Acronychia wilcoxiana	Silver Aspen	Rutaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Alectryon coriaceus	Beach Alectryon	Sapindaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Yellow
Allocasuarina littoralis	Black She-Oak	Casuarinaceae	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Red/Pink
Allocasuarina torulosa	Forest Oak	Casuarinaceae	Tree	Fast				5.0m - 8.0m (Typical Mature Heigh	Red/Pink
Alphitonia excelsa	Red Ash	Rhamnaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Yellow/White
Aphananthe philippinensis	Rough-leaved Elm	Ulmaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Pink

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Macrophyte and Groundcover Plant Species for Sedimentation Basins (MZ2.3)	Groundcover Plant Species for Bioretention Basins (MZ2.3 and MZ5)	Shrub and Tree Plant Species for Rain Gardens (MZ5)	Height	Flower Colour
Archidendron hendersonii	White Lace Flower	Fabaceae (Mimosoideae)	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	White
Archirhodomyrtus beckleri	Rose Myrtle	Myrtaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White/Pink
Banksia integrifolia subsp. integrifolia	Coastal Banksia	Proteaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow
Callicoma serratifolia	Black Wattle	Cunoniaceae	Tree	Fast				5.0m - 8.0m (Typical Mature Heigh	Yellow
Callistemon salignus	Willow Bottlebrush	Myrtaceae	Tree	Fast			Yes	2.0m - 5.0m (Typical Mature Heigh	Yellow
Callitris columellaris	White Cypress Pine	Cupressaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow
Casuarina equisetifolia subsp. incana	Coastal She-oak	Casuarinaceae	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	Brown
Casuarina glauca	Swamp Oak	Casuarinaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow/Brown
Celtis paniculata	Native Celtis	Ulmaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White/Green
Clerodendrum floribundum var. floribundum	Smooth Clerodendrum	Lamiaceae	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	White/Pink
Commersonia bartramia	Brown Kurrajong	Sterculiaceae	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	White
Corymbia intermedia	Pink Bloodwood	Myrtaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	White
Cryptocarya glaucescens	Jackwood	Lauraceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Yellow
Cryptocarya microneura	Murrogun	Lauraceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow
Cupaniopsis anacardioides	Tuckeroo	Sapindaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow/Pink
Cupaniopsis parvifolia	Small-leaved Tuckeroo	Sapindaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow/Green
Cyathea cooperi	Straw Treefern	Cyatheaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	-
Cyclophyllum longipetalum	Coast Canthium	Rubiaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	White/Orange
Daviesia arborea	Golden Pea	Fabaceae (Faboideae)	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow
Decaspermum humile	Silky Myrtle	Myrtaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	White
Duboisia myoporoides	Corkwood	Solanaceae	Tree	Fast				2.0m - 5.0m (Typical Mature Heigh	White
Dysoxylum mollissimum subsp. molle	Red Bean	Meliaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Elaeocarpus grandis	Blue Quandong	Elaeocarpaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Green/White
Elaeocarpus obovatus	Hard Quandong	Elaeocarpaceae	Tree	Medium			Yes	8.0m - 20 0m (Typical Mature Heig	White
Elaeocarpus reticulatus	Blueberry Ash	Elaeocarpaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White/Pink
Elaeodendron australe var. australe	Red Olive Plum	Celastraceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White/Green
Eucalyptus grandis	Flooded Gum	Myrtaceae	Tree	Fast				20 0m - 50.0m (Typical Mature Hei	White/Yellow
Eucalyptus microcorys	Tallowwood	Myrtaceae	Tree	Fast				20 0m - 50.0m (Typical Mature Hei	White/Yellow
Eucalyptus pilularis	Blackbutt	Myrtaceae	Tree	Fast				20 0m - 50.0m (Typical Mature Hei	White/Yellow
Eucalyptus propinqua	Small-fruited Grey Gum	Myrtaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	White/Yellow
Eucalyptus robusta	Swamp Mahogany	Myrtaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	White/Yellow
Eucalyptus siderophloia	Grey Ironbark	Myrtaceae	Tree	Fast				20 0m - 50.0m (Typical Mature Hei	White/Yellow
Eucalyptus signata	Scribbly Gum	Myrtaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	White/Yellow
Eucalyptus tereticornis	Forest Red Gum	Myrtaceae	Tree	Fast				20 0m - 50.0m (Typical Mature Hei	White
Ficus coronata	Creek Sandpaper Fig	Moraceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	-
Ficus fraseri	Sandpaper Fig	Moraceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	-
Flindersia bennettiana	Bennett's Ash	Rutaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Flindersia schottiana	Cudgerie	Rutaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Glochidion ferdinandi	Cheese Tree	Phyllanthaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	Green
Glochidion ferdinandi var. ferdinandi	Cheese Tree	Phyllanthaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Green
Glochidion sumatranum	Umbrella Cheese Tree	Phyllanthaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	Yellow
Gmelina leichhardtii	White Beech	Lamiaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White/Yellow
Guioa semiglauca	Guioa	Sapindaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	Red/Pink
Jagera pseudorhus var. pseudorhus	Foambark Tree	Sapindaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Yellow/Green
Lepiderema pulchella	Fine-leaved Tuckeroo	Sapindaceae	Tree	Medium				5.0m - 8.0m (Typical Mature Heigh	Yellow/Orange
Lophostemon confertus	Brush Box	Myrtaceae	Tree	Fast			Yes	8.0m - 20 0m (Typical Mature Heig	White
Lophostemon suaveolens	Swamp Box, Swamp Turpentin	Myrtaceae	Tree	Fast			Yes	8.0m - 20 0m (Typical Mature Heig	White
Mallotus discolor	White Kamala	Euphorbiaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White/Green
Mallotus philippensis	Red Kamala	Euphorbiaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Yellow
Melaleuca linariifolia	Flax-leaved Paperbark	Myrtaceae	Tree	Fast			Yes	2.0m - 5.0m (Typical Mature Heigh	White
Melaleuca quinquenervia	Broad-leaved Paperbark	Myrtaceae	Tree	Fast			Yes	8.0m - 20 0m (Typical Mature Heig	White
Melia azedarach	White Cedar	Meliaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	Purple
Melicope elleryana	Pink-flowered Doughwood	Rutaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Pink

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Macrophyte and Groundcover Plant Species for Sedimentation Basins (MZ2.3)	Groundcover Plant Species for Bioretention Basins (MZ2.3 and MZ5)	Shrub and Tree Plant Species for Rain Gardens (MZ5)	Height	Flower Colour
Myrsine variabilis	Muttonwood	Myrsinaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White/Yellow
Pentaceras australis	Bastard's Crow Ash	Rutaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Pittosporum undulatum	Sweet Pittosporum	Pittosporaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Polyscias elegans	Celery Wood	Araliaceae	Tree	Fast				8.0m - 20 0m (Typical Mature Heig	Purple
Psydrax lamprophylla f. lamprophylla	Large-leaved Canthium	Rubiaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Rhodamnia maideniana	Smooth Scrub Turpentine	Myrtaceae	Tree	Medium				0.5m - 1.0m (Typical Mature Heigh	Pink
Rhodamnia rubescens	Scrub Turpentine	Myrtaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Rhodomyrtus psidioides	Native Guava	Myrtaceae	Tree	Medium				1.0m - 2.0m (Typical Mature Heigh	White/Pink
Stenocarpus sinuatus	Firewheel Tree	Proteaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Red
Streblus brunonianus	Whalebone Tree	Moraceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Symplocos stawellii	White Hazelwood	Symplocaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Symplocos thwaitesii	Buff Hazelwood	Symplocaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Syncarpia glomulifera subsp. glomulifera	Turpentine	Myrtaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Synoum glandulosum subsp. glandulosum	Scentless Rosewood	Meliaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White/Pink
Syzygium hemilamprum subsp. hemilamprum	Broad-leaved Lilly Pilly	Myrtaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Syzygium oleosum	Blue Lilly Pilly	Myrtaceae	Tree	Medium				2.0m - 5.0m (Typical Mature Heigh	White
Syzygium smithii	Lilly Pilly	Myrtaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Yellow/White
Toona ciliata	Red Cedar	Meliaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	White
Tristaniopsis laurina	Kanooka	Myrtaceae	Tree	Medium				8.0m - 20 0m (Typical Mature Heig	Yellow

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Edge planting	Height	Flower Colour
Araucaria cunninghamii	Hoop Pine	Araucariaceae	Large Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	Green
Doryphora sassafras	Sassafras	Monimiaceae	Large Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Ficus macrophylla	Moreton Bay Fig	Moraceae	Large Tree	Slow	Yes	20 0m - 50.0m (Typical Mature Height)	-
Ficus obliqua	Small-leaved Fig	Moraceae	Large Tree	Slow	Yes	20 0m - 50.0m (Typical Mature Height)	-
Ficus rubiginosa	Port Jackson Fig	Moraceae	Large Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	-
Ficus superba var. henneana	Deciduous Fig	Moraceae	Large Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	-
Ficus virens var. virens	White Fig	Moraceae	Large Tree	Slow		8.0m - 20.0m (Typical Mature Height)	-
Ficus watkinsiana	Strangling Fig	Moraceae	Large Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	-
Podocarpus elatus	Plum Pine	Podocarpaceae	Large Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	Green/Brown
Sarcopteryx stipata	Steelwood	Sapindaceae	Large Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	Red/Pink
Tristaniopsis collina	Mountain Water Gum	Myrtaceae	Large Tree	Slow	Yes	2.0m - 5.0m (Typical Mature Height)	Yellow
Archontophoenix cunninghamiana	Bangalow Palm	Arecaceae	Palm	Medium		5.0m - 8.0m (Typical Mature Height)	Pink/Purple
Linospadix monostachyos	Walking-stick Palm	Arecaceae	Palm	Slow		0.5m - 1.0m (Typical Mature Height)	Yellow/Brown
Livistona australis	Cabbage Palm	Arecaceae	Palm	Slow		8.0m - 20.0m (Typical Mature Height)	White
Abrophyllum ornans	Native Hydrangea	Rousseaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	Yellow
Abutilon oxycarpum	Straggly Lantern-bush	Malvaceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	Yellow
Acalypha capillipes	Small-leaved Acalypha	Euphorbiaceae	Shrub	Slow		< 0.5m (Typical Mature Height)	Pink
Acalypha eremorum	Acalypha	Euphorbiaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	Pink
Acalypha nemorum	Hairy Acalypha	Euphorbiaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	Green
Alocasia brisbanensis	Cunjevoi	Araceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	Green/Yellow
Alpinia arundelliana	Native Ginger	Zingiberaceae	Shrub	Medium		< 0.5m (Typical Mature Height)	Pink/White
Alpinia caerulea	Native Ginger	Zingiberaceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	White
Alyxia ruscifolia	Prickly Alyxia	Apocynaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White
Ardisia bakeri	Ardisia	Myrsinaceae	Shrub	Slow		1 0m - 2.0m (Typical Mature Height)	White
Atractocarpus chartaceus	Thin-leaved Gardenia	Rubiaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White
Boehmeria macrophylla	Native Ramie	Urticaceae	Shrub	Medium		< 0 5m (Typical Mature Height)	Yellow/White
Breynia oblongifolia	Coffee Bush	Phyllanthaceae	Shrub	Medium		0.5m - 1.0m (Typical Mature Height)	Green
Callicarpa pedunculata	Velvet Leaf	Lamiaceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	Purple
Carissa spinarum	Currant Bush	Apocynaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White
Citrus australasica	Finger Lime	Rutaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White
Cordyline congesta	Tooth-leaved Palm Lily	Asteliaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	Purple/White
Cordyline petiolaris	Broad-leaved Palm Lily	Asteliaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	Purple/White
Cordyline rubra	Palm-Lily	Asteliaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	Blue/Purple
Cordyline stricta	Narrow-leaved Palm Lily	Asteliaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	Blue/Purple
Corokia whiteana	Corokia	Argophyllaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White
Cryptocarya laevigata	Red-fruited Laurel	Lauraceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	Yellow
Desmodium acanthocladum	Thorny Pea	Fabaceae (Faboideae)	Shrub	Medium	Yes	< 0.5m (Typical Mature Height)	Pink/Purple
Doryanthes palmeri	Giant Spear Lily	Doryanthaceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	Red/Brown
Eupomatia bennettii	Small Bolwarra	Eupomatiaceae	Shrub	Slow		< 0.5m (Typical Mature Height)	Yellow
Gossia fragrantissima	Sweet Myrtle	Myrtaceae	Shrub	Slow		2.0m - 5.0m (Typical Mature Height)	White
Harpullia alata	Wing-leaved Tulip	Sapindaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White
Hedraianthera porphyropetala	Hedraianthera	Celastraceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	Red
Helmholtzia glaberrima	Flax Lily	Philydraceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White
Hovea acutifolia	Pointed-leaved Hovea	Fabaceae (Faboideae)	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	Purple
Leucopogon juniperinus	Prickly Beard-heath	Ericaceae	Shrub	Slow		< 0.5m (Typical Mature Height)	White
Logania albiflora		Loganiaceae	Shrub	Slow		0 5m - 1.0m (Typical Mature Height)	White
Meiogyne stenopetala subsp. stenopetala		Annonaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	White
Melastoma affine	Blue Tongue	Melastomataceae	Shrub	Medium		0.5m - 1.0m (Typical Mature Height)	Purple
Myrsine subsessilis subsp. subsessilis	Red Muttonwood	Myrsinaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	White/Green
Ozothamnus diosmifolius	White Dogwood	Asteraceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	White/Pink
Ozothamnus rufescens	Soft Dogwood	Asteraceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	White
Persoonia media	Tall Geebung	Proteaceae	Shrub	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Phyllan hus gunnii		Phyllanthaceae	Shrub	Slow		< 0.5m (Typical Mature Height)	White
Pilidiostigma glabrum	Plum Myrtle	Myrtaceae	Shrub	Medium	Yes	1.0m - 2.0m (Typical Mature Height)	White/Pink

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Edge planting	Height	Flower Colour
Pimelea altior		Thymelaeaceae	Shrub	Slow		< 0 5m (Typical Mature Height)	White
Pisonia aculeata	Thorny Pisonia	Nyctaginaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White
Pittosporum multiflorum	Orange Thorn	Pittosporaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White
Pittosporum oreillyanum	Thorny Pittosporum	Pittosporaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White
Pittosporum revolutum	Rough Fruit Pittosporum	Pittosporaceae	Shrub	Medium	Yes	0.5m - 1.0m (Typical Mature Height)	Yellow
Psychotria daphnoides	Smooth Psychotria	Rubiaceae	Shrub	Medium		0.5m - 1.0m (Typical Mature Height)	White
Psychotria daphnoides f. 'large-leaved'	Smooth Psychotria	Rubiaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White/Yellow
Psychotria loniceroides	Hairy Psychotria	Rubiaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White
Psychotria simmondsiana	Small Psychotria	Rubiaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White
Psychotria simmondsiana var. glabrescens		Rubiaceae	Shrub	Medium		1.0m - 2.0m (Typical Mature Height)	White
Rubus nebulosus	Green-leaved Bramble	Rosaceae	Shrub	Medium		Vine/Mistletoe (Typical Mature Height)	White
Rubus rosifolius	Rose-leaf Bramble	Rosaceae	Shrub	Fast		< 0.5m (Typical Mature Height)	White
Solanum aviculare	Kangaroo Apple	Solanaceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	Purple
Solanum corifolium	Straggling Nightshade	Solanaceae	Shrub	Fast		0.5m - 1.0m (Typical Mature Height)	White/Purple
Solanum inaequilaterum	Gin's Whiskers	Solanaceae	Shrub	Medium		0.5m - 1.0m (Typical Mature Height)	Blue
Solanum spirale		Solanaceae	Shrub	Medium		0.5m - 1.0m (Typical Mature Height)	White
Solanum stelligerum	Devil's Needles	Solanaceae	Shrub	Medium		0.5m - 1.0m (Typical Mature Height)	White/Purple
Tabernaemontana pandacaqui	Banana Bush	Apocynaceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White
Tasmannia insipida	Brush Pepperbush	Winteraceae	Shrub	Slow		0.5m - 1.0m (Typical Mature Height)	White/Yellow
Triunia youngiana	Native Honeysuckle	Proteaceae	Shrub	Slow		1.0m - 2.0m (Typical Mature Height)	White/Pink
Wikstroemia indica	Tiebush	Thymelaeaceae	Shrub	Medium		0.5m - 1.0m (Typical Mature Height)	Green/Yellow
Zieria smithii	Sandfly Zieria	Rutaceae	Shrub	Medium		< 0 5m (Typical Mature Height)	White/Pink
Argophyllum nullumense	Silver Leaf	Argophyllaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Yellow
Atractocarpus benthamianus subsp. benthamianus	Native Gardenia	Rubiaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Cupaniopsis baileyana		Sapindaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Green
Cupaniopsis newmanii	Long-leaved Tuckeroo	Sapindaceae	Small Tree	Medium		1.0m - 2.0m (Typical Mature Height)	Pink
Cyathea leichhard iana	Prickly Treefern	Cyatheaceae	Small Tree	Slow		1.0m - 2.0m (Typical Mature Height)	-
Davidsonia jerseyana	Davidson's Plum	Cunoniaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Pink
Dendrocnide moroides	Gympie Stinger	Urticaceae	Small Tree	Fast		1.0m - 2.0m (Typical Mature Height)	White/Green
Eupomatia laurina	Bolwarra	Eupomatiaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Exocarpos latifolius	Broad-leaved Native Cherry	Santalaceae	Small Tree	Slow		1.0m - 2.0m (Typical Mature Height)	Green
Hibiscus heterophyllus subsp. heterophyllus	Native Rosella	Malvaceae	Small Tree	Fast		1.0m - 2.0m (Typical Mature Height)	White/Pink
Hibiscus tiliaceus	Cottonwood Hibiscus	Malvaceae	Small Tree	Fast	Yes	2.0m - 5.0m (Typical Mature Height)	Yellow
Hicksbeachia pinnatifolia	Red Boppel Nut	Proteaceae	Small Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Purple
Homalanthus populifolius	Bleeding Heart, Native Poplar	Euphorbiaceae	Small Tree	Fast		2.0m - 5.0m (Typical Mature Height)	Yellow/Green
Ixora beckleri	Native Ixora	Rubiaceae	Small Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Lenwebbia prominens	Velvet Myrtle	Myrtaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Macaranga tanarius	Blush Macaranga	Euphorbiaceae	Small Tree	Fast	Yes	2.0m - 5.0m (Typical Mature Height)	White/Green
Myoporum acuminatum	Boobialla	Myoporaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Pipturus argenteus	Native Mulberry	Urticaceae	Small Tree	Fast		2.0m - 5.0m (Typical Mature Height)	Green
Randia moorei	Spiny Gardenia	Rubiaceae	Small Tree	Medium		0.5m - 1.0m (Typical Mature Height)	White
Sambucus australasica	Native Elderberry	Adoxaceae	Small Tree	Fast		0.5m - 1.0m (Typical Mature Height)	White
Scolopia braunii	Flintwood	Flacourtiaceae	Small Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Green
Tapeinosperma pseudojambosa	Tapeinosperma	Myrsinaceae	Small Tree	Slow		1.0m - 2.0m (Typical Mature Height)	White/Pink
Trema tomentosa var. aspera	Native Peach	Ulmaceae	Small Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Green
Wilkiea austroqueenslandica	Smooth Wilkiea	Monimiaceae	Small Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Wilkiea huegeliana	Veiny Wilkiea	Monimiaceae	Small Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Wilkiea macrophylla	Large-leaved Wilkiea	Monimiaceae	Small Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Acacia bakeri	Marblewood	Fabaceae (Mimosoideae)	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Acacia disparrima subsp. disparrima	Brush Ironbark Wattle	Fabaceae (Mimosoideae)	Tree	Fast		2.0m - 5.0m (Typical Mature Height)	Yellow
Acacia melanoxylon	Blackwood	Fabaceae (Mimosoideae)	Tree	Fast	Yes	2.0m - 5.0m (Typical Mature Height)	Yellow/White
Acacia orites	Mountain Wattle	Fabaceae (Mimosoideae)	Tree	Fast		2.0m - 5.0m (Typical Mature Height)	Yellow
Ackama paniculata	Rose Marara	Cunoniaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Acradenia euodiiformis	Yellow Satinheart	Rutaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Edge planting	Height	Flower Colour
Acronychia baeuerlenii	Byron Bay Acronychia	Rutaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Acronychia imperforata	Logan Apple	Rutaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	Yellow
Acronychia laevis	Hard Aspen	Rutaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White
Acronychia oblongifolia	White Aspen	Rutaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	White
Acronychia octandra	Doughwood	Rutaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White
Acronychia pauciflora	Soft Acronychia	Rutaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Acronychia pubescens	Hairy Acronychia	Rutaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	White
Acronychia suberosa	Corky Acronychia	Rutaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	White
Acronychia wilcoxiana	Silver Aspen	Rutaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White
Actephila lindleyi	Actephila	Phyllanthaceae	Tree	Slow		1.0m - 2.0m (Typical Mature Height)	White/Yellow
Ailanthus triphysa	White Bean	Simaroubaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Green
Akania bidwillii	Turnipwood	Akaniaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White/Pink
Alangium villosum subsp. polyosmoides	Muskwood	Cornaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Yellow
Alchornea ilicifolia	Native Holly	Euphorbiaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Green
Alectryon coriaceus	Beach Alectryon	Sapindaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Yellow
Alectryon subcinereus	Wild Quince	Sapindaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	White
Alectryon tomentosus	Hairy Bird's Eye	Sapindaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Pink/Yellow
Allocasuarina torulosa	Forest Oak	Casuarinaceae	Tree	Fast	Yes	5.0m - 8.0m (Typical Mature Height)	Red/Pink
Alloxylon pinnatum	Dorrigo Waratah	Proteaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Pink
Alphitonia excelsa	Red Ash	Rhamnaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Yellow/White
Angophora subvelutina	Broad-leaved Apple	Myrtaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White
Anopterus macleayanus	Queensland Laurel Macleay Laurel	Escalloniaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Anthocarapa ni idula	Incense Cedar	Meliaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Aphananthe philippinensis	Rough-leaved Elm	Ulmaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Pink
Archidendron grandiflorum	Pink Lace Flower	Fabaceae (Mimosoideae)	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Pink
Archidendron hendersonii	White Lace Flower	Fabaceae (Mimosoideae)	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White
Archidendron muellerianum	Veiny Lace Flower	Fabaceae (Mimosoideae)	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Archirhodomyrtus beckleri	Rose Myrtle	Myrtaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Pink
Argyrodendron actinophyllum subsp. actinophyllum	Black Booyong	Sterculiaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Yellow
Argyrodendron trifoliolatum	White Booyong	Sterculiaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Arytera distylis	Twin-leaved Coogera	Sapindaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow/White
Arytera divaricata	Coogera	Sapindaceae	Tree	Slow	Yes	2.0m - 5.0m (Typical Mature Height)	Yellow/White
Atalaya multiflora	Broad-leaved Whitewood	Sapindaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Atalaya salicifolia	Brush Whitewood	Sapindaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Auranticarpa rhombifolia	Diamond-leaf Pittosporum	Pittosporaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Austrobuxus swainii	Pink Cherry	Picrodendraceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Green
Backhousia myrtifolia	Grey Myrtle	Myrtaceae	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	White
Backhousia sciadophora	Shatterwood	Myrtaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Baloghia inophylla	Brush Bloodwood	Euphorbiaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Beilschmiedia elliptica	Grey Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Beilschmiedia obtusifolia	Blush Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Bosistoa pentacocca var. pentacocca	Ferny-leaved Bosistoa	Rutaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	-
Bosistoa transversa	Yellow Satinheart	Rutaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Bouchardatia neurococca	Union Nut	Rutaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White
Brachychiton acerifolius	Illawarra Flame Tree	Sterculiaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Red/Pink
Brachychiton discolor	Lacebark Tree	Sterculiaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Red/Pink
Bridelia exaltata	Brush Ironbark	Phyllanthaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White/Green
Callicoma serratifolia	Black Wattle	Cunoniaceae	Tree	Fast	Yes	5.0m - 8.0m (Typical Mature Height)	Yellow
Callistemon salignus	Willow Bottlebrush	Myrtaceae	Tree	Fast	Yes	2.0m - 5.0m (Typical Mature Height)	Yellow
Callistemon viminalis	Weeping Bottlebrush	Myrtaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	Red
Canarium australasicum	Mango Bark	Burseraceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Red
Capparis arborea	Native Pomegranate	Capparaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Cassia marksiana	Brush Cassia	Fabaceae (Caesalpinioideae)	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Yellow
Castanospermum australe	Black Bean	Fabaceae (Faboideae)	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	Orange/Red

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Edge planting	Height	Flower Colour
Castanospora alphandii	Brown Tamarind	Sapindaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	White
Casuarina cunninghamiana subsp. cunninghamiana	River Oak	Casuarinaceae	Tree	Fast	Yes	8.0m - 20.0m (Typical Mature Height)	Brown
Casuarina glauca	Swamp Oak	Casuarinaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	Yellow/Brown
Celtis paniculata	Native Celtis	Ulmaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Green
Ceratopetalum apetalum	Coachwood	Cunoniaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Pink
Choricarpia leptopetala	Brush Turpentine	Myrtaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Cinnamomum oliveri	Oliver's Sassafras	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Cinnamomum virens	Red-barked Sassafras	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Citronella moorei	Churnwood	Cardiopteridaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Claoxylon australe	Brittlewood	Euphorbiaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Cleistanthus cunninghamii	Cleistanthus	Phyllanthaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Clerodendrum floribundum var. floribundum	Smooth Clerodendrum	Lamiaceae	Tree	Fast		2.0m - 5.0m (Typical Mature Height)	White/Pink
Clerodendrum tomentosum	Hairy Clerodendrum	Lamiaceae	Tree	Fast		0.5m - 1.0m (Typical Mature Height)	White
Commersonia bartramia	Brown Kurrajong	Sterculiaceae	Tree	Fast		2.0m - 5.0m (Typical Mature Height)	White
Corymbia intermedia	Pink Bloodwood	Myrtaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White
Croton acronychioides	Thick-leaved Croton	Euphorbiaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Croton verreauxii	Green Native Cascarilla	Euphorbiaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow/Green
Cryptocarya bidwillii	Yellow Laurel	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Green
Cryptocarya erythroxylon	Pigeonberry Ash	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Green
Cryptocarya foetida	Stinking Cryptocarya	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Green
Cryptocarya foveolata	Mountain Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Green
Cryptocarya glaucescens	Jackwood	Lauraceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	Yellow
Cryptocarya meissneriana	Thick-leaved Laurel	Lauraceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Yellow
Cryptocarya microneura	Murrogun	Lauraceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Yellow
Cryptocarya obovata	Pepperberry	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Cryptocarya rigida	Forest Maple	Lauraceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White/Green
Cryptocarya triplinervis	Three-veined Cryptocarya	Lauraceae	Tree	Slow	Yes	5.0m - 8.0m (Typical Mature Height)	Yellow
Cryptocarya triplinervis var. pubens	Hairy Three-veined Cryptocarya	Lauraceae	Tree	Slow	Yes	5.0m - 8.0m (Typical Mature Height)	White/Green
Cryptocarya triplinervis var. triplinervis	Three-veined Cryptocarya	Lauraceae	Tree	Slow	Yes	2.0m - 5.0m (Typical Mature Height)	White/Green
Cupaniopsis anacardioides	Tuckeroo	Sapindaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	Yellow/Pink
Cupaniopsis flagelliformis var. australis	Brown Tuckeroo	Sapindaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Cupaniopsis parvifolia	Small-leaved Tuckeroo	Sapindaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	Yellow/Green
Cupaniopsis serrata	Smooth Tuckeroo	Sapindaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Cuttsia viburnea	Elderberry	Rousseaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Cyathea australis	Rough Treefern	Cyatheaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	-
Cyathea cooperi	Straw Treefern	Cyatheaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	-
Cyclophyllum longipetalum	Coast Can hium	Rubiaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White/Orange
Daphnandra apatela	Common Socketwood	Monimiaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Green
Daphnandra micrantha		Monimiaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Green/Yellow
Daphnandra tenuipes	Red-flowered Socketwood	Monimiaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Pink/Red
Davidsonia johnsonii	Smooth Davidson's Plum	Cunoniaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Pink
Daviesia arborea	Golden Pea	Fabaceae (Faboideae)	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Yellow
Decaspermum humile	Silky Myr le	Myrtaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	White
Dendrocnide excelsa	Giant Stinging Tree	Urticaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	Green/White
Dendrocnide photinophylla	Shiny-leaved Stinging Tree	Urticaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Yellow/Green
Denhamia celastroides	Denhamia	Celastraceae	Tree	Slow	Yes	2.0m - 5.0m (Typical Mature Height)	White
Diospyros australis	Black Plum	Ebenaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Diospyros fasciculosa	Grey Ebony	Ebenaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Diospyros mabacea	Red-fruited Ebony	Ebenaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Diospyros pentamera	Myrtle Ebony	Ebenaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Diospyros yandina	Shiny-leaved Ebony	Ebenaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Diploglottis australis	Native Tamarind	Sapindaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Diploglottis campbellii	Small-leaved Tamarind	Sapindaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Drypetes deplanchei	Yellow Tulipwood	Putranjivaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow/Green

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Edge planting	Height	Flower Colour
Duboisia myoporoides	Corkwood	Solanaceae	Tree	Fast	Yes	2.0m - 5.0m (Typical Mature Height)	White
Dysoxylum fraserianum	Rosewood	Meliaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Dysoxylum mollissimum subsp. molle	Red Bean	Meliaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Dysoxylum rufum	Hairy Rosewood	Meliaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Ehre ia acuminata var. acuminata	Koda	Boraginaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White
Elaeocarpus grandis	Blue Quandong	Elaeocarpaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Green/White
Elaeocarpus kirtonii	Silver Quandong	Elaeocarpaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Elaeocarpus obovatus	Hard Quandong	Elaeocarpaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Elaeocarpus re iculatus	Blueberry Ash	Elaeocarpaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White/Pink
Elaeodendron australe var. australe	Red Olive Plum	Celastraceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Green
Elattostachys nervosa	Beetroot Tree	Sapindaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Pink/White
Elattostachys xylocarpa	White Tamarind	Sapindaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Yellow
Emmenosperma alphitonioides	Yellow Ash	Rhamnaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Endiandra compressa	White Bark	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Endiandra crassiflora	Dorrigo Maple	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Green/Pink
Endiandra discolor	Rose Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Green
Endiandra floydii	Crystal Creek Walnut	Lauraceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	Green/White
Endiandra globosa	Black Walnut	Lauraceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Endiandra hayesii	Rusty Rose Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Green
Endiandra muelleri	Green-leaved Rose Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow
Endiandra muelleri subsp. bracteata	Green-leaved Rose Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow
Endiandra muelleri subsp. muelleri	Green-leaved Rose Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow
Endiandra pubens	Hairy Walnut	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Green
Endiandra sieberi	Hard Corkwood	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Pink
Eucalyptus acmenoides	White Mahogany	Myrtaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White
Eucalyptus campanulata	New England Blackbutt	Myrtaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White/Yellow
Eucalyptus grandis	Flooded Gum	Myrtaceae	Tree	Fast		20.0m - 50.0m (Typical Mature Height)	White/Yellow
Eucalyptus microcorys	Tallowwood	Myrtaceae	Tree	Fast		20.0m - 50.0m (Typical Mature Height)	White/Yellow
Eucalyptus propinqua	Small-fruited Grey Gum	Myrtaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White/Yellow
Eucalyptus siderophloia	Grey Ironbark	Myrtaceae	Tree	Fast		20.0m - 50.0m (Typical Mature Height)	White/Yellow
Euroschinus falcatus var. falcatus	Ribbonwood	Anacardiaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Pink
Ficus coronata	Creek Sandpaper Fig	Moraceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	-
Ficus fraseri	Sandpaper Fig	Moraceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	-
Flindersia australis	Crow's Ash	Rutaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Flindersia bennettiana	Bennett's Ash	Rutaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Flindersia schot iana	Cudgerie	Rutaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Flindersia xanthoxyla	Yellowwood	Rutaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Floydia praealta	Ball Nut	Proteaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Brown
Fontainea australis	Southern Fontainea	Euphorbiaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Geijera salicifolia	Brush Wilga	Rutaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Glochidion ferdinandi	Cheese Tree	Phyllanthaceae	Tree	Fast	Yes	8.0m - 20.0m (Typical Mature Height)	Green
Glochidion ferdinandi var. ferdinandi	Cheese Tree	Phyllanthaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	Green
Glochidion sumatranum	Umbrella Cheese Tree	Phyllanthaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	Yellow
Gmelina leichhardtii	White Beech	Lamiaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Yellow
Gossia acmenoides	Scrub Ironwood	Myrtaceae	Tree	Slow		2 0m - 5.0m (Typical Mature Height)	White
Gossia bidwillii	Python Tree	Myrtaceae	Tree	Slow		8 0m - 20.0m (Typical Mature Height)	White
Gossia hillii	Scaly Myrtle	Myrtaceae	Tree	Slow	Yes	2 0m - 5.0m (Typical Mature Height)	White
Gossia punctata		Myrtaceae	Tree	Slow		2 0m - 5.0m (Typical Mature Height)	White
Grevillea hilliana	White Yiel Yiel	Proteaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White/Green
Grevillea robusta	Silky Oak	Proteaceae	Tree	Fast		5.0m - 8.0m (Typical Mature Height)	Yellow/Red
Guilfoylia monostylis	Guilfoylia	Surianaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Guioa semiglauca	Guioa	Sapindaceae	Tree	Medium	Yes	2 0m - 5.0m (Typical Mature Height)	Red/Pink
Halfordia kendack	Saffron Heart	Rutaceae	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	White
Harpullia hillii	Blunt-leaved Tulip	Sapindaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Edge planting	Height	Flower Colour
Harpullia pendula	Tulipwood	Sapindaceae	Tree	Slow	Yes	2.0m - 5.0m (Typical Mature Height)	Green/Yellow
Helicia ferruginea	Rusty Helicia	Proteaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Pink
Helicia glabriflora	Smooth Helicia	Proteaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White/Pink
Hodgkinsonia ovatiflora	Hodgkinsonia	Rubiaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow/Green
Hymenosporum flavum	Native Frangipani	Pittosporaceae	Tree	Fast		2.0m - 5.0m (Typical Mature Height)	Orange/White
Jagera pseudorhus var. pseudorhus	Foambark Tree	Sapindaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	Yellow/Green
Karrabina benthamiana	Red Carabeen	Cunoniaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Lepiderema pulchella	Fine-leaved Tuckeroo	Sapindaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	Yellow/Orange
Litsea australis	Brown Bolly Gum	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Litsea reticulata	Bolly Gum	Lauraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Green
Lomatia arborescens	Tree Lomatia	Proteaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Lophostemon confertus	Brush Box	Myrtaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White
Lophostemon suaveolens	Swamp Box, Swamp Turpentine	Myrtaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White
Macadamia tetraphylla	Rough-shelled Bush Nut	Proteaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	Pink/Purple
Mallotus discolor	White Kamala	Euphorbiaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Green
Mallotus philippensis	Red Kamala	Euphorbiaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	Yellow
Maytenus disperma	Orange Boxwood	Celastraceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Green
Medicosma cunninghamii	Pinkheart	Rutaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Melaleuca quinquenervia	Broad-leaved Paperbark	Myrtaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	White
Melia azedarach	White Cedar	Meliaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	Purple
Melicope elleryana	Pink-flowered Doughwood	Rutaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Pink
Melicope hayesii	Small-leaved Doughwood	Rutaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White
Melicope micrococca	Hairy-leaved Doughwood	Rutaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Mischocarpus anodontus	Veiny Pear-fruit	Sapindaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Mischocarpus australis	Red Pear-fruit	Sapindaceae	Tree	Slow	Yes	5.0m - 8.0m (Typical Mature Height)	White
Mischocarpus lachnocarpus	Woolly Pear-fruit	Sapindaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Mischocarpus pyriformis subsp. pyriformis	Yellow Pear-fruit	Sapindaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow/Green
Myrsine variabilis	Muttonwood	Myrsinaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Yellow
Neisosperma poweri	Milkbush	Apocynaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Neolitsea australiensis	Green Bolly Gum	Lauraceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White/Brown
Neolitsea dealbata	Hairy-leaved Bolly Gum	Lauraceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	Yellow
Niemeyera antiloga	Brown Pearwood	Sapotaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Yellow
Niemeyera whitei	Rusty Plum, Plum Boxwood	Sapotaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Notelaea johnsonii	Veinless Mock-olive	Oleaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Blue
Notelaea longifolia	Large Mock-olive	Oleaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White/Green
Ochrosia moorei	Southern Ochrosia	Apocynaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Olea paniculata	Native Olive	Oleaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White/Green
Orites excelsus	Prickly Ash	Proteaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Owenia cepiodora	Onion Cedar	Meliaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Pararchidendron pruinosum var. pruinosum	Snow Wood	Fabaceae (Mimosoideae)	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Yellow
Pennantia cunninghamii	Brown Beech	Pennantiaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Pentaceras australis	Bastard's Crow Ash	Rutaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Pittosporum undulatum	Sweet Pittosporum	Pittosporaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White
Planchonella australis	Black Apple	Sapotaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Green
Planchonella chartacea	Thin-leaved Coondoo	Sapotaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White/Pink
Planchonella myrsinifolia	Blunt-leaved Coondoo	Sapotaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	Green
Polyalthia nitidissima	Shiny-leaf Tree	Annonaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow/White
Polyosma cunninghamii	Featherwood	Polyosmaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	Green/White
Polyscias elegans	Celery Wood	Araliaceae	Tree	Fast		8.0m - 20.0m (Typical Mature Height)	Purple
Polyscias murrayi	Pencil Cedar	Araliaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White/Yellow
Polyscias sambucifolia subsp. Long leaflets		Araliaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Yellow/Green
Pouteria queenslandica	Blush Coondoo	Sapotaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Green/White
Premna lignum-vitae		Lamiaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Purple/Red
Psydrax lamprophylla f. lamprophylla	Large-leaved Canthium	Rubiaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White

Appendix B - TVH
Recommended Species Lists MZ 6 and 7 Vegetation Buffers

Scientific Name	Common Name	Family Name	Habit	Growth Rate	Edge planting	Height	Flower Colour
Psydrax odorata	Shiny-leaved Canthium	Rubiaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Quintinia sieberi	Brown Possumwood	Quintiniaceae	Tree	Slow		5.0m - 8.0m (Typical Mature Height)	White
Quintinia verdonii	Grey Possumwood	Quintiniaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White
Rhodamnia argentea	Silver Myrtle	Myrtaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Rhodamnia maideniana	Smooth Scrub Turpentine	Myrtaceae	Tree	Medium		0.5m - 1.0m (Typical Mature Height)	Pink
Rhodamnia rubescens	Scrub Turpentine	Myrtaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White
Rhodomyrtus psidioides	Native Guava	Myrtaceae	Tree	Medium	Yes	1.0m - 2.0m (Typical Mature Height)	White/Pink
Rhodosphaera rhodanthema	Deep Yellowwood	Anacardiaceae	Tree	Fast	Yes	8.0m - 20.0m (Typical Mature Height)	Pink/Red
Rhysotoechia bifoliolata subsp. bifoliolata	Two-leaved Tuckeroo	Sapindaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Orange
Sarcomelicope simplicifolia subsp. simplicifolia	Big Yellow Wood	Rutaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	Yellow
Schizomeria ovata	Crabapple	Cunoniaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White/Yellow
Siphonodon australis	Ivorywood	Celastraceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	Yellow
Sloanea australis	Maiden's Blush	Elaeocarpaceae	Tree	Slow		8.0m - 20.0m (Typical Mature Height)	White
Sloanea woollsii	Yellow Carabeen	Elaeocarpaceae	Tree	Medium		20.0m - 50.0m (Typical Mature Height)	White
Stenocarpus salignus	Scrub Beefwood	Proteaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White/Yellow
Stenocarpus sinuatus	Firewheel Tree	Proteaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Red
Sterculia quadrifida	Red-fruited Kurrajong	Sterculiaceae	Tree	Medium		5.0m - 8.0m (Typical Mature Height)	White/Green
Streblus brunonianus	Whalebone Tree	Moraceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Symplocos baeuerlenii	Small-leaved Hazelwood	Symplocaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Symplocos stawellii	White Hazelwood	Symplocaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Symplocos thwaitesii	Buff Hazelwood	Symplocaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	White
Syncarpia glomulifera subsp. glomulifera	Turpentine	Myrtaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Synoum glandulosum subsp. glandulosum	Scentless Rosewood	Meliaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White/Pink
Syzygium australe	Brush Cherry	Myrtaceae	Tree	Medium	Yes	5.0m - 8.0m (Typical Mature Height)	White
Syzygium corynanthum	Sour Cherry	Myrtaceae	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	White
Syzygium crebrinerve	Rose Satinash	Myrtaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Syzygium francisii	Giant Water Gum	Myrtaceae	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	White
Syzygium hemilamprum subsp. hemilamprum	Broad-leaved Lilly Pilly	Myrtaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Syzygium hodgkinsoniae	Red Lilly Pilly	Myrtaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White
Syzygium ingens	Red Apple	Myrtaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Syzygium luehmannii	Small-leaved Lilly Pilly	Myrtaceae	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	White
Syzygium moorei	Durobby	Myrtaceae	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	Pink/Red
Syzygium oleosum	Blue Lilly Pilly	Myrtaceae	Tree	Medium	Yes	2.0m - 5.0m (Typical Mature Height)	White
Syzygium smithii	Lilly Pilly	Myrtaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	Yellow/White
Toechima dasyrrhache	Blunt-leaved Steelwood	Sapindaceae	Tree	Slow	Yes	8.0m - 20.0m (Typical Mature Height)	Yellow/White
Toona ciliata	Red Cedar	Meliaceae	Tree	Medium		8.0m - 20.0m (Typical Mature Height)	White
Tristaniopsis laurina	Kanooka	Myrtaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	Yellow
Trochocarpa laurina	Tree Heath	Ericaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	Yellow
Uromyrtus australis	Peach Myrtle	Myrtaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White/Pink
Waterhousea floribunda	Weeping Lilly Pilly	Myrtaceae	Tree	Medium	Yes	8.0m - 20.0m (Typical Mature Height)	White
Xylosma terrae-reginae	Queensland Xylosma	Flacourtiaceae	Tree	Medium		2.0m - 5.0m (Typical Mature Height)	Green/Yellow
Zanthoxylum brachyacanthum	Thorny Yellowwood	Rutaceae	Tree	Slow		2.0m - 5.0m (Typical Mature Height)	White

APPENDIX C. KOALA CROSSING ADVISORY SIGNAGE

CROSSING
AHEAD

APPENDIX D. HABITAT MANAGEMENT SUB-PLAN

Stage 2 Biodiversity Management Plan – Habitat Management Sub-Plan

NSW Health Infrastructure

Tweed Valley Hospital

1. SUMMARY

In accordance with Condition 2 B21 (j), the Stage 2 BMP must include a Habitat Management Sub-Plan (HMP) for the identified threatened species, ecological endangered communities (EEC) and threatened ecological communities (TEC) including the Koala food trees Zone 6.

The mitigation and management measures for the identified threatened species, EEC's and Koala food trees identified on or directly adjacent to the Site are addressed collectively within the subsections of the BMP, namely the VMP (**Section 2**), FMP (**Section 3**) and WQMP (**Section 4**) sub-sections.

This HMP presents a summary of the relevant BMP actions developed to address the requirements to adequately manage risks associated to habitat management on site and should be read in conjunction with the body of the BMP.

2. MANAGEMENT AND MITIGATION ACTIONS

Plant community types (PCTs), threatened ecological communities (TECs) and ecological endangered communities (EECs) are described in **Table 3** of the BMP and presented in **Figures 3** and **4** of the BMP. Vegetation that is to be retained is presented in **Figure 5** and summarised in a series of vegetation management zones (BMP MZs) in **Table 4** and **Figure 6** of the BMP.

The table below presents a summary of the relevant management and mitigation measures relevant to the HMP.

Table 1 Management of Threatened Species

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
Koala *Phascolarctos cinereus* A 0.2ha area of preferred Koala habitat located on site (MZ 1.6), outside of the Project Footprint.						**FMP Section 3.2.1** **Figure 6**
1	Conduct primary weed control within area of preferred Koala habitat.	MZ 1.6	Improvement/ enhancement of preferred Koala habitat	Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control)	VMP Section 2.3.2 Table 9 Item 18
2	Conduct secondary weed control within areas of preferred Koala habitat within 6-8 weeks following primary weed control.					
3	Maintain MZ 1.6 in accordance with APZ guidelines.			Stage 2 C and O		VMP Section 2.4.1
4	Ensure appropriate selection of Koala food tree species, placement and density during assisted regeneration works.	MZ 1.6, 2.1, 6 and 7	Improvement/ enhancement of preferred Koala habitat	Stage 2 C		VMP Sections 2.3.3 and 2.4.1 Table 9 Item 20 FMP Section 3.2.1
5	Install 'post and bridge' system around boundary fencing.	Perimeter fencing	Facilitate movement of species during construction phase of project	Stage 1 Stage 2 C	Management, Contractor	VMP Section 3.3.1 Appendix C
6	Create tree protection zones (TPZs).	MZs	Protect retained vegetation and maintain habitat connectivity	Stage 1 Stage 2 C	Management, Contractor (Bush Regeneration)	VMP Section 3.3.2
7	Conduct pre-clearing inspections where any activities are undertaken within Koala habitat areas.	MZs	Protection of native fauna	Stage 2 C	Fauna spotter	VMP Section 3.7
8	If Koalas are found on the Site during vegetation clearing works and/or earthworks: • All construction clearing/earthwork activities must be temporarily suspended within a range of 30 metres from any tree which is occupied by a Koala.	Project footprint within a range of 30m from any tree	Protection of native fauna	Stage 2 C	Management and suitably qualified wildlife rescuer	VMP Section 3.7 Table 9 Item 63

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
	• Works are to be avoided in any area between the Koala and the nearest areas of habitat to allow the animal to move to adjacent undisturbed areas. • Works must not resume until the Koala has moved from the tree of its own volition.	which is occupied by a Koala				
9	'Koala crossing' advisory signage will be installed to establish a wildlife crossing to the north-east of the Site where the Turnock St roadway passes through the remnant vegetation (MZ 1.6) between the two Turnock St roundabouts.	Cudgen Road/Turnock Street access road	Protection of native fauna	Stage 2 C and O	Management	Section 3.8.2 Table 9 Item 69
10	Undertake weed control measures outlined in Section 3.2.1 to improve the function of the wildlife fence along Turnock Street and provide better protection for risk of vehicle strike to fauna trying to cross Turnock Street.	MZ 1.1 and 1.6	Protection of native fauna	Stage 2 C and O	Management	VMP Section 3.2.1 Table 9 Item 64
Mitchell's rainforest snail *Thersites mitchellae* Mitchell's rainforest snail (MRS) habitat is present on the site in MZs 1.1 and 1.2						VMP Section 3.2.2 Figure 10
11	Conduct staged primary weed control within core MRS habitat.	MZ 1.1 and 1.2	Improvement/ enhancement of MRS habitat	Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control with relevant experience)	VMP Sections 2.3.2 and 2.4.4 Table 5 Item 3 Table 9 Item 18 FMP Section 3.2.2.2 Table 11 Item 37
12	Conduct secondary weed control within core MRS habitat 6-8 weeks following primary weed control.					
13	Revegetate barner grass and camphor laurel dominated patch to increase area of MRS Subtropical rainforest habitat onsite.	MZ 1.4 and 1.5				VMP Section 2.4.4 Table 5 Item 11 Table 9 Item 19
14	Maintenance of planting areas					Table 9 Items 23, 25 and 26
15	Vegetation Management to protect MRS populations including weed control and creation of diverse, dense Subtropical Rainforest with a closed canopy suitable with key habitat components: well developed leaf litter, intact canopy.	MZs 1.1, 1.2, 1.4 and 1.5	Conserve and enhance MRS habitat	Stage 2 C & O		VMP Section 2.4.4 Table 11 Item 38

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
15	Implement a target-specific Black rat *Rattus rattus* control program. In order to avoid impact on non-target native species, control measures are to be undertaken around the ancillary facilities and not within native animal habitat (i.e. MZs 1.1 to 7).	Main building/ within Project footprint	Conservation of the MRS population	Stage 2 C & O	Management and contractors	VMP Section 3.2.2.2
16	Assess potential impacts of change in hydrology/flow regimes.	MZs 1.1, 1.2, 1.4 and 1.5	Conservation of the MRS population	Stage 2 C & O	Specialist consultant	Section 4.1.3
17	Long term monitoring of MRS population size at the Site. Ongoing monitoring will be conducted every second year to identify any changes in the status of the species.	MZs 1.1, 1.2, 1.4 and 1.5	Long term data on MRS population size	Stage 2 C & O	Specialist consultant	VMP Section 3.2.2.2 Table 11 Item 33
18	Following the monitoring program conducted every two years, a specialist invertebrate consultant will submit a report including but not limited to; date, personnel, weather, areas surveyed, survey methodology and results of population size, trends in population size, observations, photos, impacts on the MRS, an evaluation of the monitoring program and any recommendations.					VMP Section 3.2.2.2 Table 11 Item 34
19	Specialist invertebrate consultant survey/report results indicate a stable or increasing trend in MRS population size.		Conservation of the MRS population			VMP Section 3.2.2.2 Table 11 Item 35
20	Specialist invertebrate consultant survey/report results indicate a significant decreasing trend in MRS population size or identify potential impacts from Project activities which could results in a significant decreasing trend in population size, in consultation with specialists Project management will undertake an investigation into addressing the decreasing population and adaptive measures will be implemented to mitigate any impacts.					VMP Section 3.2.2.2 Table 11 Item 36

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
Wallum froglet *Crinia tinnula* and **Olongburra frog *Litoria olongburensis*** Two pH dependent amphibians were identified by the BAM Calculator as candidate threatened species – Wallum froglet *Crinia tinnula* and Olongburra frog *Litoria olongburensis*. There are records for these species within the 1,500 m assessment area and within the receiving catchment.						**VMP Section 3.2.3**
21	Undertake Nocturnal frog survey (on a rainy night, any time of year) to assess if frogs are in the area prior to dam decommissioning works	Dam	Threatened aquatic species conservation	Stage 2C	Specialist consultant	VMP Section 2.3.2.7
22	A suitably qualified and experienced fauna rescue person shall be present for the dam decommissioning, including the removal of any vegetation around the dam.	Dam	Threatened aquatic species conservation	Stage 2C	Specialist consultant	VMP Section 2.3.2.7
23	To avoid any potential changes in pH and impacts on threatened aquatic species (i.e. Wallum froglet and Olongburra frog) other commercially available flocculants that work as effectively as a gypsum replacement yet do not create the large changes in pH will be used on the Site (i.e. Turbiclear).	Sediment basins	Threatened aquatic species conservation	Stage 2C	Management and contractors	Table 11 Item 43 WQMP Section 4.1.4
24	If herbicides are to be used in conjunction with *Salvina molesta* control, 'frog-friendly' surfactant free glyphosate is to be used.	Water bodies	Threatened aquatic species conservation	Stage 2C	Specialist weed control contractor with experience in salvinia	FMP Section 2.3.2.6
25	A cane toad *Rhinella marina* exclusion fencing will be installed around sediment basins and bio-detention basins	Sediment basins	Threatened aquatic species conservation	Stage 2C	Management and contractors	VMP Section 2.4.2 FMP Section 3.4 Table 14 Item 121
26	A bio-detention basin hydrodynamic design will be created by suitably qualified and experienced environmental engineers with experience in wetland design. The design will outline technical specifications for the bioretention basins, including; zonal design (i.e. inlet zone, macrophyte zone and embankment (littoral) zone), cane toad and mosquito deterrents, weed control, vegetation types and planting densities for each zone within the basin.	Sediment basins	Threatened aquatic species conservation	Stage 2C	Management and contractors	Table 14 Item 115

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
27	Assess potential impacts of change in hydrology/flow regimes.	Wetlands	Threatened aquatic species conservation	Stage 2 C & O	Specialist consultant	WQMP Section 4.1.3
28	Conduct water quality monitoring, including assessment of pH.	Wetlands	Threatened aquatic species conservation	Stage 2 C & O	Specialist consultant	WQMP Section 4.4.1
Grey-headed flying fox *Pteropus poliocephalus* Initial desktop assessment determined that there were two flying fox camps located within a 1 km radius of the Site, however, there are no flying fox camps located on the Site. Potential impacts (injury/mortality) from aviation activities on flying foxes during operations of the Project.						**VMP Section 2.3.4**
29	Aviation procedures will be informed and advised by HLS documentation and start up meetings prior to operation which will cover topics of wildlife hazards in close proximity to the Site. From then, measures will be applied by aviation system documentation such as Aviation company procedures, air services publications and CASA documentation which will be determined post these meetings.	Site	Protection of native fauna	Stage 2 O Upon HLS commissioning	Management (HLS Operations Manual) Avipro (Fly Neighbourly or equivalent) and aviation crew	VMP Section 3.8.3 Table 11 Item 70
Eastern Osprey *Pandion cristatus* and White-bellied Sea Eagle *Haliaeetus leucogaster* Coastal raptors such as the eastern osprey *Pandion cristatus* and white-bellied sea eagle *Haliaeetus leucogaster* have been recorded in the Tweed LGA. No coastal raptor nests were recorded on the Site, however, two known osprey nests have been recorded within the 1,500m assessment area. Potential impacts exist relating to helicopter collision from aviation activities and indirect impacts on coastal raptors that potentially utilise the paperbark swamp forest (MZ 1.1).						**VMP Section 3.2.5**
30	Aviation procedures will be informed and advised by HLS documentation and start up meetings prior to operation which will cover topics of wildlife hazards in close proximity to the Site. From then, measures will be applied by aviation system documentation such as Aviation company procedures, air services publications and CASA documentation which will be determined post these meetings.	Site	Protection of native fauna	Stage 2 O Upon HLS commissioning	Management (HLS Operations Manual) Avipro (Fly Neighbourly or equivalent) and aviation crew	VMP Section 3.8.3 Table 11 Item 70

Table 2 Management of Ecological Endangered Communities and Threatened Ecological Communities

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
Swamp sclerophyll forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC Approximately 0.29ha of Paperbark swamp forest is located in MZ 1.1.						**VMP Sections 2.2 and 2.3.1.1** **Tables 3 and 4** **Figure 6**
31	Conduct primary weed control within area of Paperbark swamp forest.	MZ 1.1	Improvement/ enhancement of TEC within EEC	Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control)	VMP Section 2.3.2 Table 9 Item 18
32	Conduct secondary weed control within Paperbark swamp forest within 6-8 weeks following primary weed control.					
33	Following completion of primary and secondary weed control and site preparation activities, conduct assisted regeneration to retain and enhance biodiversity values, create/maintain stepping-stone or 'moist corridor' habitat corridors across the site.					VMP Section 2.3.2 Table 9 Items 20 and 32
34	Maintain planting areas following completion of primary works, at a minimum of four maintenance events per year for the three-year period.		Maintain condition of TEC within EEC	Stage 2 C & O		VMP Section 2.3.2 Table 9 Items 24 and 32
35	Monitor condition of planting areas following completion of primary works across two monitoring events per year for the three-year period.		Maintain condition of TEC within EEC	Stage 2 C & O		VMP Section 2.3.2 Table 7 Item 17 Table 9 Items 25, 27, 28, 30 and 32
36	Monitor quality of stormwater run-off.		Maintain condition of TEC within EEC	Stage 2 C & O	Management, Contractor	WQMP Section 4.4
37	Ensure all management activities within MZ 1.1 consider requirements associated with MRS habitat.		Improvement/ enhancement of MRS habitat	Stage 2 C & O	Management, Contractor (Bush Regeneration/ Weed control)	HMP Items 11-20 VMP Section 3.2.2

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
Lowland rainforest on floodplain in the NSW North Coast Bioregion EEC Approximately 0.36 and 0.73 ha of low and moderate condition White Booyong – Fig subtropical rainforest is present on site in MZ 1.2 and a further 0.75ha is present in self-sown windrows (MZ 2.2), 0.4ha of which is to be cleared for construction.						**VMP Sections 2.2 and 2.3.1.1** **Tables 3 and 4** **Figure 6**
38	Conduct primary weed control within area of Paperbark swamp forest.	MZ 1.2	Improvement/ enhancement of TEC within EEC	Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control)	VMP Section 2.3.2 Table 9 Item 18
39	Conduct secondary weed control within Paperbark swamp forest within 6-8 weeks following primary weed control.					
40	Following completion of primary and secondary weed control and site preparation activities, conduct assisted regeneration to retain and enhance biodiversity values, create/maintain stepping-stone or 'moist corridor' habitat corridors across the site.					VMP Section 2.3.2 Table 9 Items 20 and 32
41	Maintain planting areas following completion of primary works, at a minimum of four maintenance events per year for the three-year period.		Maintain condition of TEC within EEC	Stage 2 C & O	Management, Contractor (Bush Regeneration/ Weed control)	VMP Section 2.3.2 Table 9 Items 24 and 32
42	Monitor condition of planting areas following completion of primary works across two monitoring events per year for the three-year period.		Maintain condition of TEC within EEC	Stage 2 C & O	Management, Contractor (Bush Regeneration/ Weed control)	VMP Section 2.3.2 Table 7 Item 17 Table 9 Items 25, 27, 28, 30 and 32
43	Monitor quality of stormwater run-off.		Maintain condition of TEC within EEC	Stage 2 C & O	Management, Contractor	WQMP Section 4.4
44	Ensure all management activities within MZ 1.2 consider requirements associated with MRS habitat.		Improvement/ enhancement of MRS habitat	Stage 2 C & O	Management, Contractor (Bush Regeneration/ Weed control)	HMP Items 11-20 VMP Section 3.2.2

HMP Item	Activity	Location(s)	Outcome	Project Phase	Who	BMP Reference
General activities that will support the ongoing management of TECs and EECs (including use by Threatened Species)						
45	Revegetate basins as per BMP Section 2.4.2 to enhance biodiversity values and create stepping-stone or 'moist corridor' habitat across the site.	MZ 2.3	Increase area of habitat available for threatened species and create habitat corridors across the site.	Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control)	VMP Sections 2.4.2 and 2.6 Table 9 Item 21
46	Following completion of primary and secondary weed control and site preparation activities, retain existing vegetation (where possible) and revegetate buffer zones to Subtropical Rainforest as per BMP Section 2.3.3.	MZ 6 and 7		Stage 2 C	Management, Contractor (Bush Regeneration/ Weed control)	VMP Sections 2.3.3 and 2.6 Table 9 Item 22 Table 11 Item 47
47	Use fencing to appropriately provide barriers to retained vegetation whilst maintaining habitat connectivity.	MZs	Enhance and maintain habitat connectivity.	Stage 2 C & O	Management, Contractor	VMP Section 2.3.1 FMP Section 3.3.1 Table 11 Item 47
48	Establish TPZs as required by the BMP.					VMP Section 2.3.1 FMP Section 3.3.2
49	Conservation areas are to be clearly demarcated.		Maintain boundaries and other incursions.			VMP Section 2.3.4