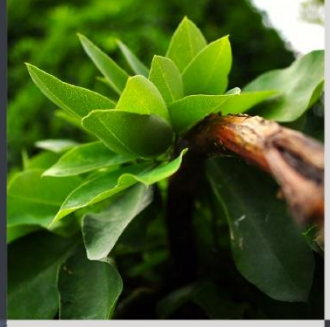
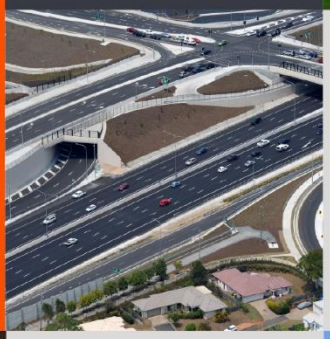
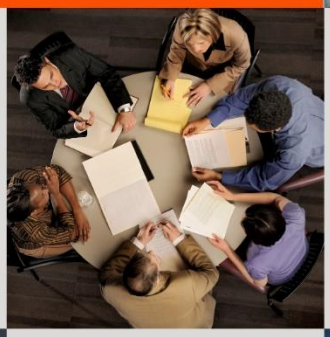

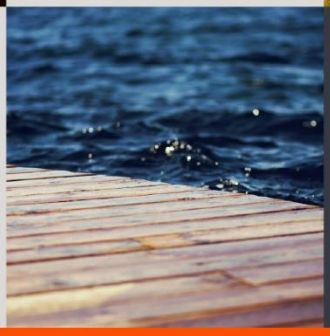

# Basic Terrestrial Flora and Fauna Assessment

156-158 Jonson Street, Byron Bay

Prepared for 156 Jonson Street Pty Ltd
By Planit Consulting Pty Ltd

**September 2020**



## This report has been written by

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### Project Details

| | |
|---|---|
| **Project Name** | **156-158 Jonson Street, Byron Bay** |
| **Client** | **156 Jonson Street Pty Ltd** |
| **Client Project Manager** | **NO** |
| **Authors** | **TR** |
| **Planit Reference** | **J6799** |

### Disclaimer

# Contents

# Figures

# Tables



# Attachments

*Attachment 1 – Proposal Plans*

*Attachment 2 – NSW Bionet Database Records (2020)*

*Attachment 3 – BOSET Report Prepared for the Site*

# 1 INTRODUCTION

Planit Consulting Pty Ltd has been engaged by 156 Johnson Street Pty Ltd (the applicant) to prepare a Basic Terrestrial Flora and Fauna Assessment document for a proposed mixed used development for commercial purposes and includes the provision of a two-storey parking structure.

The subject site (refer to **Figure 1**) is located in Byron Bay, NSW, which forms part of the Byron Shire Council (BSC) local government area. The site is at 156-158 Jonson Street, Byron Bay, NSW).

This report outlines the results of flora and fauna investigations and describes vegetation types, habitat associations and ecological values of the proposed development envelope and surrounding areas.

# 2 SITE DESCRIPTION & LOCATION

## 2.1 Site Description

The proposed development site (refer to **Figure 2**) is located in an area zoned for local centres and infrastructure which forms part of the Byron Shire Council (BSC) Local Government Area (LGA). The subject site is located on Lot 9 on DP818197 (local Centre), Lot 51 on DP844054 (infrastructure), and a Portion Lot 4729 on DP1228104 (infrastructure). Road upgrade works and compensatory plantings are proposed within sections of the road reserve east of Lot 51 on DP844054.

The site currently contains:

- Lot 9 on DP818197:
  - Large shed covering the majority of the site.
  - Site access at the north to a carpark.
  - Battle axe access to the south of the lot.
  - Small landscaped area.
- Lot 51 on DP844054 and portion of Lot 4729 on DP1228104:
  - Complete grass cover with scattered trees.
  - Wetland in the south area of the site.
  - Lot 4729 on DP1228104 is currently part of a rail corridor.

The site borders Byron bay CBD, Jonson Street to the north, residential development to the east, wetlands to the south and west. The surrounding area is predominantly utilised for industrial and residential use.


**Figure 1: Subject Site (Nearmap, 2020)**

## 2.2 Project Description

The proposed development involves the construction of a mixed use development and carpark as depicted within **Figure 2** and **Attachment 1**. A 2-storey carpark accessed from Jonson Street is proposed to service the development as well as provide parking credits for potential future developments in the area.

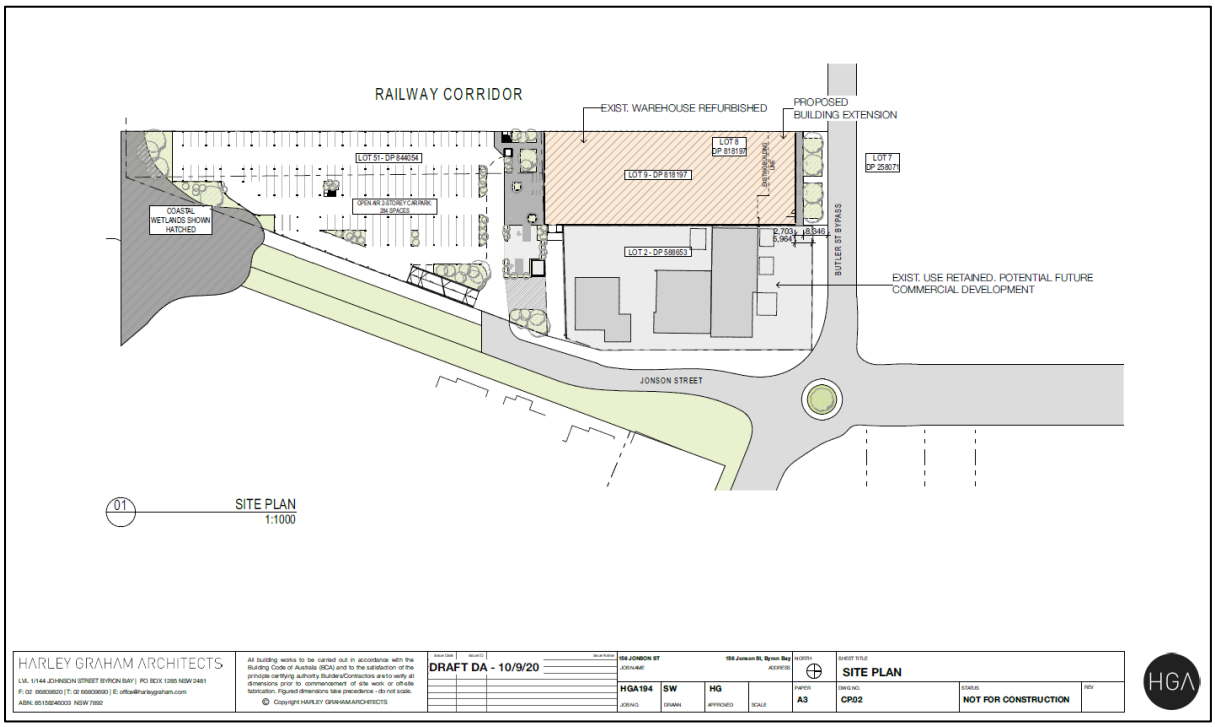


**Figure 2: Proposal Plan**

## 2.3 Geology & Topography

As illustrated within the eSPADE geology mapping extract (refer to **Figure 3**), the site contains one soil landscape type, described as follows:

- Tyagarah (9540ty).

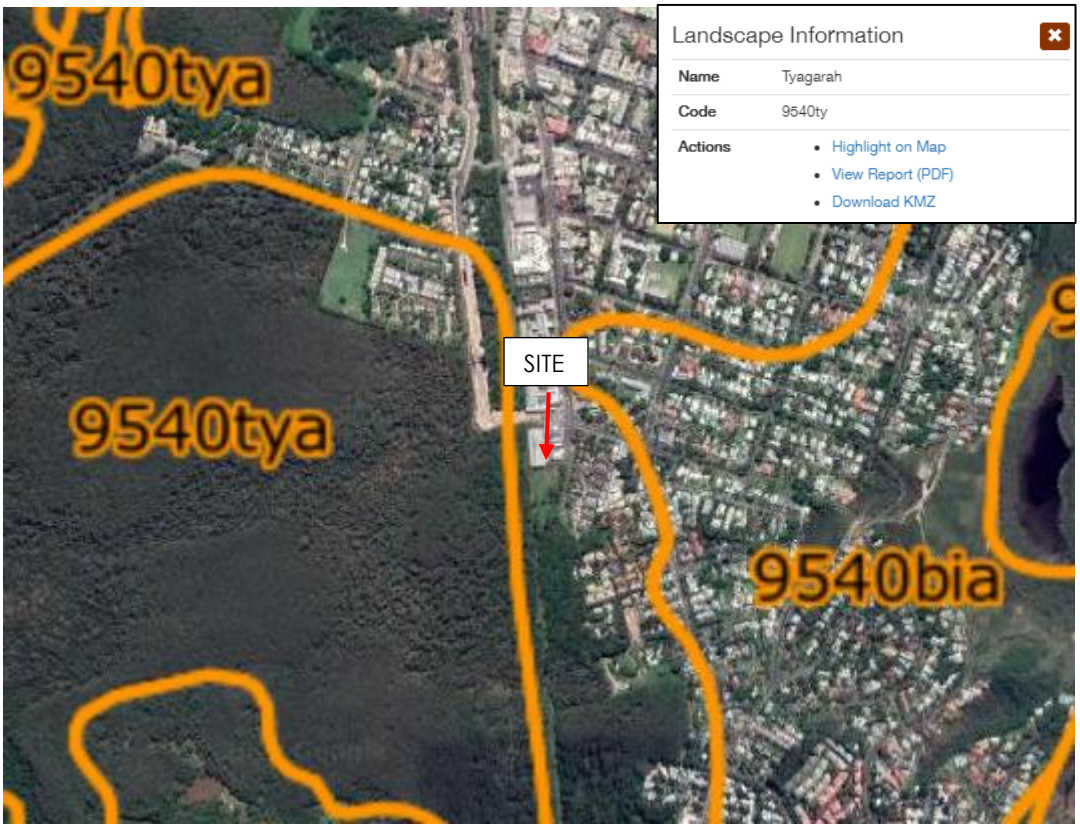


**Figure 3: eSPADE Geology Mapping Extract (Source: eSPADE Mapping, 2020)**

Such areas are described in detail within Morland, 1994:

- Tyagarah (ty): mapped over the entire site.

Location: Sediment basins of mixed estuarine and aeolian origin within the inland margins of the Tweed-Byron Coast.
Geology: Quaternary estuarine alluvium overlain by and/or mixed with Quaternary (Pleistocence) sands. The sands are generally Aeolian, originating from the adjacent beach ridge systems.
Topography: Level to gently undulating plains. Watertables are generally within 100-200cm of the surface but can be higher in poorly drained areas. These are essentially the back barrier environment (Thom, 1984), a flat-lying sediment basin located inland of the inner barrier system. Within the back barrier zone sediments have accumulated from a number of processes, as listed below (summarised from Thom, 1984):

- Deposition by suspension from rivers
- Washover sand deposition as extensive sheets which have been transported by storm surges across the shore zone and frontal dune ridges
- Aeolian reworking of exposed sand surfaces to produce back dune flats
- Channel-fill deposition of flood-tidal delta origin

Slopes are 1-2%, relief is 1-2m and elevation is 2-5m (Morland 1994; 160-161 + map).

The site is predominantly flat with a 1% grade towards the north to the south of the subject site. The current highpoint (RL approximately 3.112m above AHD) is located in the north east of the site and the low point is located directly south of the site towards the wetlands (RL approximately 2.771).

## 2.4 Aims of Study

The aim of this report is to describe the terrestrial flora and fauna habitat of the Study Area and adjoining areas and to examine the potential for the occurrence of threatened species, populations, their habitats or endangered ecological communities. In order to provide this information, the following specific objectives are to:

- Determine and describe the existing flora, vegetation communities, fauna assemblage and associated habitats of the Study Area and adjoining areas,
- Determine the occurrence, or likely occurrence, threatened species, populations, their habitats or endangered ecological communities as a result of detailed survey and literature review,
- Undertake the 'test of significance' pursuant to Section 7.3 of the *Biodiversity Conservation Act 2016*,
- Undertake SEPP (Koala Habitat Protection) 2019 & SEPP (Coastal Management) assessments,
- Describe the potential direct and indirect impacts of the proposal on existing terrestrial ecological values,
- Propose amelioration measures to avoid, manage or mitigate potential impacts upon the ecological values of the Study Area.

## 2.5 Definitions, Terminology & Nomenclature

For the purposes of this flora and fauna assessment the following definitions apply:

*Site / Subject Site:* refers to the extent of the lands forming the boundaries of this development application as described in Section 2.0

*Works Envelope/Development Footprint/Proposal Footprint*: refers to those areas of the site which will be occupied by the works footprint (as depicted within **Figure 2 and Attachment 1**).

*Study Area*: refers areas which onsite ecological survey works were conducted as a part of this application. This includes the works envelope and additional areas which could be potentially affected by the development directly or indirectly. In this case the 'Study Area' is considered to be the subject site buffered by a zone of approximately 20m.

*EEC:* denotes an Endangered Ecological Community as defined within the *Biodiversity Conservation Act 2016.*

Additional terminology associated with significance assessments (i.e. threatened species, populations, communities, threatening process, direct impacts, indirect impacts etc.) and the factors of such assessments (i.e. test of significance) are taken to be those existing within the *Biodiversity Conservation Act 2016*, *Environmental Planning and Assessment Act 1979*, and OEH documents entitled *Guidance to assist a decision-maker to determine a serious and irreversible impact* (OEH 2017) and *Threatened Species Test of Significance Guidelines (OEH 2018)*. Additional terms within the report which warrant the source of the definition have been specifically referenced in the text.

Nomenclature for all plant species contained within this document follow Harden (1992, 1993, 2000 & 2003) The Flora of NSW Volumes 1-4. Scientific names for plants are used primarily in the document to avoid any confusion associated with use of common or descriptive plant names.

Nomenclature for all animal species contained within this document follows those utilised by the Office of Environment and Heritage/National Parks and Wildlife Service (2020) in association with the Atlas of NSW Wildlife. Scientific names for fauna are used primarily in the document to avoid any confusion associated with use of common or descriptive animal names.

## 2.6 Contributors

Contributors to this report and their roles are tabulated below:

**Table 1: Report Contributors**

| NAME | ORGANISATION | ROLE |
|---|---|---|
| Tomislav Rados | Planit Consulting | Report preparation, flora/fauna survey and assessment |

All work was performed under the appropriate licences which are summarized within **Section 4.4**.

## 2.7 Biodiversity Offsets Scheme

The *Biodiversity Conservation Act 2016*, together with the *Biodiversity Conservation Regulation 2017*, outlines the framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme (BOS).

The Biodiversity Offsets Scheme creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity. It also establishes biodiversity stewardship agreements, which are voluntary in-perpetuity agreements entered into by landholders, to secure offset sites.

The Scheme applies to:

- Local development (assessed under Part 4 of the *Environmental Planning and Assessment Act 1979*) that is likely to significantly affect threatened species or triggers the Biodiversity Offsets Scheme threshold.
- State significant development and state significant infrastructure projects, unless the Secretary of the Department of Planning and Environment and the Chief Executive of OEH determine that the project is not likely to have a significant impact
- Biodiversity certification proposals
- Clearing of native vegetation in urban areas and areas zoned for environmental conservation that exceeds the Biodiversity Offsets Scheme threshold and does not require development consent
- Clearing of native vegetation that requires approval by the Native Vegetation Panel under the *Local Land Services Act 2016*
- Activities assessed and determined under Part 5 of the *Environmental Planning and Assessment Act 1979* (generally, proposals by government entities), if proponents choose to 'opt in' to the Scheme.

The Biodiversity Offsets Scheme Threshold is a test used to determine when is necessary to engage an accredited assessor to apply the Biodiversity Assessment Method (the BAM) to assess the impacts of a proposal.

It is used for local developments (development applications submitted to councils) and clearing that does not require development consent in urban areas and areas zoned for environmental conservation (under the *State Environmental Planning Policy (Vegetation in Non-Rural Areas) 2017*).

The *Biodiversity Conservation Regulation 2017* sets out threshold levels for when the Biodiversity Offsets Scheme will be triggered. The threshold has two elements:

- whether the amount of native vegetation being cleared exceeds a threshold area set out below
- whether the impacts occur on an area mapped on the Biodiversity Values map published by the Minister for the Environment.

If clearing and other impacts exceeds either trigger, the Biodiversity Offset Scheme applies to the proposed development including biodiversity impacts prescribed by clause 6.1 of the *Biodiversity Regulation 2017*.

*Biodiversity Values Map Threshold*

The Biodiversity Values Map identifies land with high biodiversity value, as defined by clause 7.3(3) of the *Biodiversity Conservation Regulation 2017.* The Biodiversity Offsets Scheme applies to all clearing of native vegetation and other biodiversity impacts prescribed by clause 6.1 of the *Biodiversity Regulation 2017* on land identified on the map.


**Figure 4: Biodiversity Values Map with the Site Highlighted Blue**

Reviewing the Biodiversity Values Map (refer to **Figure 4**), a small area in the southern boundary of the site contains mapped 'Biodiversity Values'.

*Area Clearing Threshold*

The area threshold varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan (LEP)), or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

| Minimum lot size associated with the property | Threshold for clearing, above which the BAM and offsets scheme apply |
|---|---|
| Less than 1 ha | 0.25 ha or more |
| 1 ha to less than 40 ha | 0.5 ha or more |
| 40 ha to less than 1000 ha | 1 ha or more |
| 1000 ha or more | 2 ha or more |

**Figure 5: BOS Area Clearing Threshold**

The area threshold applies to all proposed native vegetation clearing associated with a proposal, regardless of whether this clearing is across multiple lots. In the case of a subdivision, the proposed clearing must include all future clearing likely to be required for the intended use of the land after it is subdivided / developed.

Reviewing the *Byron Local Environmental Plan (2014*), the minimum Lot size over the subject site is 200sqm. Reviewing the BOS area clearing threshold, it is noted that threshold for native vegetation clearing is 0.25ha or more (refer to **Figure 5**).

The proposal requires the removal of ~997 sqm of native vegetation community.

Reviewing the above, a BAM assessment will not be required for the proposed development.

A Biodiversity Offset Scheme Entry Threshold (BOSET) report has been prepared for the overall allotment and provided within **Attachment 3**.

*Threatened Species 'Test of Significance'*

Proponents are also required to carry out a 'Test of Significance' for all local development proposals that do not exceed the Biodiversity Offset Scheme Threshold.

The 'Test of Significance' is intended to provide standardised and transparent consideration of threatened species, ecological communities, and their habitats, through the development assessment process.

In the context of a Part 4 development (not including major projects) if the 'Test of Significance' assessment indicates that there will be a significant impact, the proponent must carry out a BAM assessment.

Please refer to **Section 6** for the 'Test of Significance' conducted for the proposal.

## 2.8 Existing Vegetation

The Byron Shire Vegetation Mapping (refer to **Figure 6**) maps a portion of the site as containing Paperbark. This was ground-truthed to be largely accurate although extent of Paperbark occurring within the central portions of Lot 51 is considerably less (further details provided within **Section 3**).

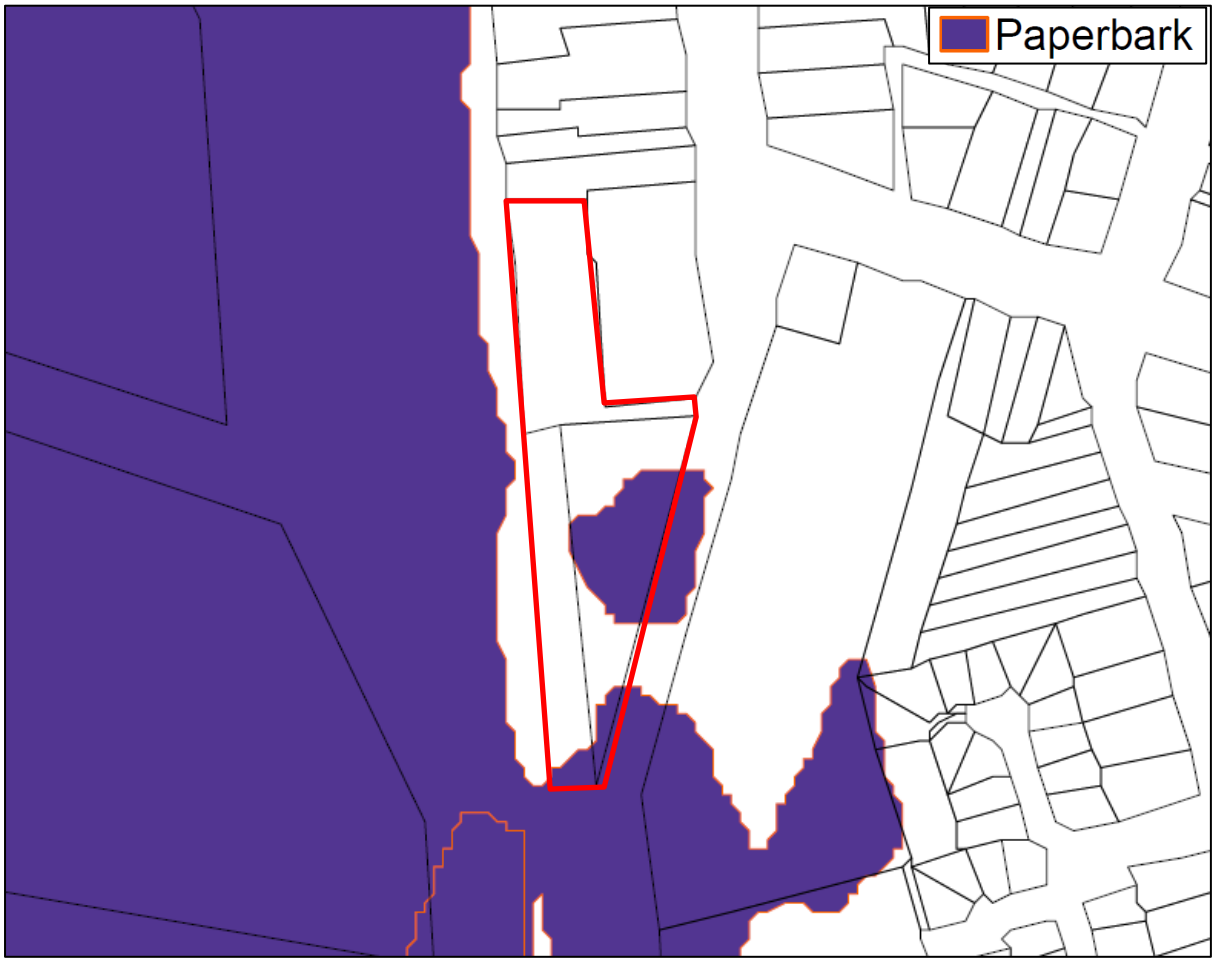


**Figure 6: Byron Shire Vegetation Mapping (Source: BSC, 2012)**

# 3 VEGETATION ASSESSMENT

To identify and classify vegetation species and communities which occur within the Study Area, the following methodology was applied over ~4 hours total on the 14th July 2020:

- Desktop analysis including:
  - i. Review of Council's Planning Scheme Mapping & Associated Reporting (i.e. Byron Shire LEP 2014 Maps)
  - *ii.* Review of existing vegetation community documentation to confirm dominant elements, forest descriptions and conservation status of mapped forested remnants/ecosystems including:
    - Forestry Commission NSW (1989) *Research Note 17: Forest Types in NSW*.
    - National Parks and Wildlife Service (1999) *Forest ecosystem classification and mapping for the upper and lower north east cra regions*. CRA Unit-Northern Zone.
    - DECC (2008) *BioMetric: Terrestrial Biodiversity Tool for the NSW Property Vegetation Planning System: Definitions of Vegetation Types for CMA Areas* (online @ http://www.environment.nsw.gov.au/projects/Biometric Tool.htm)
    - Keith, D. (2004) *Ocean Shores to Desert Dunes*. The native vegetation of NSW. DECC, Hurstville.
    - Sheringham, P.R., Dr. Benwell, A., Gilmour, P., Graham, M.S., Westaway, J., Weber, L., Bailey, D., & Price, R. (2008). *Targeted Vegetation Survey of Floodplains and Lower Slopes on the Far North Coast*. A report prepared by the Department of Environment and Climate Change for the Comprehensive Coastal Assessment. Department of Environment and Climate Change (NSW), Coffs Harbour, NSW.
  - iii. Review of threatened flora species and endangered ecological communities listed as occurring within the Murwillumbah (Qld – Southeast Hills and Ranges) CMA sub-region of the Northern Rivers CMA: (http://threatenedspecies.environment.nsw.gov.au/tsprofile/cma_subregion_list.aspx?id=15)
  - iv. Review of search of the Atlas of NSW Wildlife database within a search area 10km surrounding the site to review threatened plant records
  - v. Review of Environment Australia Protected Matters data within a search area 10km surrounding the site to review threatened plant records
  - vi. Review of SEPP Mapping (Coastal Management) mapping to determine the indicative presence/absence of regional forest ecosystems reflective of wetland (marine, estuarine, riverine, lacustrine and/or palustrine) communities and/or Littoral Rainforests.
  - vii. Review of selected ecological surveys previously undertaken in the locality
  - viii. Review of the following legislation to ensure the latest lists of threatened species and communities were noted as well as investigating the existence of any relevant recovery plans, threat abatement plans, key threatening processes or any preliminary determinations which may be applicable to the site and/or the proposed use/action:
    - *Biodiversity Conservation Act (2016)*
    - *Environment Protection and Biodiversity Conservation Act (1999)*
- *Site survey including:*
  - i. Random Meander/Diversity Searches: Random searches within each vegetation community were undertaken recording all species observed was undertaken in

accordance with Cropper (1993) and DEC (2004). Knowledge of known habitat of protected and uncommon floral species was utilized to target such species. Observation also included recording crown cover, tree heights and DBH estimation, dominant species present and identification of ecologically dominant layer.

The above survey techniques were applied to determine the following:

- Validate or modify existing vegetation mapping;
- Meet minimum Council and State Government vegetation/survey requirements;
- Identify floral species existing within the site;
- Measure and/or estimate Crown Cover (Walker and Hopkins, 1998, Nelder, 2004. EPA, 2005) to determine vegetation structure designations;
- Identify average height of canopy trees;
- Identify the incidence of senescent trees;
- Determine species dominance within ecologically dominant layer;
- Determine incidence of weed invasion and disturbance over the site and within vegetation strata;
- Determine incidence of species listed as endangered, vulnerable or rare under the *Biodiversity Conservation Act 2016;*
- Determine incidence of species listed as endangered or vulnerable under the *Environment Protection and Biodiversity Conservation Act 1999.*

The above methodology is considered to be reasonably consistent with the intent of the following documents:

- NSW Department of Infrastructure, Planning and Natural Resources (1997) *Interim Guidelines for Targeted and General Flora and Fauna Surveys under the Native Vegetation Conservation Act 1997*.
- NSW NPWS (2001) *The Community Biodiversity Survey Manual*. New South Wales National Parks & Wildlife Service.
- QLD Department of Environment and Heritage (1999) *Suggested Conservation Criteria for Development Assessment*.
- Gold Coast City Council (2004) *Guidelines for preparing Ecological Site Assessments during the Development Process (v1.1)*. G.C.C.C., Nerang.
- Shire of Maroochy (1997) *Flora and Fauna Assessment Requirements for Developments in Maroochy Shire*. M.S.C
- Brisbane City Council (1999) *Ecological Assessment Guidelines*. B.C.C.
- Byron Shire Council *Guidelines for Ecological Assessment in Byron Shire*. B.S.C
- Walker, J. & Hopkins, M.S. (1998) Chapter 5: Vegetation in McDonald, R. C., Isbell, R.F., Speight, J.G., Walker, J. & Hopkins, M.S. *Australian Soil and Land Survey: Field Handbook Second Edition*. CSIRO Australia, Canberra.
- Nelder, V. J., Wilson, B.A., Thompson, E. J. & Dillewaard, H.A. (2004) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. EPA, Brisbane.
- DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft*. DEC, NSW.

The above methodology is considered to be reasonably consistent with the intent of the following documents:

- NSW Department of Infrastructure, Planning and Natural Resources (1997) *Interim Guidelines for Targeted and General Flora and Fauna Surveys under the Native Vegetation Conservation Act 1997*.
- NSWNPWS (2001) *The Community Biodiversity Survey Manual*. New South Wales National Parks & Wildlife Service.
- QLD Department of Environment and Heritage (1999) *Suggested Conservation Criteria for Development Assessment*.
- Gold Coast City Council (2004) *Guidelines for preparing Ecological Site Assessments during the Development Process (v1.1)*. G.C.C.C., Nerang.
- Shire of Maroochy (1997) *Flora and Fauna Assessment Requirements for Developments in Maroochy Shire*. M.S.C
- Brisbane City Council (1999) *Ecological Assessment Guidelines*. B.C.C.
- Walker, J. & Hopkins, M.S. (1998) Chapter 5: Vegetation in McDonald, R. C., Isbell, R.F., Speight, J.G., Walker, J. & Hopkins, M.S. *Australian Soil and Land Survey: Field Handbook Second Edition*. CSIRO Australia, Canberra.
- Nelder, V. J., Wilson, B.A., Thompson, E. J. & Dillewaard, H.A. (2004) *Methodology for Survey and Mapping of Regional Ecosystems and Vegetation Communities in Queensland*. EPA, Brisbane.
- DEC (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft*. DEC, NSW.

## 3.1 Vegetation Survey Results

As a result of flora surveying two (2) vegetation communities were identified within the site and are described separately below and designated the most appropriate Plant Community Type (PCT) as per NSW's Biometric Vegetation Database. Where possible, identified communities were compared to recognized documents such as Forest Types in NSW (1989), CRA Forest Ecosystems (1999), Byron Shire Vegetation Mapping (2012), Byron Flora and Fauna Study (1999) and Keith (2004) Ocean Shores-Desert Dunes. A vegetation community map has been produced for the site (refer to **Figure 7**) with descriptions provided below.

**Vegetation Community 1: Paperbark Swamp Forest of the Coastal Lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064)**

This community occurs as a fragmented patch within the eastern portion of the site, extending into the road reserve. The southern boundary of the site also reflects this community. The canopy layer generally ranges between 8-16m in height although several emergent Swamp Mahogany and Bloodwoods exceeds this.

Canopy species within this community were mixed although Broad-leaved Paperbark (*Melaleuca quinquenervia*). Lesser occurring canopy and sub-canopy species included Swamp Mahogany (*Eucalyptus robusta*), Cheese Trees (*Glochidion sumatranum, G. ferdinandi*), Tuckeroo (*Cupaniopsis anacardioides*), Pink Bloodwood (*Corymbia intermedia*), Swamp Oak (*Casuarina glauca*), Swamp Box (*Lophostemon suaveolens*) and Canary Island Date Palm (*Phoenix canariensis*).

The shrub and small tree layer (2-6m in height) contained immature canopy species as well as Bangalow Palm (*Archontophoenix cunninghamiana*), Alexander Palm (*A. alexandere*), Camphor Laurel (*Cinnamomum camphora*), Umbrella Tree (*Schefflera actinophylla*), Wattles (*Acacia longifolia subsp. sophorae, A. melanoxylon, A. suaveolens*), Beach Acronychia (*Acronychia imperforata*), Sandpaper Fig (*Ficus coronata*), Sweet Pittosporum (*Pittosporum undulatum*), Riberry (*Syzygium luehmannii*), Pink Euodia (*Melicope elleryana*) and Willow Bottlebrush (*Callistemon salignus*).

Species within the ground layer were primarily limited to weeds and exotic grasses mentioned below, although the several natives were noted which included Pennywort (*Centella asiatica*), Native Violet (*Viola hederacea*), Wandering Jew (*Commelina cyanea*), Bracken (*Pteridium esculentum*), Fishbone Fern (*Nephrolepis cordifolia*), Cunjevoi (*Alocasia brisbanensis*), Swamp Water Fern (*Blechnum indicum*) and Red-fruit Saw-sedge (*Gahnia sieberiana*).

Grass species include both native and exotic species such as Whiskey Grass (*Andropogon virginicus*), Wiry Panic (*Entolasia stricta*), Blady Grass (*Imperata cylindrica*), Red Natal Grass (*Melinis repens*), Molasses Grass (*M. minutiflora*) Guinea Grass (*Megathyrsus maximus var. maximus*),

Scramblers, vines and epiphytic species included Snake Vine (*Hibbertia scandens*), Coastal Morning Glory (*Ipomoea cairica*), Climbing Fern (*Lygodium microphyllum*), Common Milk Vine (*Marsdenia rostrata*), Monkey Rope (*Parsonsia straminea*), Barbed Wire Vine (*Smilax australis*), Wombat Berry (*Eustrephus latifolius*), Tape Vine (*Stephania japonica*), Strangler Fig (*Ficus watkinsiana*) and Bird's Nest Fern (*Asplenium australasicum*).

Weed were common and dominated the understorey of the community, in particularly Singapore Daisy (*Sphagneticola trilobata*) and exotic grasses such as Pigeon Grass (*Setaria sphacelata*), Dallis Grass (*Paspalum dilatatum, P. mandiocanum*), Couch (*Cynodon dactylon*), Carpet Grass (*Axonopus compressus*). Additional exotic species noted within this community included Blue Billygoat Weed (*Ageratum houstonianum*), Thickhead (*Crassocephalum crepidioides*), Umbrella Tree (*Schefflera actinophylla*), Broad-leaved Pepper Tree (*Schinus terebinthifolius*), Chinese Elm (*Ulmus parvifolia*), Easter Cassia (*Senna pendula var. glabrata*), Crofton Weed (*Ageratina adenophora*), Paddy's Lucerne (*Sida rhombifolia*), Wild Tobacco (*Solanum mauritianum*), Cocos Palm (*Syagrus romanzoffianum)* and Alexander Palm (*Archontophoenix alexandrae*).

Equivalent vegetation communities

Forest Types in NSW 1989: Code 31_ Paperbark

CRA Forest Ecosystems 1999: Code112_Paperbark

Byron Shire Vegetation Mapping 2012: Paperbark

Byron Flora and Fauna Study 1999: Paperbark (PB)

Keith (2004) Ocean Shores-Desert Dunes: Coastal Swamp Forests

**Vegetation Community 2: Modified / Cleared Areas with Garden Beds, Ornamental Species and Weeds**

This community occurs over the majority of the site and is characterized by maintained grassland areas. Existing buildings, warehouses and associated car parking and driveways occupies the northern areas of the site. Areas surrounding the warehouses and buildings are landscaped with planted ornamental species such as Weeping Bottlebrush (*Callistemon viminalis*), Black Tea-tree (*Melaleuca bracteata*), Mango (*Mangifera indica*) and Leopard Tree (*Libidibia ferrea*).

Native regrowth (<3m in height) occurs along the driveway and/or within garden beds proximate to the dwellings which included Tuckeroo (*Cupaniopsis anacardiodes*), Macaranga (*Macaranga tanarius*) and Cheese Tree (*Glochidion sumatranum*).

Native groundcovers, vines and epiphytes were generally uncommon within this association although Native Violet (*Viola hederacea*), Pennywort (*Centella asiatica*), Fishbone Fern (*Nephrolepis exaltata*), Monkey Rope (*Parsonsia straminea*), Bird's Nest Fern (*Asplenium australasicum*), Wombat Berry (*Eustrephus latifolius*), Tape Vine (*Stephania japonica*) and Wandering Jew (*Commelina cyanea*) were noted.

Self-sown pasture weeds were evident throughout this association which primarily contained herbaceous species such as Blue Billygoat Weed (*Ageratum houstonianum*), Cobbler's Pegs (*Bidens pilosa*), Siratro (*Macroptilium atropurpuremum*), Fireweed (*Senecio madagascariensis*), Tasselflower (*Emilia sonchifolia*), Thickhead (*Crassocephalum crepidioides*), Flaxleaf Fleabane (*Conyza bonariensis*), Bunchy Sedge (*Cyperus polystachyos*), Singapore Daisy (*Sphagneticola trilobata*), Siratro (*Macroptilium atrourpureeum*), Wild Tobacco (*Solanum mauritianum*), Blackberry Nightshade (*S. nigrum*), Rattlepods (*Crotalaria spp.*), Flatweed (*Hypochaeris radicata*), Camphor Laurel (*Cinnamomum camphora*), Easter

Cassia (*Senna pendula var. glabrata*), Umbrella Tree (*Schefflera actinophylla*), Columbian Waxweed (*Cuphea carthagenensis*), Coastal Morning Glory (*Ipomoea cairica*), Micky Mouse Plant (*Ochna serrulata*) and Broad-leaved Pepper Tree (*Schinus terebinthifolius*).

Grasses previously mentioned within Community 1 also occurring throughout this community.

A small drainage line occurs along the western boundary of the road reserve which extends into the bushland south of the subject site. This drainage line is heavily infested with exotic grasses, in particularly Pigeon Grass.

Equivalent vegetation communities

Forest Types in NSW 1989: Code 220_Cleared/Partially Cleared

CRA Forest Ecosystems 1999: Code173_Cleared/Partially Cleared

Byron Shire Vegetation Mapping 2012: N/A cleared

Byron Flora and Fauna Study 1999: N/A cleared

Keith (2004) Ocean Shores-Desert Dunes: N/A


**Figure 7: Vegetation Community Plan**

## 3.2 Endangered Ecological Communities

A discussion of potentially applicable endangered ecological communities (EECs) scheduled under the *Biodiversity Conservation Act 2016* is provided below in the context of vegetation surveys undertaken of the Study Area and the relevant scientific determinations for EECs.

One vegetation community within the site (Community 1) is floristically similar to one (1) EEC known to occur on coastal floodplains:

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions

*Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions is the name given to the ecological community associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less (adapted from Speight 1990). Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions. Bioregions are defined in Thackway and Cresswell (1995). The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent. Typically these forests, scrubs, fernlands, reedlands and sedgelands form mosaics with other floodplain forest communities and treeless wetlands, and often they fringe treeless floodplain lagoons or wetlands with semi-permanent standing water (e.g. Pressey 1989a).*

*The composition of Swamp Sclerophyll Forest on Coastal Floodplains is primarily determined by the frequency and duration of waterlogging and the texture, salinity nutrient and moisture content of the soil. Composition also varies with latitude.*

*Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions has an open to dense tree layer of eucalypts and paperbarks, which may exceed 25 m in height, but can be considerably shorter in regrowth stands or under conditions of lower site quality. For example, stands dominated by Melaleuca ericifolia typically do not exceed 8 m in height. The most widespread and abundant dominant trees include Eucalyptus robusta (swamp mahogany), Melaleuca quinquenervia (paperbark) and, south from Sydney, Eucalyptus botryoides (bangalay) and Eucalyptus longifolia (woollybut). Other trees may be scattered throughout at low abundance or may be locally common at few sites, including Callistemon salignus (sweet willow bottlebrush), Casuarina glauca (swamp oak) and Eucalyptus resinifera subsp. hemilampra (red mahogany), Livistona australis (cabbage palm) and Lophostemon suaveolens (swamp turpentine). A layer of small trees may be present, including Acacia irrorata (green wattle), Acmena smithii (lilly pilly), Elaeocarpus reticulatus (blueberry ash), Glochidion ferdinandi (cheese tree), Melaleuca linariifolia and M. styphelioides (paperbarks). Shrubs include Acacia longifolia (Sydney golden wattle), Dodonaea triquetra (a hopbush), Ficus coronata (sandpaper fig), Leptospermum polygalifolium subsp. polygalifolium (lemon-scented tea tree) and Melaleuca spp. (paperbarks). Occasional vines include Parsonsia straminea (common silkpod), Morinda jasminoides and Stephania japonica var. discolor (snake vine). The groundcover is composed of abundant sedges, ferns, forbs, and grasses including Gahnia clarkei, Pteridium esculentum (bracken), Hypolepis muelleri (batswing fern), Calochlaena dubia (false bracken), Dianella caerulea (blue flax lily), Viola hederacea, Lomandra longifolia (spiny-headed mat-rush) and Entolasia marginata (bordered panic) and Imperata cylindrica var. major (blady grass). The endangered swamp orchids Phaius australis and P. tankervillei are found in this community. On sites downslope of lithic substrates or with soils of clay-loam texture, species such as Allocasuarina littoralis (black she-oak), Banksia oblongifolia, B. spinulosa (var. collina or var. spinulosa) (hairpin banksia), Ptilothrix deusta and Themeda australis (kangaroo grass), may also be present in the understorey. The composition and structure of the understorey is influenced by grazing and fire history, changes to hydrology and soil salinity and other disturbance, and may have a substantial component of exotic grasses, vines and forbs* (NSW Scientific Committee 2011 online @

https://www.environment.nsw.gov.au/topics/animalsand-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2011-2012/swamp-sclerophyll-forest-on-coastal-floodplains-of-the-nsw-north-coast-minor-amendment-determination).

It is considered that portions of Community 1 [Paperbark Swamp Forest of The Coastal Lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064)] are partially reflective of the above listed EEC as described by the Scientific Committee. The community has dominance of Paperbark within the canopy for the most part and is situated in low-lying areas (<5mAHD).

Review of Gales Holdings Pty Ltd VS Tweed Shire Council (NSWLEC 209, 2008) notes that:

> *As with the Scientific Committee's description of Freshwater Wetlands, the description of Swamp Sclerophyll Forest has three components: an edaphic component ("humic clay loams and sandy loams"), a topographical component ("waterlogged or periodically inundated alluvial flats and drainage lines") and a locational component ("associated with coastal floodplains"). [106]*

The court in this instance held that the soils described in the applicable soil landscapes of Kingscliff Aeolian sand sheets establish that the soils are not humic clay loams or sandy loams, nor are they associated with such soils. For this reason the court held that the edaphic component of the EEC determination was not met and thus not an EEC.

A detailed analysis of coastal floodplain forests and freshwater wetlands associated with sandy deposits in NE NSW was composed by Smith (2009) was also reviewed which notes that while some forest types which are 'similar in floristic composition to Coastal Floodplain EECs and which may be dominated by the same tree species, including Casuarina glauca and Melaleuca quinquenervia, can occur on other low lying coastal landforms such as coastal sands, beach ridges and swales, lagoons, tidal flats and sand plains with regard to coastal floodplain forests. These communities, while similar in species dominance to some Coastal Floodplain EECs, are not identified as endangered ecological communities by Keith and Scott (2005) because they do not occur on coastal floodplains' (Smith, 2009 in Consulting Ecology V23, 38-39).

Regardless of the above, as no detailed soil survey work has occurred within the affected area, a precautionary approach is adopted, and Community 1 is assessed as the Swamp Sclerophyll EEC. A 'test of significance' has been conducted for Community 1 (refer to **Section 6**).

No other vegetation communities within the Subject Site are considered to be reflective of an Endangered Ecological Community listed under the *Biodiversity Conservation Act 2016* or a Threatened Ecological Community under the *Environment Protection and Biodiversity Conservation Act 1999*.

# 4 FAUNA ASSESSMENT

This section describes the Study Areas' fauna and associated habitat as identified through surveying. The methodology applied to arrive at the species list is outlined and significant species have been identified where relevant.

## 4.1 Methodology

- Desktop analysis including:
  - i. Review of Council's Planning Scheme Mapping and associated reporting (i.e. Byron Shire LEP 2014 maps)
  - ii. Review of threatened fauna species and endangered populations listed as occurring within the Murwillumbah (Qld - Southeast Hills and Ranges) CMA sub-region of the

Northern Rivers CMA (http://threatenedspecies.environment.nsw.gov.au/tsprofile/cma_subregion_list.aspx?id=15

iii. Review of search of the Atlas of NSW Wildlife database within a search area 10km surrounding the site to review threatened plant records

iv. Review of selected ecological surveys/reports previously undertaken in the locality

v. Review of the following legislation to ensure the latest lists of threatened species were noted as well as investigating the existence of any relevant recovery plans, threat abatement plans, key threatening processes or any preliminary determinations which may be applicable to the site and/or the proposed use/action:
  - *Biodiversity Conservation Act (2016)*
  - *Environment Protection and Biodiversity Conservation Act (1999)*

- Field survey of the flora communities located within and immediately adjacent to the Study Area (in accordance with Section 3 above) to review habitat values;
- The following fauna field survey methods were implemented on 14th July 2020 in general accordance with the following:
  - DEC (2004) Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities Working Draft. DEC, NSW.
  - NSWNPWS (2001) The Community Biodiversity Survey Manual. New South Wales National Parks & Wildlife Service.
  - Gold Coast City Council (2006) Planning Scheme Policy 8: Guidelines for Ecological Assessments. G.C.C.C., Nerang.
  - Shire of Maroochy (1997) Flora and Fauna Assessment Requirements for Developments in Maroochy Shire. M.S.C
  - Department of Land and Water Conservation (1997) Interim Guidelines for Targeted and General Flora and Fauna Surveys under the Native Vegetation Conservation Act 1997. NSWDLWC, Parramatta.
  - Brisbane City Council (1999) Ecological Assessment Guidelines. B.C.C.
  - Redland Shire's Planning Scheme Policy 4-Ecological Impacts

Weather conditions were warm during the day becoming cool at night (maximum of 17.3 C° and minimum of 9.7 C° as measured at Cape Byron AWS [058216]). No rainfall occurred during the onsite survey works.

## 4.2 Fauna Survey Techniques

*Diurnal Survey*

- Binocular search and identification of all fauna heard or sighted;
- Bird identification surveys were conducted in association with dusk activity and comprised walked transects through the study area.

Duration: 1 x dusk (1 researcher x 60 minutes) [14th July 2020]

- Ground track/trace survey was performed including:
  - Scat/pellet examination
  - Scratch/trace examination of trees
  - Diggings, burrow, trace and track examination
  - Humus/crevice examination
  - Examination and assessment of any tree hollows, hanging bark, termite mounds, flowering and nesting trees etc.

Duration: 1 researcher x 30 minutes [14th July 2020] and opportunistic during other survey works

- Diurnal frog-call recognition and identification

Duration: Opportunistic during all other survey works.

- Ground strata searches and rock/timber/leaf litter rolls and examination for reptiles, frogs and the Mitchell's Rainforest Snail (*Thersites mitchellae*).

Duration: 1 researcher x 60 minutes during the middle of the day and at night [14th July 2020], opportunistic during all other survey works.

*Nocturnal Survey*

Nocturnal survey included the following survey techniques:

- Audible survey for calls, scratching and landings;
- Spotlighting focusing on flowering and senescent trees, vegetated areas, drainage lines/wetlands, open grassland and canopy breaks utilising:
  - Short duration-long distance white light, and
  - Long duration-short distance red light

Duration: 1 researcher on one night for 60 minutes [14th July 2020]

- Naked eye observation utilising dusk/moon light for bats and fauna returning to potential nest/shelter areas.

Duration: One dusk/evening [14th July 2020]

- Amphibian waterbody assessments were conducted along areas considered to represent potential habitat for amphibians (i.e. drainage lines and wetlands). This included randomized walks adjacent the waterbodies actively looking for exposed frogs and active frogs and eyeshine. Aspects of the waterbody and adjacent areas were searched, including under rocks and logs, under bark, leaf litter and emergent vegetation. Call playback was conducted randomly for targeted species either from the surveyor's mobile phone, or on a 25W Toa Megaphone.

- Amplified call recording/playback for avifauna, mammals and amphibians. Playback of pre-recorded calls included the following threatened species:

  - Koala
  - Squirrel Glider
  - White-eared Monarch
  - Black Bittern
  - Australasian Bittern
  - Powerful Owl
  - Masked Owl
  - Sooty Owl

- Bush-stone Curlew
- Little Lorikeet
- Wallum Froglet
- Wallum Sedgefrog

Each call playback session comprised of the following:

- A 5min listening period for unelicited fauna calls
- A 5min call playback for relevant species on a 25W Toa Megaphone or mobile phone
- A 5min search/spotlight for fauna at the playback site

Depending on the targeted species playback was undertaken at dawn, dusk and after dark. All call files were obtained from BOCA or NATURESOUND. The approximate locations of fauna survey plots (for defined methods such as call playback, spotlighting etc.) across the Study Area are depicted in **Figure 8**.


**Figure 8: Fauna Survey Locations**

## 4.3 Survey Limitations

Whilst the duration of flora surveys and inspections of the site are considered appropriate for the small area of modified residual habitat on the site, additional undetected native flora species may be present (particularly exotic species within lawn and garden bed areas). Seasonal surveys would also be necessary to detect flora species that are dormant or inconspicuous for part of the year (i.e. from the Asteraceae, Orchidaceae, Cyperaceae, Poaceae etc). Some of these species (dormant or non-flowering) may have been undetected or under-represented within the survey period. Further ungerminated seed of various species may have been present within the soil seed bank.

Whilst the duration and sampling methodology of the fauna survey is considered appropriate for the proposal site, it is acknowledged that the entire seasonal fauna assemblage is unlikely to be recorded. It is also accepted that although assessments of habitat and species ecology does provide an additional measure to anticipate the presence of species (as a surrogate for its actual observation), there is no absolute certainty to the absence of a species from marginal or potential habitat.

Additionally, there may be some species that may utilise the habitats within the site but have remained undetected due to their rarity, elusive nature or the sporadic utilisation of the habitats (i.e. the Long-nosed Potoroo, Common Planigale and Dunnart are elusive species that are difficult to trap or observe directly; the Black-necked Stork, Powerful Owl, Spotted-tail Quoll and Red Goshawk may only visit an area occasionally within a much larger home-range; the Swift Parrot and Regent Honeyeater may only visit an area during peak flowering periods etc.).

The conclusions of this report are therefore based upon data available at the time and the results of field works undertaken and are therefore indicative of the environmental condition of the site at the time of sampling, including the presence or otherwise of species. At should be acknowledged that site conditions, including the presence of threatened species, can change over time. Additionally, flora and fauna results from previous ecological studies of the site were taken into account.

The above limitations have been taken into account and the likelihood of threatened such species occurring within the site assessed through habitat assessment, records of the species within the locality and aspects of species ecology. Previously conducted ecological studies over the site by other consultants have also been considered for this proposal.

## 4.4 Licencing

The following issued licences are held by the surveyors:

**Table 2: Relevant NSW Licences**

| Authority | Licence/Permit | Title | Expiration | Permit No. |
|---|---|---|---|---|
| NSW DPI Animal Care & Ethics Committee | Animal Research Approval | Fauna Surveying, Trapping & Release | 30 June 2023 | TRIM 14/1971 |
| NSW DPI Animal Care & Ethics Committee | Animal Research Authority | Fauna Surveying, Trapping & Release | 30 June 2021 | TRIM 14/1971 |
| NSW National Parks & Wildlife Service | Scientific Licence | Ecological Survey | 31 July 2020 | SL100142 |

It is also noted that Tomislav Rados is an accredited assessor under the Biodiversity Offsets Scheme.

## 4.5 Habitat Assessment

Prior to the commencement of the abovementioned survey works within the Study Area a broad habitat assessment was conducted. The purpose of this overview was to determine potential occurrence of fauna based on available habitat components and to target areas for detailed surveying of protected fauna species. The following habitat components were reviewed and occur as a result of previous land use, vegetation types (refer **Section 3**), geomorphic variability, surrounding uses and hydraulic regime:

**Table 3: Habitat Features**

| Habitat Element/Feature | Comment |
|---|---|
| Presence of hollow bearing trees | Not recorded. |
| Presence of koala habitat and/or favoured koala trees | Although no Eucalypt Forest is present, several individual Swamp Mahogany (*Eucalyptus robusta*) were noted. A small portion of the site has been mapped as containing Secondary (A) Koala Habitat under Byron Council's Koala Habitat Mapping (2012). No signs of Koala activity were recorded during site survey. |
| Presence of caves, culverts or disused buildings suitable for roosting of microchiropteran bat species | Existing structures (i.e. buildings, sheds etc.) present although no evidence of microbats occurring. No caves, overhangs or substantial culverts noted. |
| Presence of scratches or feeding scars on tree trunks | Not recorded. |
| Presence of megabat roosting sites | Not recorded. Nearest known flying-fox roost camp occurs ~1km north of the development site located near Middleton Street (DoEE, 2020). |
| Presence of creeklines, estuaries, mudflats, mangroves and/or riparian vegetation | Limited to Paperbark Swamp Forest (Community 1). |
| Presence of dams, ponds, lakes and/or other natural or constructed permanent water sources | Small man-made drainage line occurring along eastern boundary within road reserve (dry at the time of surveys). Lower laying areas to the south contained |
| Presence of dense understorey and ground cover vegetation | Scarce although there are dense areas of Singapore Daisy and unmaintained grasses within the eastern portions of the site along the fence. |
| Presence of deep leaf litter layer and/or debris (fallen logs etc.) | Scarce. |
| Presence of fruiting flora species | Scarce. |
| Presence of flowering species | Scarce and limited to Paperbarks, Swamp Mahogany and ornamental species. Abundant within forested areas to the south and west of the south. |
| Presence of large stick nests indicative of raptor presence | Not recorded. |
| Presence of rocky outcrops and/or extensive exposed rocky areas favoring reptile populations | Absent. |

## 4.6 Fauna Survey Results

The following section(s) list the fauna species recorded on the subject site during detailed surveying and lists the methods by which each species was identified. Results are grouped by the Class of species recorded. Those techniques utilised to record fauna are listed below and correlate with the acronyms included within the Survey Methods column of the grouped Survey Results tables. All bolded fauna species are threatened under the *BC Act 2016*.

Survey Method Codes:

| | |
|---|---|
| A | Stranding/beached |
| AR | Acoustic recording |
| B | Burnt |
| C | Cat kill |
| D | Dog kill |
| E | Nest/roost |
| F | Tracks, scratchings |
| FB | Burrow |
| G | Crushed Cones |
| H | Hair, feathers or skin |
| I | Subfossil/Fossil Remains |
| K | Dead |
| O | Observed |
| OW | Observed and Heard call |
| P | Scat |
| Q | Camera |
| R | Road kill |
| S | Shot |
| T | Trapped or netted |
| U | Ultrasonic recording |
| V | Fox kill |
| W | Heard call |
| X | In scat |
| Y | Bone, teeth or shell |
| Z | In raptor/owl pellet |

| | |
|---|---|
| * | All birds were either directly observed through diurnal survey, spotlighting or call identification |
| ** | Introduced/feral species |
| *** | Recorded in adjacent areas or circling overhead |

**BIRDS***

| Family | Species Name | Common Name |
|---|---|---|
| Accipitridae | *Haliastur sphenurus*** | Whistling Kite |
| Alcedinidae | *Ceyx azureus* | Azure Kingfisher |
| Alcedinidae | *Dacelo novaeguineae* | Laughing Kookaburra |
| Anatidae | *Chenonetta jubata* | Australian Wood Duck |
| Ardeidae | *Ardea ibis* | Cattle Egret |
| Artamidae | *Artamus leucorynchus* | White-breasted Woodswallow |
| Artamidae | *Cracticus nigrogularis* | Pied Butcherbird |
| Artamidae | *Cracticus tibicen* | Australian Magpie |
| Artamidae | *Cracticus torquatus* | Grey Butcherbird |
| Artamidae | *Strepera graculina* | Pied Currawong |
| Cacatuidae | *Eolophus roseicapillus* | Galah |
| Campephagidae | *Coracina novaehollandiae* | Black-faced Cuckoo-shrike |
| Centropodidae | *Centropus phasianinus**** | Pheasant Coucal |
| Charadriidae | *Vanellus miles* | Masked Lapwing |
| Cisticolidae | *Cisticola exilis* | Golden-headed Cisticola |
| Columbidae | *Geopelia humeralis* | Bar-shouldered Dove |

| Family | Species Name | Common Name |
|---|---|---|
| Columbidae | *Ocyphaps lophotes* | Crested Pigeon |
| Coraciidae | *Eurystomus orientalis* | Dollarbird |
| Corvidae | *Corvus orru* | Torresian Crow |
| Dicruridae | *Dicrurus bracteatus* | Spangled Drongo |
| Estrildidae | *Taeniopygia bichenovii* | Double-barred Finch |
| Hirundinidae | *Hirundo neoxena* | Welcome Swallow |
| Megapodiidae | *Alectura lathami**** | Australian Brush-turkey |
| Meliphagidae | *Manorina melanocephala* | Noisy Miner |
| Meliphagidae | *Meliphaga lewinii* | Lewin's Honeyeater |
| Meliphagidae | *Myzomela sanguinolenta* | Scarlet Honeyeater |
| Meliphagidae | *Entomyzon cyanotis* | Blue-faced Honeyeater |
| Meliphagidae | *Lichmera indistincta* | Brown Honeyeater |
| Meliphagidae | *Philemon corniculatus* | Noisy Friarbird |
| Meropidae | *Merops ornatus* | Rainbow Bee-eater |
| Monarchidae | *Grallina cyanoleuca* | Magpie-lark |
| Podargidae | *Podargus strigoides**** | Tawny Frogmouth |
| Psittacidae | *Trichoglossus chlorolepidotus* | Scaly-breasted Lorikeet |
| Psittacidae | *Trichoglossus haematodus* | Rainbow Lorikeet |
| Psophodidae | *Psophodes olivaceus* | Eastern Whipbird |
| Rallidae | *Porphyrio porphyrio* | Purple Swamphen |
| Rhipiduridae | *Rhipidura leucophrys* | Willie Wagtail |
| Sturnidae | *Sturnus tristis*** | Common Myna |
| Threskiornithidae | *Threskiornis molucca* | Australian White Ibis |
| Timaliidae | *Zosterops lateralis* | Silvereye |

**MAMMALS**

| FAMILY | SCIENTIFIC NAME | COMMON NAME | METHOD |
|---|---|---|---|
| Pteropodidae | *Pteropus alecto**** | Black Flying-fox | OW |
| Canidae | *Canis lupus familiaris*** | Dog | W |
| Leporidae | *Lepus capensis*** | Brown Hare | O |
| Peramelidae | *Isoodon macrourus* | Northern Brown Bandicoot | SL |
| Macropodidae | *Wallabia bicolor* | Swamp Wallaby | SL, O |

**REPTILES**

| FAMILY | SCIENTIFIC NAME | COMMON NAME | METHOD |
|---|---|---|---|
| Gekkonidae | *Hemidactylus frenatus*** | House Gecko | O |
| Scincidae | *Lampropholis delicata* | Dark-flecked Garden Sunskink | O |
| Agamidae | *Intellagama lesueurii* | Eastern Water Dragon | O |

**AMPHIBIANS**

| FAMILY | SCIENTIFIC NAME | COMMON NAME | METHOD |
|---|---|---|---|
| Hylidae | *Litoria fallax* | Eastern Dwarf Tree Frog | W |

| | | | |
|---|---|---|---|
| Hylidae | *Litoria nasuta* | Striped Rocket Frog | SL |
| Myobatrachidae | *Limnodynastes peronii* | Striped Marsh Frog | W |
| Bufonidae | *Rhinella marina*** | Cane Toad | OW |

# 5 DISCUSSION OF RECORDED & POTENTIALLY OCCURRING SCHEDULED COMMUNITIES, POPULATIONS AND SPECIES CONSERVATION SIGNIFICANCE

## 5.1 Endangered Populations

Endangered populations are listed under Schedule 1 of the *Biodiversity Conservation Act 2016*. No endangered populations occur within the site with the nearest being 'Koala population between the Tweed River and Brunswick River east of the Pacific Highway (Goldfuss, 1817). It is noted that the site occurs approximately 20km south of the Brunswick River and is well removed from this Endangered Population.

## 5.2 Threatened Flora Species

No flora species listed scheduled under the *Biodiversity Conservation Act 2016* were observed within the Study Area during survey efforts. Additionally, no species scheduled under the *Environment Protection and Biodiversity Conservation Act 1999* were recorded within the site.

A search of the NPWS 'Atlas of NSW Wildlife' (2020) determined that thirty-four species of threatened flora have been previously recorded within the locality (search area: North: -28.60; West: 153.56; East: 153.66 South: -28.70). Searches throughout the occurring vegetation communities within the Study Area were undertaken to locate the presence or absence of these species which are tabulated below.

It is considered that preferred habitat for the majority of the nominated species is absent from the proposed development area. Notwithstanding, searches were undertaken to locate the presence or absence of the tabled species. As the species were not recorded within the proposal envelope (or areas immediately adjacent), further assessment is considered unnecessary.

**Table 4: Potentially Occuring Threatened Flora Species**

| Species | Preferred Habitat | BCA Status | EPBC Status | Expected Impact |
|---|---|---|---|---|
| *Marsdenia longiloba* | Clear Milkvine is known from scattered sites on the NSW north coast from Hastings River northwards to Mount Nebo in Queensland (Forster, 1996). Clear Milkvine grows in open eucalypt forest, or margins of subtropical and warm temperate rainforest, and in areas of rocky outcrops (Forster, 1996; DECC, 2005a). Associated species include *Eucalyptus crebra, E. microcorys, E. acmenoides, E. saligna, E. propinqua, Corymbia intermedia* and *Lophostemon confertus* (QDNR, 2000). | E1 | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Allocasuarina defungens* | The Dwarf Heath Casuarina is found in coastal areas of wet to dry, dense, low, closed heath land growing on Pleistocene-aged marine aeolian derived soils (Wilson & Johnson 1989). A few populations occur in coastal clay heath on bedrock soils, and on hinterland sandstone (Benwell & Steed 1997). These soils are humus podzols. The drier heath is on podzols with a sub-soil hard pan. Both soil types are subject to a high watertables during the rainy season (Benwell 1993). | E1 | E | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Davidsonia jerseyana* | The Davidson's Plum is restricted to the Brunswick and Tweed River catchments of the north coast of NSW. The southern-most confirmed record of the species is located near Mullumbimby. Records extend only a short distance inland on the Brunswick River. The northern-most and westernmost confirmed record is at Chillingham. There is an unconfirmed record further north near the border gate at Tomewin (Watson 1987). The Davidson's Plum is found in coastal and lowland subtropical rainforest and wet sclerophyll forest, often with an overstorey including *Lophostemon confertus* (Brush Box), *Araucaria cunninghamii* (Hoop Pine) and/or eucalypt species. Several sub-populations of the Davidson's Plum are known from areas of regrowth rainforest with a high percentage of Camphor Laurel, *Lantana camara* (Lantana) and other exotic weeds. Some trees are isolated in paddocks or in road reserves (McKinley & Stewart 1999). | E1 | E | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Elaeocarpus williamsianus* | The Hairy Quandong's habitat is subtropical to warm temperate rainforest, including regrowth areas. The Hairy Quandong occurs along the coastal range within Notophyll vine rainforests and wet sclerophyll ecotones on metasediment-derived soils (Hunter et al. 1991b). The species is typically found on steep and eroding slopes at low altitude in gullies, toe slopes, steep drops adjacent to creeks and the headwater areas of creeks (DECC 2004a; Floyd 1989). | E1 | E | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Chamaesyce psammogeton* | *Chamaesyce psammogeton* has been recorded from the NSW coast from Jervis Bay northwards and from Lord Howe Island (DECC, 2011). *Chamaesyce psammogeton* is a prostrate perennial herb which grows on foredunes and exposed sites on headlands (DECC, 2011). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |

| Species | Preferred Habitat | BCA Status | EPBC Status | Expected Impact |
|---|---|---|---|---|
| *Caesalpinia bonduc* | *Caesalpinia bonduc* is distributed widely in the tropics and subtropics. Within NSW it has only been found on Lord Howe Island and the far north coast of mainland NSW. There are no known records from north-eastern NSW since the 1890's, when it was collected from Tintenbar and Murwillumbah<br><br>Caesalpinia bonduc is currently found on Lord Howe Island at 2 locations in the north of the island, on sandy soil close to the shoreline. Plants of Caesalpinia bonduc that were previously recorded at a third location in the same vicinity could not be relocated in a recent survey. In 2001, one of the locations had 18 mature plants over an area of 0.24ha with a lone individual a further c.200m along the shore. The second location included only one individual (Hutton 2001). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Desmodium acanthocladum* | The Thorny Pea occurs mainly in the Lismore area of north-eastern NSW, but there are also records of the species from near Grafton, Coraki, Casino and the Mount Warning area (DECC, 2005a). The species has been recorded in two reserves —the Mount Warning National Park (though this is a very old record from 1898) and Andrew Johnston Big Scrub Nature Reserve (NSW NPWS, 2007). This species occurs within the Northern Rivers (NSW) Natural Resource Management Region. The Thorny Pea occurs on basalt-derived soils at low elevations, mainly along rivers (Harden, 1991), in dry rainforest and on the fringes of riverine subtropical rainforest (DECC, 2005a). [in DSEWPC, 2008:1] | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Archidendron hendersonii* | This tree has been recorded from riverine and lowland subtropical rainforest and littoral rainforest from north Queensland, south to the Richmond River in north-east NSW. It is found on a variety of soils including coastal sands and those derived from basalt and metasediments (DECC, 2005). | V | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Xylosma terrae-reginae* | This species is known from six populations in NE NSW north of Lismore where it occurs in association with Littoral and Sub-tropical Rainforest (NPWS, 2004). Of the six populations only two populations in conservation reserves (Broken Head and Brunswick Heads Nature Reserves). Individual populations are small and the best estimate of the total population in New South Wales is less than 250 mature individuals (NSW Scientific Committee, 2000). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Cryptocarya foetida* | Stinking Cryptocarya is known from Iluka, NSW, to Fraser Island and east of Gympie, southern Queensland where it occurs within littoral rainforest, usually on sandy soils, but mature trees are also known on basalt soils. (DECC, 2005). | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development |

| Species | Preferred Habitat | BCA Status | EPBC Status | Expected Impact |
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| *Endiandra floydii* | The Crystal Creek Walnut is known from Pimpama, just north of the Queensland Gold Coast, south to Byron Hills, six km south of Cape Byron, NSW. Several large populations are known. Two are in the ranges to the north of Murwillumbah, where numerous other smaller occurrences are also found. At least 50 individuals are known from the Urliup Road area (Barry & Thomas 1994) and 40–50 trees have been reported from Crystal Creek (R. Cremer pers. Comm.). A further concentration of plants is in Mooball National Park where nearly 80 individuals have been recorded (NPWS survey data, 1997). The Crystal Creek Walnut occurs in subtropical (including littoral) rainforest or wet sclerophyll forest. Most locations are on soils derived from paleozoic metamorphics, sometimes with basalt nearby. A small number of sites are on alluvium or sand. Sheltered locations are apparently preferred, and landforms including ridgelines, slopes, gullies and creek flats have been documented. The altitude varies between close to sea level up to 430 m above sea level (Floyd 1989). | E1 | E | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Endiandra hayesii* | The Rusty Rose Walnut has a restricted distribution in northern NSW and southern Queensland (Hyland 1989). Records of this species are clustered in the Border Ranges, Nightcap Ranges and surrounds, and at a few scattered near-coastal locations. Vegetation includes subtropical and warm temperate rainforests and Brush Box forests, including regrowth and highly modified forms of these habitats (NPWS, 2004). | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Endiandra muelleri subsp. Bracteata* | Rainforest or wet eucalypt forest, chiefly at lower altitudes (DECC, 2005). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Owenia cepiodora* | This species is known from subtropical and dry rainforest on or near soils derived from basalt from the Richmond River north to just north of the Qld border (DEC, 2005; BSC, 2006). | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Tinospora tinosporoides* | Arrow-head Vine occurs near the coast at Richmond River in northern NSW to Burleigh Heads National Park (NP) in Queensland where it is locally common rainforest on basalt and also occurs in complex notophyll vine forest (DSEWPC, 2008:1). | V | | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Rhodamnia rubescens* | In New South Wales (NSW), *Rhodamnia rubescens* is currently known to occur from coastal districts north from Batemans Bay, approximately 280 km south of Sydney, to the Queensland (Qld) border. Populations | E4 | - | Not recorded during site survey works. Unlikely to |

| Species | Preferred Habitat | BCA Status | EPBC Status | Expected Impact |
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| | of the species extend north to Maryborough, Qld. NSW populations of R. rubescens are mainly coastal and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000–1,600 mm (Benson and McDougall 1998).<br><br>Populations and individuals of R. rubescens are often found in wet sclerophyll associations in rainforest transition zones and creekside riparian vegetation (Benson and McDougall 1998). *Rhodamnia rubescens* commonly occurs in all rainforest subforms except cool temperate rainforest. The species occupies a range of volcanically derived and sedimentary soils and is also a common pioneer species in eucalypt forests (Floyd 1989). | | | be significantly impacted upon as a result of the proposed development. |
| *Rhodomyrtus psidioides* | In New South Wales (NSW), *Rhodomyrtus psidioides* is currently known to occur from Broken Bay, approximately 30 km north of Sydney, to the Queensland (Qld) border. Populations of the species extend north to Gympie, Qld. NSW populations are typically restricted to coastal and sub-coastal areas of low elevation however the species does occur up to c. 120 km inland in the Hunter and Clarence River catchments and along the Border Ranges.<br><br>The species occurs in rainforest and its margins with sclerophyll vegetation, often near creeks and drainage lines. *Rhodomyrtus psidiodes* is a pioneer species in disturbed environments (Williams and Adam 2010) and is locally common in disturbed areas, such as regrowth and rainforest margins. | E4 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Syzygium hodgkinsoniae* | Smooth-bark Rose Apple occurs in riverine rainforest on rich alluvial or basaltic soils, from the Richmond River in NSW to Gympie, Queensland, with a disjunct occurrence in north Queensland (Floyd, 1989). The species occurs mostly as scattered individuals along watercourses, where the habitat is frequently limited and degraded (Landmark Ecological Services, Ecograph & Terrafocus, 1999). | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Syzygium moorei* | The Durobby occurs in warm, protected, fertile soils in riverine and gully rainforests at low altitudes, along sections of the Richmond, Brunswick and Tweed Rivers in NSW, as well as at three sites in Upper Mudgeeraba Creek and Upper Tallebudgera Creek in south-east Queensland (Floyd, 1989). Rose Apple is most commonly found in Subtropical Rainforest. | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Diuris byronensis* | This orchid is known from a single location only, at Byron Bay in north-east NSW. Only about 20 plants have been recorded (OEH, 2012). Occurs in low-growing grassy heath on clay soil (OEH, 2012). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted |

| Species | Preferred Habitat | BCA Status | EPBC Status | Expected Impact |
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| | | | | upon as a result of the proposed development. |
| *Geodorum densiflorum* | This orchid is found in dry sclerophyll forest, often on coastal sand, at lower altitudes, north from the Macleay River on the north coast of NSW (NPWS, 2004). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Oberonia complanata* | In Australia the species occurs in Queensland and New South Wales. Within New South Wales, there are several historical collections (all pre 1917) of *Oberonia complanata* from Byron Bay and Lismore, and a collection from Coffs Harbour from 1961. Preferred habitat appears to be rainforest, but it can also occur in sclerophyll forest, coastal scrub and mangroves (NPWS, 2002). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Phaius australis* | This species is known from swampy grassland or swampy forest including rainforest, eucalypt or paperbark forest, mostly in coastal areas (NPWS, 2002). | E1 | E | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Pterostylis nigricans* | Occurs within coastal heathland with Heath Banksia (*Banksia ericifolia*), and lower-growing heath with lichen-encrusted and relatively undisturbed soil surfaces, on sandy soils (OEH, 2012). | V | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Arthraxon hispidus* | "In NSW and Queensland, Hairy-joint Grass is found in or on the edges of rainforest and in wet eucalypt forest, often near creeks or swamps (Queensland CRA/RFA Steering Committee, 1997, 1998; DECC NSW, 2005), as well as woodland (Queensland Herbarium, 2008). In south-east Queensland, Hairy-joint Grass has also been recorded growing around freshwater springs on coastal foreshore dunes, in shaded small gullies, on creek banks, and on sandy alluvium in creek beds in open forests (Queensland CRA/RFA Steering Committee, 1997, 1998), and also with bog mosses in mound springs (Queensland Herbarium, 2008)" [Department of the Environment, Water, Heritage and the Arts 2008:1-2] | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development |
| *Drynaria rigidula* | Occurs widely in eastern Queensland. In NSW it is only found north of the Clarence River, in a few locations at Maclean, Bogangar, Byron Bay, Mullumbimby, in the Tweed Valley and at Woodenbong. Usually found in rainforest but also in moist eucalypt and Swamp Oak forest (OEH, 2019). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted |

| Species | Preferred Habitat | BCA Status | EPBC Status | Expected Impact |
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| | | | | upon as a result of the proposed development. |
| *Floydia praealta* | The Ball Nut inhabits floristically-rich, tall, closed riverine to subtropical rainforest (Barry & Thomas 1994; Floyd 1989; Harden 1991, 2000; Quinn et al. 1995; Sheringham & Westaway 1995) or coastal scrub (Foreman 1995a). | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Grevillea hilliana* | This species is known from small remnant patches of subtropical rainforest on basaltic soils in Brunswick and Tweed Heads (NPWS, 2002). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Macadamia tetraphylla* | This species of nut tree is confined chiefly to the Richmond and Tweed Rivers in north-east NSW, extending just across the border into Queensland where it occurs within subtropical rainforest, particularly on basaltic soils. (Williams, Harden and McDonald, UNE, 1984; DECC, 2005). The species is also commonly noted as a paddock tree on soils of basaltic influence and as an ornamental or orchard tree associated with residential and/or rural activities. | V | V | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Psilotum complanatum* | Epiphyte in rainforest, often found growing from bases of other large clumps of epiphytes; rare in N.S.W., north from Ballina, also recorded at Port Macquarie (PlantNET, 2020) | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Acronychia littoralis* | Scented Acronychia occurs from Fraser Island in Queensland to Port Macquarie in NSW. Most populations occur in NSW, between Ballina and Tweed Heads. In NSW, populations are conserved in Bongil Bongil NP, Bundjalung NP, Broken Head Nature Reserve (NR), Cape Byron NR, Brunswick Heads NR, Cudgen Lake NR and Cooloola NP. Scented Acronychia is found on sand in humid, high rainfall zones (greater than 1600 mm), within 2 km of the ocean. The species occurs in transition zones between littoral rainforest and swamp sclerophyll forest; between littoral and coastal cypress pine communities; and margins of littoral forest and cleared land (Harden, 2002). | E1 | E | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |

| Species | Preferred Habitat | BCA Status | EPBC Status | Expected Impact |
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| *Melicope vitiflora* | The species occurs in Queensland and reaches its southern limit in NSW, where it is restricted to the far north east corner of the State, in coastal areas around the Brunswick Heads and Broken Head. *Melicope vitiflora* grows in subtropical and littoral rainforest (NPWS 2003). | E1 | - | Not recorded during site survey works. Unlikely to be significantly impacted upon as a result of the proposed development. |
| *Niemeyera whitei* | Rusty Plum occurs in the coast and adjacent ranges of northern NSW from the Macleay River into southern Queensland. Its distributional stronghold is on the mid north coast around Coffs Harbour. The species is found in gully, warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest. It occurs on poorer soils in areas below 600 metres above sea level (OEH, 2019).<br><br>The species was recorded within the northern portions of the subject site within rainforest. The species is well known to the site and is subject to routine monitoring. The species is well removed from the proposal footprint (>450m) and will not be impacted upon as a result of the proposal. | V | - | A large tree and several saplings recorded within rainforest in the northern portions of the subject site. These specimens have previously been recorded within the site and are subject to routine monitoring.<br><br>These specimens are well removed from the proposal site and will not be impacted upon. |

*Note: E1 = Endangered (BCA, 2016); E = Endangered (EPBC 1999); E4A = Critically Endangered (BCA, 2016); CE = Critically Endangered (EPBC 1999); and V = Vulnerable (BCA, 2016 and EPBC 1999)*

## 5.3 Threatened Fauna Species

A search of the NPWS 'Atlas of NSW Wildlife' (2020) has determined that forty-eight species of threatened fauna have been previously recorded within the locality (search area: North: -28.60; West: 153.56; East: 153.66; South: -28.70).

A review of available habitats and the ecology of the database listed species (i.e. range, preferred habitat, home range etc.) indicate that it is unlikely that all of these previously recorded species in the locality would rely on the habitats of the Study Area. Subsequently several such threatened species are considered unlikely to be significantly affected by a future development of the site for one or more of the following reasons:

- Core/favoured habitats were not recorded in the Study Area
- Resources used by the species are unlikely to be adversely affected or only likely to be minimally affected by a future proposal.

Details of such species requirements and reasons for not considering impacts to these species further are discussed below (refer to **Table 5**). A number of threatened species have been excluded from discussion in the below table where they are considered reasonably unlikely occurrences and impacts are unlikely to be occasioned as a result of the proposal due to the following:

- Being a marine reptile or mammal (i.e. whale, turtle, seal).
- Being a pelagic seabird, wader bird or inter-tidal zone coastal bird (i.e. tern, godwit, oystercatcher).

For species considered a potential occurrence (based upon distribution, database recording, suitable habitat present etc.) or which were recorded within or directly adjacent the site during the survey period and for which it is considered that the species may be affected (i.e. impact on feeding, roosting, nesting, behaviour and associated habitat), the 'test of significance' is performed.

Notwithstanding, all the species tabled below were targeted during the fauna survey or were reviewed in the context of documented ecology and available habitats.

**Table 5: Potentially Occurring Threatened Fauna Species**

| Species | Potential occurrence based upon known habitat & range | Notes | BCA Status | EPBC Status | Potential for the species or associated habitat to be impacted upon by proposal |
|---|---|---|---|---|---|
| Wallum Froglet (*Crinia tinnula*) | Unlikely | This species of wallum frog is found along drainage lines in sub-coastal wet heath, in acid paperbark (Melaleuca) swamps, and sedge swamps associated with sandy coastal plains (but rarely from around coastal lakes) and low slopes below 40m altitude and above areas of tidal influence (Ehmann, 1997; Meyer et al, 2006). The habitats in which the wallum froglet species breed are typically oligotrophic (i.e. nutrient poor), tannin-stained and acidic ((pH 4.3-5.2) [QPWS 2001; Meyer et al. 2006; McDonald et al, 2009; Hines et al, 2004). The coastal distribution occurs as far north as Litabella National Park on the southeast coast of Queensland south to Kurnell in mid-eastern New South and also upon a number of offshore islands including Fraser Island, Bribie Island, Moreton Island and North Stradbroke Island (BCC, 2010). A regionally significant population of the species is noted to occur within a wide variety of habitats investigated in association with the Tugun Bypass SIS (PB, 2004; Hero et al, 2001). Known habitat broadly encompasses the following vegetation communities: Slashed Heathland, Wet Heathland, Swamp Mahogany Forest, Swamp Mahogany–Brushbox Forest, Littoral Rainforest, Swamp Paperbark Forest and other moist forest types.<br><br>Although the species is known to occur within the locality (pers obs.), preferred habitat for the Wallum Froglet is considered absent from the site. The species was not recorded during survey efforts of the Study Area. It is considered unlikely that the proposal will have a significant impact upon this species. | V | - | Favoured habitat absent. Unlikely to be significantly impacted upon as a result of the proposed development. |
| Green and Golden Bell Frog (*Litoria aurea*) | Unlikely | This species is restricted to isolated coastal populations between Brunswick Heads and East Gippsland where it inhabits marshes, dams and stream sides, particularly those containing bullrushes *Typha* spp. or spikerushes *Eleocharis* spp (NPWS, 1999).<br><br>Preferred habitat for this species is considered absent from the site. The species was not recorded during survey efforts of the Study Area and has rarely been recorded within the region in recent years. Unlikely to be significantly impacted by the proposal. | E1 | V | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Olongburra Frog *(Litoria olongburensis)* | Unlikely | The Wallum Sedge Frog is found in ephemeral, seasonal and permanent wetlands with emergent reeds, ferns and/or sedges, in undisturbed coastal wallum swamps. Griffith and colleagues (2003) describe wallum as sandmass heathland and shrubland, and various forest, woodland, sedgeland and grassland communities (Bantianoff & Elsol 1989; Coaldrake 1961). While most common in swamps, the Wallum Sedge Frog may also be found around | V | V | Favoured habitat absent. Unlikely to be significantly impacted as a result of the |

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| | | creeks and freshwater lakes in coastal wallum. At swamp sites, the Wallum Sedge Frog can be found sheltering amongst sedges, reeds and ferns all year round (Anstis 2002; Ehmann 1997; Ingram & Corben 1975; James 1996; Lewis & Goldingay 2005; Liem & Ingram 1977; Neilson 2000).<br><br>Although the species is known to occur within the locality (i.e. Byron STP, West Byron), preferred habitat for the Wallum Sedgefrog is considered absent from the site. The species was not recorded during survey efforts. It is considered unlikely that the proposal will have a significant impact upon this species. | | | proposed development. |
| Wompoo Fruit-Dove (*Ptilinopus magnificus*) | Unlikely | This species is confined to mature rainforest and adjacent wet sclerophyll environments in eastern Australia from Cape York to around Coffs Harbour. As an obligate frugivore it requires a high availability of fruiting materials which it generally feeds on in the high canopy (Recher et al, 1995).<br><br>Preferred habitat for the Wompoo Fruit-dove is considered absent from the site. The species was not recorded during fauna survey works of the site. Additionally, no nests were observed within the site during fauna survey works. It is considered unlikely that the proposed development will have a significant impact upon the Wompoo Fruit-dove. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Rose-crowned Fruit-Dove (*Ptilinopus regina*) | Unlikely | This species generally occurs within sub-tropical rainforest, camphor laurel and occasionally wet sclerophyll and swamp forests which contain suitable fruiting species for foraging (DEC, 2005; Recher et al, 1995). As an obligate frugivore a high proportion of fruiting species (figs, lillipillis, laurels etc.) is necessary and as such rainforest habitats are favoured. The species is considered a partial migrant and moves north in autumn/winter and returning in spring/summer to breed (Recher et al, 1995).<br><br>Preferred habitat for the Rose-crowned Fruit-dove is considered absent from the site. The species was not recorded during fauna survey works of the site. Additionally, no nests were observed within the site during fauna works. It is considered unlikely that the proposed development will have a significant impact upon the Rose-crowned Fruit-dove. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Superb Fruit-Dove (*Ptilinopus superbus*) | Unlikely | This species is known from rainforest and adjacent eucalypt forests which contain suitable fruiting species for foraging (DEC, 2005; Recher et al, 1995). As an obligate frugivore a high proportion of fruiting species (figs, palms, lillipillis, laurels etc) is necessary and as such rainforest habitats are favoured where the species spends most of its time in the canopy. The species is considered a partial migrant and moves north in autumn/winter and returning in spring/summer to breed (Recher et al, 1995). | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |

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| | | Preferred habitat for the Superb Fruit-dove is considered absent from the site. The species was not recorded during fauna survey works of the site. Additionally, no nests were observed within the site during fauna works. It is considered unlikely that the proposed development will have a significant impact upon the Superb Fruit-dove. | | | |
| Marbled Frogmouth (*Podargus ocellatus*) | Unlikely | This species favours prefers subtropical or warm-temperate rainforest containing deep, wet, sheltered gullies dominated by stands of Bangalow Palms and/or dense rainforest understorey in SEQld and NENSW (DEC, 2005; Smith et al, 1994; Milledge, 1983). Tracking studies undertaken by Smith et al (1994) indicates that the species occupies a moderately large home range (8-10 hectares) which centres around a creek or gullyline although movements were greatly restricted during the breeding season. Roosts sites are in, or on the margins of, rainforest, frequently associated with vines (Smith *et al.*, 1998).<br><br>Preferred habitat for the marbled frogmouth is considered to be absent from the site and the species was not recorded during fauna survey works. It is considered unlikely that the proposed development will have a significant impact upon the marbled frogmouth. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Black-necked Stork (*Ephippiorhynchus asiaticus*) | Unlikely | The species is generally associated with wetlands, mudflats, mangroves, swamps and floodplains while it may also sometimes be found in open woodland environs where a grassy understorey is present (NPWS, 2002, Readers Digest, 2002; DEC, 2005). Irrigated lands are also occasionally a foraging resource and it has also been recorded foraging in artificial wetlands of sewerage treatment plants (ERM, 2001). The species has also been recorded foraging within grassed paddocks and pasture areas in Cedar Creek, Mudgeeraba and Coomera (pers. Obs.).<br><br>Preferred habitat for the Black-necked Stork is considered to be absent from the site and the species was not recorded during fauna survey works. It is considered unlikely that the proposed development will have a significant impact upon the species. | E1 | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Australasian Bittern (*Botaurus poiciloptilus*) | Unlikely | The Australasian Bittern inhabits terrestrial and estuarine wetlands, generally where there is permanent water. The species prefers wetlands with dense vegetation, including sedges, rushes and reeds. (Marchant & Higgins 1990; Garnett 1992). Freshwater is generally preferred, although dense saltmarsh vegetation in estuaries and flooded grasslands are also used by the species (Smith *et al.* 1995) [in NPWS, 1999: 2-3].<br><br>Given the absence of densely vegetated wetlands areas, favoured habitat for the Australasian Bittern is considered absent from the site. The species has not been recorded within the site survey efforts. It is considered unlikely that the proposal will have a significant impact upon this species. | E1 | E | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |

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| Black Bittern (*Ixobrychus flavicollis*) | Unlikely | The species is widely distributed throughout the coastal regions of Australia but is more common in the northern extent of the country. Within its distribution, the species shows a preference for densely vegetated areas within terrestrial and aquatic wetlands. It has been recorded from a variety of vegetation types (including grassland, mangroves, wet sclerophyll forest, rainforest) where permanent water is present (Marchant & Higgins, 1990; Simpson & Day, 1996; NPWS, 2001). In northern NSW black bitterns are most often recorded in riparian habitats along fresh or brackish streams, although the species is also known to utilise drains, permanently inundated swamp forest, and freshwater wetlands (Sandpiper Ecological Surveys, 2003).<br><br>Given the absence of densely vegetated wetlands areas, favoured habitat for the Black Bittern is considered absent from the development footprint. Suitable habitat occurs west of the site in association with expansive areas of Paperbark Swamp Forests with a well-established ground-layer.<br><br>The species have been historically recorded as a part of the Byron bypass Ecological Studies within bushland northwest of the subject site (Mills and Associates 1997, Sandpiper Ecological Surveys 2001).<br><br>The species has not been recorded within the site during survey efforts. It is considered unlikely that the proposal will have a significant impact upon this species. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| White-bellied Sea-eagle (*Haliaeetus laucogaster*) | Unlikely | The White-bellied Sea-Eagle is found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, the sea). Birds have been recorded in (or flying over) a variety of terrestrial habitats (Marchant & Higgins 1993). The White-bellied Sea-Eagle feeds opportunistically on a variety of fish, birds, reptiles, mammals and crustaceans, and on carrion and offal (del Hoyo et al. 1994; Ferguson-Lees & Christie 2001; Marchant & Higgins 1993; Rose 2001a).<br><br>Expansive favoured habitat for the Sea-eagle occurs in the locality (in association with the foreshore and river estuaries such as Belongil Creek, Tallow Creek). Preferred foraging habitat is considered absent from the site due to the absence of suitable waterbodies and the species was not recorded during survey efforts. Large stick nests were not observed within the site. It is considered unlikely that the proposal will have an impact upon this species. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Little Eagle (*Hieraaetus morphnoides*) | Possible | The Little Eagle occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Sheoak or acacia woodlands and riparian woodlands of interior NSW are also used (Marchant and Higgins 1993; Aumann 2001a). The Little Eagle is distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a |

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| | | escarpment (Marchant and Higgins 1993). It occurs as a single population throughout NSW. The population in New Guinea is now classified as a separate species, the Papuan Booted Eagle *Hieraaetus weiskei* (Lerner and Mindell 2005).<br><br>The site may fall within the species hunting range although the species has not been recorded within the site. No stick nests suitable for this species was observed within the site. It is considered unlikely that the proposal will have a significant impact upon this species. | | | result of the proposed development. |
| Square-tailed Kite (*Lophoictinia isura*) | Possible | This species typically prefers the coastal forested and wooded lands of tropical and temperate Australia where it appears to occupy large hunting ranges of more than 100km$^2$ (Marchant & Higgins 1993; NPWS, 1999; DEC, 2005). 'It particularly favours productive forests on the coastal plain, box-ironbark-gum woodlands on the inland slopes, and Coolibah/River Red Gum on the inland plains (Marchant & Higgins 1993). It also forages over coastal heathlands, and often near openings and edges of forest. A common feature of the kite's habitat is the presence of profuse eucalypt blossom and attendant nectivorous/passerine birds which are the favoured prey of the kite (Readers Digest, 2002, NPWS, 1999). In eastern NSW, neighbouring nests of the Square-tailed Kite are about 13 km apart, with a density of one pair per 170 km$^2$, and home range of roughly 50 km$^2$ (Lutter *et al.* 2004).<br><br>The site may fall within the species large hunting range, although the Kite was not recorded during survey efforts of the site. Large stick nests indicative of a raptor was not observed. It is considered highly unlikely that the proposal will have a significant impact upon the Square-tailed Kite. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Eastern Osprey (*Pandion cristatus*) | Unlikely | This species is associated with waterbased habitats including estuaries, coastal wetlands, rivers and streams. The Osprey is predominately a coastal raptor frequenting estuaries, bays, inlets, islands and rocky cliffs within all Australian states except for Tasmania and sporadically within Victoria (DEC, 2005; NPWS, 2002). It is noted however, that the species sometimes inhabits inland islands (Pizzey and Knight, 1997; Readers Digest, 2002). Within suitable environment it usually constructs a nest in an overhanging large tree or upon elevated man-made structures such as platforms or telegraph poles.<br><br>Expansive favoured habitat for the Osprey occurs in the locality (in association with the foreshore and river estuaries such as Belongil Creek, Tallow Creek). Preferred foraging habitat is considered absent from the site due to the absence of suitable waterbodies and the species was not recorded during survey efforts. Additionally, no Osprey nests were noted on the site. It is considered unlikely that the proposal will have an impact upon this species. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development |
| Brolga (*Grus rubicunda*) | Unlikely | The Brolga inhabits the large open swamplands/wetlands of coastal and subtropical coastal Australia where it may form flocks of several hundred individuals during the breeding season (Readers Digest, 2002). Studies conducted in southern NSW and Northern Victoria (Charles | V | - | Favoured habitat absent. Unlikely to be significantly |

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| | | Sturt University, 2000) indicates that most Brolga breeding sites were large (>50 ha) remnant wetlands with extensive areas of water around 30 cm deep. More than 90% of breeding sites were dominated by Canegrass (*Eragrostis australasica*, *E. infecunda*) or Spike-rushes (*Eleocharis* species), with emergent vegetation cover usually around 25% and 90 cm in height. DEC (2005) notes that the species may also forage within grassed paddocks or ploughed fields.<br><br>Preferred habitat for the Brolga is considered absent from the site and is unlikely to be significantly impacted upon as a result of the proposed development. | | | impacted as a result of the proposed development |
| Pale-vented Bush-hen (*Amaurornis moluccana*) | Unlikely | This species favors coastal rivers and inlets from the Clarence River, north. It prefers densely overgrown margins of permanent terrestrial freshwater wetlands such as creeks and rivers, billabongs, ponds, swamps, waterholes, dams, lakes and roadside ditches (Muranyi and Baverstock, 1996). Three Bush-hens were recorded from Swamp Mahogany Forest in areas NE of the Cobaki Broadwater in association with fauna survey works undertaken in association with the Tugan Bypass SIS (Ecopro, 2004). PB (2008) has also recorded the bush hen at Banora Point within early regrowth rainforest west of Martinelli Avenue.<br><br>Given the absence of densely vegetated wetlands areas, favoured habitat for the Bush-hen is considered absent from the development site. Suitable habitat occurs west of the site in association with expansive areas of Paperbark Swamp Forests with a well-established groundlayer.<br><br>The species have been historically recorded as a part of the Byron bypass Ecological Studies within bushland northwest of the subject site (Mills and Associates 1997, Sandpiper Ecological Surveys 2001).<br><br>The species has not been recorded within the site during recent or previous survey efforts. Preferred habitat occurs further to the west of the site in association with Paperbark Forests<br><br>It is considered unlikely that the proposal will have a significant impact upon this species. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development |
| Bush Stone-curlew (*Burhinus glallarius*) | Possible | In NSW, Bush Stone-curlews occur in lowland grassy woodland and open forest. Habitat is described by broad ground and understorey structural features and is not necessarily associated with any particular vegetation communities. In general, habitat occurs in open woodlands with few, if any, shrubs, and short, sparse grasses of less than 15cm in height, with scattered fallen timber, leaf litter and bare ground present. In coastal areas, structurally similar elements of tidal and estuarine communities provide suitable habitat, for example Bush Stone curlews are recorded within Casuarina woodlands, saltmarsh and mangroves (Price 2004). The important structural elements of Bush Stone-curlew habitat appear to be: | E1 | - | Marginal habitat present. Unlikely to be significantly impacted as a result of the proposed development |

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| | | ○ a low sparse ground cover<br>○ some fallen timber and leaf litter<br>○ a general lack of a shrubby understorey<br>○ open woodlands (DECC, 2006: 8)<br>Foraging however, has been noted to occur over a broader spectrum of habitats including paddocks, grasslands, domestic areas (gardens, sports fields, [golf courses, residential areas pers. Obs] etc), estuarine areas (mudflats, saltmarsh, mangrove forest, swamp oak, melaleuca forest) (NPWS, 1999; 2006).<br><br>As the species utilizes a wide range of habitats (including modified residential areas) it is considered most of the site represents potential habitat. During the survey period the curlew was not recorded via diurnal and nocturnal investigations, heard vocalising or encountered in response to amplified call playback. It is considered unlikely that the proposal will have a significant impact upon this species. | | | |
| Beach Stone-curlew (*Esacus magnirostris*) | Unlikely | The beach stone-curlew is usually found on open, undisturbed beaches, islands, reefs, and estuarine intertidal sand and mudflats, preferring beaches with estuaries or mangroves nearby. However, this species also frequents river mouths, offshore sandbars associated with coral atolls, reefs and rock platforms, and coastal lagoons. The beach stone-curlew has been observed around the north coast of Australia and associated islands from Derby in Western Australia to the Manning River in New South Wales. The species has largely disappeared from the south-eastern part of its former range, and is now rarely recorded on ocean beaches in New South Wales.<br><br>Preferred habitat for the Beach Stone-curlew is considered absent from the site. It is considered highly unlikely that the proposal will have a significant impact upon this species. | E4A | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Comb-crested Jacana (*Irediparra gallinacea*) | Unlikely | This species inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies It occurs throughout coastal Australia and well inland in the north from the Kimberley to Sydney (DEC, 2005).<br><br>Preferred habitat for the Comb-crested Jacana is considered absent from the site. The species was not recorded on site during site survey efforts and is considered unlikely to be significantly impacted upon as a result of the proposed development. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Glossy Black-cockatoo (*Calyptorhynchus lathami*) | Unlikely | Glossy Black Cockatoos are uncommon parrots found in scattered localities in the forests and woodlands of eastern Australia and Kangaroo Island (Forshaw, 1981). The eastern subspecies of Glossy Black Cockatoos seems thinly distributed through its range with the highest densities occurring in south-eastern Queensland and north-eastern New South Wales (Forshaw, 1989). The main habitat of the eastern subspecies is *Eucalyptus* woodlands and forest with moderate-high densities of *Allocasuarina* which are required for feeding (Clout, | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the |

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| | | 1989; Park & Borsboom, 1996; Forshaw & Cooper, 1989; Crome & Shields, 1992; Cleland & Sims, 1968; Garnett, 1992b; Blakers *et al*, 1984). Suitable senescent trees (large hollow within a live or dead Eucalypt: 10-20m, Depth: 40-120cm, Entry: ~21cm: Inside Dia: ~23cm (Forshaw, 1981; Gibbons & Lindenmayer, 2002)) are also required for nesting.<br><br>Preferred substantial areas of eucalypt forest/woodland habitat containing feed trees (*i.e. Allocasuarina spp.*) are absent from the site. Additionally, no suitable sized hollows were recorded within the site. Survey included dusk avifauna searches and dusk amplified call playback which did not locate the species during the survey period. It is considered unlikely that the proposed development will have a significant impact upon this species. | | | proposed development. |
| Coxen's Fig-Parrot (*Cyclopsitta diophthalma coxeni*) | Unlikely | The small, predominantly green Coxen's Fig Parrot is found wherever fig trees are present in lowland and upland forest types, riparian corridors, farmland and urban environments (Coxen's Fig-Parrot Recovery Team 2001). Seeds of native figs are the major food source of this endangered bird species (Forshaw 1981, Romer and Spittall 1994, Pizzey and Knight 1997). The Moreton Bay Fig (*Ficus macrophylla*) and Green-leaved Strangler Fig (*F. watkinsiana*) are preferred species. Most records of Coxen's Fig-Parrot have been taken within small remnant stands, forest edges (Holmes 1994) or thin strips of gallery forest (Norris 1964). Subtropical rainforest, dry rainforest, sclerophyll forest and subtropical rainforest are preferred nesting sites (Coxen's Fig-Parrot Recovery Team 2001). High trees within or near the edge of rainforest are suitable for nesting. Coxen's Fig-Parrot is estimated to occur in four subpopulations: greater Bundaberg region, Maleny/Imbil/Kin Kin Creek area, the Qld/NSW border area (Lamington National Park, Whian Whian State Forest, Alstonville plateau), and the upper Hastings River catchment. This estimate is considered to be of low reliability (i.e. there is uncertainty about the number of subpopulations and the extent of genetic separation between subpopulations) (Garnett & Crowley 2000 in DSEWPC, 2013). Most recent records of the species are recorded from the Lamington Plateau (Qld) with only seven unconfirmed sightings recorded from NSW since 1981. It is estimated that the remaining wild population of the species may be less than 100 individuals (DSEWPC, 2013).<br><br>Preferred habitat (rainforest containing Figs) is absent from the subject site and the species was not recorded during survey efforts of the site. It is considered unlikely that the proposed development will have a significant impact upon this species. | E4A | E | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Diamond Firetail (*Stagonopleura guttata*) | Unlikely | The Diamond Firetail is a brightly coloured finch that occupies eucalypt woodlands, forests and mallee where there is a grassy understorey. Firetails build bottle-shaped nests in trees and bushes, and forage on the ground, largely for grass seeds and other plant material, but also for insects (Blakers et al. 1984, Read 1994). | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |

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| | | Favoured eucalypt woodland containing a grassy understorey is considered absent from the site. The species was not recorded during survey efforts of the site. It is considered unlikely that the proposed development will have a significant impact upon this species. | | | |
| Little Lorikeet (*Glossopsitta pusilla*) | Possible | The distribution of the Little Lorikeet extends from just north of Cairns, around the east coast of Australia, to Adelaide. In New South Wales Little Lorikeets are distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri (Barrett *et al*. 2003). There is no evidence of regular migration, but Little Lorikeets are generally considered to be nomadic (Higgins 1999), with irregular large or small influxes of individuals occurring at any time of year, apparently related to food availability. Little Lorikeets mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. In south-east Queensland (Smyth *et al*. 2002), Little Lorikeets were more likely to occupy forest sites with relatively short to intermediate logging rotations (15–23 years) and sites that have had short intervals (2.5– 4 years) between fires" (DECC, 2009).<br><br>Although extensive sclerophyll/eucalypt forests are absent from the site, the residual Paperbark and Swamp Mahogany trees may provide foraging resources for the species. The site is well removed from known breeding grounds of the little lorikeet. The distance of the site from preferred foraging areas proximate to the Great Dividing Range reduces the importance of the site for the little lorikeet which was not recorded. It is considered unlikely that the proposal will significantly impact the Little Lorikeet. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Eastern Grass Owl (*Tyto longimembris*) | Unlikely | This species is generally recorded within tussock-grasslands but has also been noted to occur within heathland, swamps, coastal dunes, tree-lined creeks, treeless plains, mangrove fringes, grassy gaps between trees and crops and sugar cane plantation (Garnett and Crowley 2000; Pizzey and Knight, 1997). Within these habitats it sources a wide range of prey including birds, insects and terrestrial mammals. However, it feeds predominately on rodents and its population numbers can fluctuate wildly with the rise and fall of prey populations (Olsend and Doran, 2002). The fall of primary prey species following plague events (during which owl breeding increases) can result in widespread dispersal by the Owls with starvation also noted as the forage base reduces (Debus et al, 1998).<br><br>Preferred habitat for the Eastern Grass Owl is considered absent from the site given the largely maintained nature of the groundstorey. The species was not recorded during recent or previously conducted fauna surveys and is considered unlikely to be significantly impacted upon as a result of the proposal. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Masked Owl (*Tyto novaehollandiae*) | Possible | The Masked Owl lives in eucalypt forests and woodlands from the coast, where it is most abundant, to the western plains (Kavanagh 2002b in NPWS, 2005). Within suitable habitat | V | - | This species is considered |

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| | | that species occupies a range of 5-10km$^2$ where it forages mostly upon rodents and marsupials, although this may be supplemented by bandicoots, arboreal mammals (Sugar Glider, Common Ringtail Possum) and some birds with introduced rodents and rabbits becoming important in disturbed environments (Debus, 1993, Kavanagh, 1996; NPWS, 2005). Habitats containing stands of large, hollow bearing eucalypts are also critical to roosting and nesting (NPWS, 2005; Kavanagh and Murray, 1996).<br><br>Although the site may fall within the hunting range for the Masked Owl, it is unlikely to represent significant habitat within its home range given the small size of the site (in comparison to the species home range). Suitable hollows were noted recorded within the site. The species was not recorded during nocturnal survey efforts of the site. It is considered unlikely that the proposal will have a significantly impact upon the Masked Owl. | | | unlikely to be significantly affected by the proposed development |
| Sooty Owl (*Tyto tenebricosa*) | Possible | This species is known predominantly from dry, subtropical and warm temperate rainforest and wet sclerophyll forest of the coastal, escarpment and eastern tablelands regions of NSW (Kavanagh 2002; DEC, 2005). The owl is reported as occupying the easternmost one-eighth of NSW (Debus 1994; DEC, 2005). Within this habitat it feeds largely on mammals ranging from small terrestrial species to medium sized arboreal species such as the Common Ringtail Possum, Sugar Glider, Bush Rat and Brown Antechinus (DEC, 2005; Lundie-Jenkins, 1992).<br><br>Nesting occurs in large hollow trees which are mostly Eucalypts but can include Moreton Bay Figs and Giant Stinging Trees (DEC, 2005). A very large home range has been estimated as "200-800 ha according to habitat productivity; measured as 3000 ha (1000 ha actually used) for one unmated, nonbreeding individual in marginal habitat, and 450+ ha for one adult female in continuous habitat of mesic gullies within dry forest (Kavanagh 1997, Kavanagh and Jackson 1997 in DEC, 2005: 12). Kavanagh & Stanton (2002) further note that small (<200 ha) fragments do not provide a significant reservoir for populations of large forest owl (Sooty, Powerful, Masked) species.<br><br>Although the site may fall within the hunting range for the Sooty Owl, it is unlikely to represent significant habitat within its home range given the small size of the site and paucity of suitable forest/woodland areas. No suitable hollow bearing trees were observed within the subject site. The species was not recorded during nocturnal survey efforts of the site. Reviewing the above, it is considered that no significant impact will arise upon the sooty owl as a result of the proposed development. | V | - | This species is considered unlikely to be significantly affected by the proposed development |
| White-eared Monarch (*Carterornis leucotis*) | Unlikely | This species generally occurs within Coastal/Subtropical/Littoral Rainforests and occasionally Eucalypt/Riparian Forest, Mangroves and Swamp Sclerophyll with mesomorphic understorey along the eastern coast of Australia from Cape York to the Tweed River (Readers Digest, 2002; DEC, 2005). In NSW, White-eared Monarchs occurs in rainforest, especially drier types, | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a |

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| | | such as littoral rainforest, as well as wet and dry sclerophyll forests, swamp forest and regrowth forest.<br><br>• They appear to prefer the ecotone between rainforest and other open vegetation types or the edges of rainforest, such as along roads.<br>• They are highly active when foraging, characteristically sallying, hovering and fluttering around the outer foliage of rainforest trees. They are usually observed high in the canopy or subcanopy<br><br>Preferred habitat for the White-eared Monarch is considered absent from the site and is unlikely to be significantly impacted upon as a result of the proposed development. The species was not observed during survey efforts of the site. | | | result of the proposed development. |
| Spotted-tailed Quoll (*Dasyurus maculatus*) | Unlikely | The species has been recorded from a wide range of habitats such as rainforest, open forest, woodland, coastal heathland, and inland riparian forest (Edgar and Belcher, 2002; Forest Practices Board, 2002). Additional habitat requirements include suitable den sites (such as hollow logs, tree hollows, rock outcrops or caves) and an abundance of food (such as birds and small mammals) (NSWNPWS, 1999; Edgar & Belcher, 2001; Belcher, 2000; Jones & Ross, 1996). Habitat range for males has been estimated to be as large as 2000-2200 hectares per individual, while for females, which are more protective of their dens, this value is considerably less at between 700-850 hectares per individual (Belcher, 2000; NPWS, 1999). In addition, Quolls are known to frequently swap dens and disperse large distances on any one night.<br><br>Given the modified and fragmented nature of the site, suitable habitat for the quoll is considered absent. Furthermore, rocky outcrops/cave areas providing potential denning and latrine sites were not encountered on the site. It is considered unlikely that the proposal will have a significant impact upon the spotted-tailed quoll. | V | E | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Common Planigale (*Planigale maculata*) | Unlikely | This species is known to 'inhabit a broad range of habitats incorporating a dense ground cover layer including rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas (Redhead in Strahan, 2002; Lewis, 2005). In northern NSW, it has been suggested that their distribution often corresponds with the low lying flat and undulating areas of the coastal plains often near intensively settled areas (Gilmore and Parnaby 1994 in Lewis, 2005). A small population of the species has been recently recorded on the northern banks of the Cobaki Broadwater in association with Swamp Mahogany/Brushbox Forest (Ecopro, 2004; Lewis Ecological Surveys, 2004). A population of Planigales is also known further south of the site within the Koala Beach development where the species has been recorded within Brushbox Forest, Tall Eucalypt dominated Wet Sclerophyll Forest, Swamp Forest, Regrowth Eucalypt | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |

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| | | Forest and utilising artificial habitats within recorded habitats (AKF, 2005; TSC, 2007). Habitat features that appear most important to the local Planigale population include:<br>i) Dense or scattered tree canopy-cover;<br>ii) Dense ground-cover vegetation; and<br>iii) Areas within or adjacent to low-lying sites subject to seasonally wet conditions, with occasional inundation for short periods (AKF, 2005).<br><br>Preferred habitat for the Common Planigale is considered absent from the development site given the absence of dense ground cover of litter and connected bushland. Potential habitat for the planigale occurs to the west in association with expansive areas of Paperbark Forests containing a well-developed understorey further to the south and west.<br><br>The species have been historically recorded as a part of the Byron bypass Ecological Studies within bushland northwest of the subject site (Mills and Associates 1997, Sandpiper Ecological Surveys 2001).<br><br>It is considered unlikely that the proposed development will have a significant impact upon the Common Planigale. | | | |
| Koala (*Phascolarctos cinereus*) | Possible | This species primarily occurs within Eucalypt Forest and Woodlands containing a suitable density of favoured food trees within coastal eastern and southeastern Australia. Preferred habitat generally contains a high percentage of primary food trees although underlying geology and soil type can be an important factor. Eucalypt Forests associated with drainage lines and floodplains of richer soil types (i.e. moisture and nutrients) can also be favoured due to feed trees containing higher levels of nutrients and less potential for toxicity (Hindell & Lee, 1990; Moore & Foley, 2000).<br><br>Within SEQLD six primary foraging trees were identified by Pahl (1993); Tallowwood (*Eucalyptus microcorys*), Forest Red Gum (*E. tereticornis*), Scribbly Gum (*E. racemosa*), Grey Gum (*E. propinqua*), Red Mahogany (*E. resinifera*) and White Stringybark (*E. tindaliae*). Further research undertaken by Phillips & Callaghan (1996) in Tweed Shire indicates that Swamp Mahogany (*E. robusta*) and Blue Gum (*E. tereticornis*) [including hybrids of the two] on alluvial deposits and Quaternary and Neranleigh-Fernvale Group geomorphologies were considered to be primary habitats. Areas with sub-dominance of these species on Neranleigh-Fernvale alliances supporting Blue Gum (*E. tereticornis*), Tallowwood (*E. microcorys*) and/or Grey Gum (*E. propinqua*) comprise secondary habitat or primary habitat depending on the density of the latter two species. Phillips & Callaghan (1998) also noted Tallowwood to be a primary browse species and two types of Grey Gum (*E. propinqua, E. biturbinata)* to be secondary browse species in Currumbin. | V | V | Unlikely to be significantly impacted upon as a result of the proposed development.<br><br>'Test of Significance' conducted. |

Recent studies (Biolink, 2007) indicate that *Eucalyptus tereticornis, E. microcorys* and *E. propinqua/E. biturbinata* are the most preferred koala food trees throughout the Gold Coast LGA.
Within the Tweed Coast Swamp Mahogany *Eucalyptus robusta* and Forest Red Gum *E. tereticornis* are the most preferred tree species with Tallowwood *E. microcorys* and Grey Gum *E. propinqua* being the next most preferred (Biolink, 2011).

Recent studies (Biolink, 2012) notes Swamp Mahogany (*E. robusta*), Forest Red Gum (*E. tereticornis*) and Tallowwood (*Eucalyptus microcorys*) being primary food tree species with Grey Gum (*E. propinqua*) being a secondary food tree species within Byron Shire.

Within utilized Eucalypt Forest habitat the koala spends most of its time in distinct home-ranges which may overlap if available habitat area is reduced. Males are territorial but a dominance-hierarchy exists, and they may attack during the summer breeding season. Home ranges of the species are considered to be large and can vary dependent upon habitat quality and extent. Studies have shown various home range sizes exist with the males usually larger than the female (Male 135ha, Female: 110ha [Ellis et al, 2002], Male: 34.4ha, Female: 15ha [White, 1999]).

A review of a number of published scientific reports notes that Koala density generally ranges between 0.02 and 1.26 animals per hectare. Densities are considered to vary dependent upon habitat quality, size, connectivity, presence of impediments to movement (stock fences, dogs, roads etc).

| Source | Study Location | Habitat Type | Additional Comments | Koala/ha |
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| Dique et al, 2003 | Southeast QLD Pine Rivers Shire | Tall shrubby open forest (Tertiary surfaces) and Tall open forest upon metamorphics | Stratified by two habitat descriptions 'urban' and 'bushland' | 0-0.76 |

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| | | | Dique et al, 2004 | Southeast QLD Koala Coast ~375sqm of Redland, Logan and Brisbane City shires | Eucalypt Forests. Predominately RE 12.9-10.4 & 12.11.5 | Study stratified by habitat descriptions: 'urban', 'remnant bushland', 'bushland' and 'other'. Remnant and bushland areas further stratified by proximity to the centre of the study area (high density=close to centre, low density=further away) | Range 0.02-1.26<br>Urban: 0.17 +/- 0.013<br>High remnant: 0.70 +/- 0.023<br>Low remnant: 0.20 +-/0.014<br>High bushland: 0.30+/-0.006<br>Low bushland: 0.11 +/-0.007<br>Other: 0 | | | |
| | | | White and Kunst 1990 | Southeast QLD Sheldon | Eucalypt Forest | | 0.4 (0.3-0.46) | | | |
| | | | Sullivan et a 2004 | Southwest QLD | Eucalypt Forest/woodland within the mulgalands | Habitat stratified by floristics and landzone. | 0.0007-2.513 | | | |
| | | | Biolink 2007 | Coombabah Koala Habitat Area | Mapped gold coast city vegetation (per Ryan et al, 2003) filtered to exclude communities not containing eucalypts | Spot assessment technique for koala faecal pellets. Not based upon koala observation transects per *Dique, 2003; EPA, 2005.* | 0.22+/-0.04 | | | |

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| | | <table><tr><td>Biolink 2007</td><td>Coomera-Pimpama Koala Habitat Area</td><td>Mapped gold coast city vegetation (per Ryan et al, 2003) filtered to exclude communities not containing eucalypts</td><td>Spot assessment technique for koala faecal pellets. Not based upon koala observation transects per *Dique, 2003; EPA, 2005.*</td><td>0.23+/-0.03</td></tr></table><br>Although suitable habitat (Eucalypt forest) is considered to be absent from the site, favoured foraging trees (*Eucalyptus robusta*) are present (although very scarce).<br><br>No koalas were recorded during the survey via diurnal searches, nocturnal spotlighting, amplified call playback or trunk basal searches for scats. Additionally, no scratch marks indicative of a Koala was observed on any smooth barked trees.<br><br>The proposal seeks to remove two (2) Swamp Mahogany (*Eucalyptus robusta*), as well as ~997ha of potential habitat (Community 1). This is not considered to be significant for the species given that the site is adjoining a heavily urbanised area, and the site is proximate to a significant area of potential habitat (to the west). Compensatory plantings measures are proposed for the removal of the two (2) Swamp Mahogany (as well as the removal of all assessable native vegetation) which is to occur either onsite, or within land in close proximity to the site.<br><br>Reviewing the above, it is considered unlikely that the proposal will have a significant impact upon the local Koala population.<br><br>Nevertheless, a 'Test of Significance' was conducted for this species. | | | |
| Long-nosed Potoroo (*Potorous tridactylus*) | Unlikely | Long-nosed Potoroos are generally restricted to areas with an annual rainfall greater than 760 mm where they inhabit dry and wet sclerophyll forests and woodland with a heathy understorey (Johnson in Strahan, 2002; DEC, 2005). The preferred habitat in north eastern NSW is dry and wet open shrubland (Mason 1997, DEC, 2005, Johnston in Strahan, 2002). In all habitats the species requires relatively thick groundcover growing on friable soils (Bennett, 1993). Within these areas the Potoroo digs for its food the main component of which is | V | V | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |

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| | | hypogeal fungi with other important items including hard-bodied arthropods, vascular plant tissues, seeds and fleshy fruits (Bennett & Baxter, 1989; Claridge et al, 1993).<br><br>Required habitat (forested areas containing dense understorey elements in the form of ferns and shrubs) is considered absent from the site. It is considered unlikely that the proposed development will have a significant impact upon this species. | | | |
| Grey-headed Flying Fox (*Pteropus poliocephalus*) | Likely | The Grey-headed Flying-fox inhabits subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (Eby, 1995). Urban gardens and cultivated fruit crops also provide habitat for this species (NSW NPWS 1999c). Grey-headed Flying-foxes forage on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca, Banksia (Eby, 2000) and fruits of rainforest trees and vines (NSW NPWS 1999c). During periods when native food is limited, Grey-headed Flying-foxes disperse from colonial roosts, often foraging in cultivated gardens and fruit crops (NSW NPWS 1999c). This species roosts in large aggregations or camps in close proximity (20 km or less) to a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest (Eby, 1995). This species is a canopy-feeding frugivore, blossom-eater and nectarivore of rainforests, open forests, woodlands, Melaleuca swamps and Banksia woodlands. As such, it plays an important ecosystem function by providing a means of seed dispersal and pollination for many indigenous tree species (Eby 1996; Pallin 2000).<br><br>All vegetated areas of the site represent potential foraging habitat for this wide-ranging species, although similar habitat occurs in abundance throughout the locality at a much larger scale (i.e. Expansive areas of Paperbark Forest to the east, Cumbebin Swamp Nature Reserve, Arakwal National Park, Tyagarah Nature Reserve, private allotments etc.).<br><br>No evidence of roosting on the site was observed with the nearest known flying-fox roost camp occurring ~1km northeast of the site along Middleton Street (DoEE, 2020). It is considered unlikely that this colony would be affected by the proposal.<br><br>Whilst not recorded during site survey efforts, it is considered likely that the species would utilise areas of the site during peak flowering and fruiting periods (i.e. paperbarks, eucalypts, ornamental species etc.).<br><br>The proposal will result in minor loss of potential foraging resources for the species. Given the abundance of forage species in the locality and the species is capable of travelling extensive distances to forage, it is considered unlikely that the proposed development will significantly impact the Grey-headed Flying-fox. | V | V | Species likely to utilise site during flowering periods.<br><br>No roosting sites recorded.<br><br>'Test of Significance' conducted. |

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| | | Nevertheless, a test of significance was conducted for this species given the likely occurrence of this species within the site (refer to the later sections of the report). | | | |
| Common Blossom-bat (*Syconycteris australis*) | Possible | This species is one of the smallest members of the flying fox family (Pteropodidae) and is considered to be a specialist pollen feeder favouring Banksia, Melaleuca, Callistemon and certain species of Eucalypt (Strahan eds, 2002). Required habitats include Coastal rainforest, heathlands and Melaleuca swamps. Roosting is noted to occur in Littoral Rainforest with foraging occurring in proximate heathland and melaleuca forest primarily on the flowers of *Banksia integrifolia* (Law, 1993; 1994; 1996).<br><br>Potential habitat is considered to occur in all forested areas of the site which includes paperbarks and eucalypts, although the species was not recorded during spotlighting efforts of the site.<br><br>Given the abundance of preferred foraging material within the locality (i.e. expansive areas of Paperbark Forest east of the site) and the absence of roosting sites, it is considered unlikely that the proposed development will have a significant impact upon the Common Blossom Bat. | V | - | This species is considered unlikely to be significantly affected by the proposed development. |
| Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) | Possible | This species of bats utilises most habitats across its wide distribution and hunts over the canopy in forested areas and lower within mallee or open country (DECC, 2005). Roosting may occur within hollow trees and buildings and also within caves and derelict mines (NPWS, 2004; Richards in Van Dyck and Strahan, 2008). DECC (2005) notes that in treeless areas the sheathtail bat is known to utilise mammal burrows.<br><br>Although the site may fall within the fly way zone for the species between habitats of the locality, is not considered important for the species given its small size and abundance of similar habitats within the locality. No roosting sites were observed on site during site inspection. It is considered unlikely that the proposed development will significantly impact the species given the minor loss of potential habitat in comparison to the available habitat within the locality. | V | - | This species is considered unlikely to be significantly affected by the proposed development. |
| Eastern Freetail-bat (*Mormopterus norfolkensis*) | Possible | Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. This species forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.<br><br>All forested areas of the site are considered to represent potential Eastern Free-tail Bat habitat although roosting sites were not observed. It is considered unlikely that the proposal will have a significant impact upon this species given the availability of suitable habitat within the locality. | V | - | This species is considered unlikely to be significantly affected by the proposed development. |

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| Little Bentwing-bat (*Miniopterus australis*) | Likely | This species utilises well-timbered habitats including rainforest, *Melaleuca* swamps and dry sclerophyll forests where it It feeds on insects within the canopy and requires caves, mines, stormwater drains and/or tree hollows to roost (Strahan eds, 2002). In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young.<br><br>All forested areas of the site are considered to represent potential habitat for the Little Bentwing bat, although roosting sites were not observed. The species is regularly recorded within the region (pers obs.).<br><br>Given the abundance of similar habitats within the locality, it is considered unlikely that the proposed development will significantly impact the species.<br><br>As the species is commonly recorded within the locality, and is likely to utilise the site, a 'test of significance' was conducted for the species (refer to the later sections of the report). | V | - | Species likely to utilise the site.<br><br>No roosting sites recorded.<br><br>'Test of Significance' conducted. |
| Eastern Bentwing-bat (*Miniopterus oceanensis*) | Possible | This species usually forages on insects within intact, well timbered forest complexes and have been found to roost within caves, tunnels, stormwater culverts or disused mining areas (Strahan eds, 2002; DEH, 2005). They utilize a broad range of habits including wet and dry sclerophyll forest, open woodland, paperbark forests, rainforests and open grasslands (North & Pasic, 2006). Twelve known maternity roost sites occur within its distribution ranging from tens of thousands to >100000 individuals. The known large roost sites are located in limestone and sandstone caves, abandoned gold mines, concrete bunkers and lava tubes. Outside the breeding season the eastern bentwing often selects cool areas within caves, mines, tunnels, drains and bridges (Hoye & Hall in Van Dyck & Strahan, 2008).<br><br>All forested habitats of the site represent potential habitat for the Eastern Bentwing which is also known to forage over modified habitats such as grasslands although significant roosting/breeding areas are considered to be absent. Given the small nature of proposed disturbance in comparison to the available habitat within the locality, it is considered unlikely that the proposal will have a significant impact upon this species. | V | - | This species is considered unlikely to be significantly affected by the proposed development. |
| Southern Myotis (*Myotis macropus*) | Unlikely | The Myotis roosts within caves, tunnels, hollow-bearing trees, bridges, buildings and dense tree foliage always in close proximity to permanent water (NPWS, 2002; Richards, 2002). Breeding colonies may consist of 10-15 individuals or occasionally up to several hundred. Within breeding colonies small clusters are made where a male establishes a territory from which other males are actively excluded and breeding females are protected. Outside of breeding males roost solitarily within a defended zone or established a small group of up to 20 males. | V | - | This species is considered unlikely to be significantly affected by the proposed development. |

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| | | Preferred habitat (permanent waterbodies) is absent from the site. The drainage line along the eastern boundary of the site, within the road reserve, is heavily infested with weeds with open water not visible. No roosting sites were observed. It is considered unlikely that the proposed development will have a significant impact upon this species. | | | |
| Eastern Long-eared Bat (*Nyctophilus bifax*) | Possible | This species of bat inhabits lowland subtropical rainforest and wet and swamp eucalypt forest, extending into adjacent moist eucalypt forest with coastal rainforest and patches of coastal scrub particularly favoured (DEC, 2005; NPWS, 2002). Roosting occurs within tree-hollows, under bark and/or palm fronds and within dense foliage with a seasonal shift in roost sites from rainforest edges (summer) to the rainforest interior (winter) (NPWS, 2002; Parnaby in Strahan, 2002; Lunney et al, 1995).<br><br>All forested areas of the site are considered to represent potential Eastern Long-eared Bat habitat although roosting sites were not observed. It is considered unlikely that the proposal will have a significant impact upon this species given small nature of the proposal in comparison to the availability of suitable habitat within the locality. | V | - | This species is considered unlikely to be significantly affected by the proposed development. |
| Greater Broad-nosed Bat (*Scoteanax rueppellii*) | Possible | This species of bat favours the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland but also extends to the coast over much of its range (DEC, 2005, Hoye & Richards in Strahan eds, 2002). Within this range it favours tall wet forest including creek/river corridors although it will also utilise a variety of other habitats such ranging from dry eucalypt woodlands to rainforest (DEC, 2005, Hoye & Richards in Strahan eds, 2002). This species is noted to favour roosts within tree hollows although it has also been recorded within buildings (DEC, 2005, Hoye & Richards in Strahan eds, 2002). Radiotracking within Bundjalung National Park noted the species to roost exclusively within Melaleuca quinquenervia (Campbell, 2001).<br><br>All forested areas of the site are considered to represent potential Greater Broad-nosed Bat habitat although roosting sites were not observed. It is considered unlikely that the proposal will have a significant impact upon this species given the availability of suitable habitat within the locality. | V | - | This species is considered unlikely to be significantly affected by the proposed development. |
| Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*) | Unlikely | In NSW the Eastern Chestnut Mouse is mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands. Optimal habitat appears to be in vigorously regenerating heathland burnt from 18 months to four years previously. By the time the heath is mature, the larger Swamp Rat becomes dominant, and Eastern Chestnut Mouse numbers drop again. Feeds at night via runways through the grassy and sedge understorey, within an area of less than half a hectare. It has a broad diet of grass stems, invertebrates, fungi and seeds, with the relative significance of each component varying seasonally. | V | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |

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| | | Potential habitat for the Eastern Chestnut Mouse is considered absent from the subject site given the absence of wet heath. It is considered unlikely that the proposed development will significantly impact the species. | | | |
| Southern Pink Underwing Moth (*Phyllodes imperialis southern subspecies*) | Unlikely | *Phyllodes imperialis* southern ssp. ANIC 3333 is distributed from Nambour, south-east Queensland, to Dorrigo in northern NSW (Clarke & Spier-Ashcroft, 2003). It is currently known from five locations of which Mary Cairncross Scenic Reserve near Maleny (Queensland) contains the only confirmed breeding habitat (NSW Scientific Committee, 2003). In Australia, the northern subspecies of P. imperialis occurs in rainforest in northeastern Queensland. Other subspecies occur in Papua-New Guinea, Solomon Islands, Vanuatu and New Caledonia. This subspecies occurs within the Burnett Mary and South East (Queensland) and Northern Rivers (NSW) Natural Resource Management Regions. The subspecies occurs below altitudes of 600 m in undisturbed subtropical rainforest in association with the vine *Carronia multisepalea*.<br><br>Preferred habitat for the Pink Underwing Moth is considered to be absent from the site as rainforest and *Carronia multisepalea* was not recorded. The species was not recorded during site survey efforts. It is considered unlikely that the proposed development will have a significant impact upon the species. | E1 | - | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |
| Mitchell's Rainforest Snail (*Thersites mitchellae*) | Unlikely | This species was formally widely distributed on coastal alluvia between the Richmond and Tweed Rivers (Stanisic, 1998, 2000; NSWNPWS, 2001). NPWS previously funded surveying within northern NSW to determine the extant distribution of the species in relation to its historical distribution. Surveys conducted (1998-2000) have provided limited success with only one robust population being recorded within the region at Stotts Island and evidence of marginal populations present at four additional sites (Stanisic 1998, 2000). An additional population was more recently discovered within Swamp Sclerophyll Forest in Kingscliff (Planit 2002, Stanisic 2003). Within its range the species is restricted to lowland subtropical rainforest and swamp sclerophyll forest with a rainforest understorey, typically on alluvial soils with a basaltic influence (NPWS, 2001, Stanisic 2002).<br><br>Although marginal potential habitat occurs on site in association with the Paperbark Swamp Forest, these areas lack the rainforest elements in the understory which is required for this species. Surveys failed to record the species (or shells) during ground search efforts of the site.<br><br>The species is known to occur within bushland west of the subject site within Paperbark Swamp Forest with some sub-tropical rainforest elements. The species has been recorded within these areas in association with works conducted for the Byron Bay Bypass (GDH, 2015). | E1 | CE | Favoured habitat absent. Unlikely to be significantly impacted as a result of the proposed development. |

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| | | The proposed works footprint is well removed from these recorded areas and is buffered by the railway line. Reviewing the above, it is considered unlikely that the species will be significantly impacted upon as a result of the species. | | | |

*Note: E1 = Endangered (BCA, 2016); E = Endangered (EPBC 1999); E4A = Critically Endangered (BCA, 2016); CE = Critically Endangered (EPBC 1999); and V = Vulnerable (BCA, 2016 and EPBC 1999)*

## 5.4 Areas of Outstanding Biodiversity Value

Areas of Outstanding Biodiversity Value (AOBV) listed under the *Biodiversity Conservation Act 2016* include:

- Wollemia nobilis (the Wollemi pine)
- Little penguin population in Sydney's North Harbour

The proposal will not impact upon any of these AOBV.

## 5.5 Wetlands and Waterways

A significant portion of the site is mapped as containing EcoWetland on Byron's LEP Environmental Values Mapping (refer to **Figure 9**). Site inspection revealed that the majority of the mapping extent is inaccurate (i.e. existing constructed areas mapped as being a wetland), with the majority of the site not reflective of being a wetland. The majority of the site has been historically raised and is not subject to regular ponding. Additionally, there are no natural waterways and/or waterbodies occurring within the subject site.

It is noted that a constructed drainage line occurs along the western boundary of the road reserve, although significantly clogged with weeds. This drainage line will be retained as a part of the proposal with weed removal proposed.

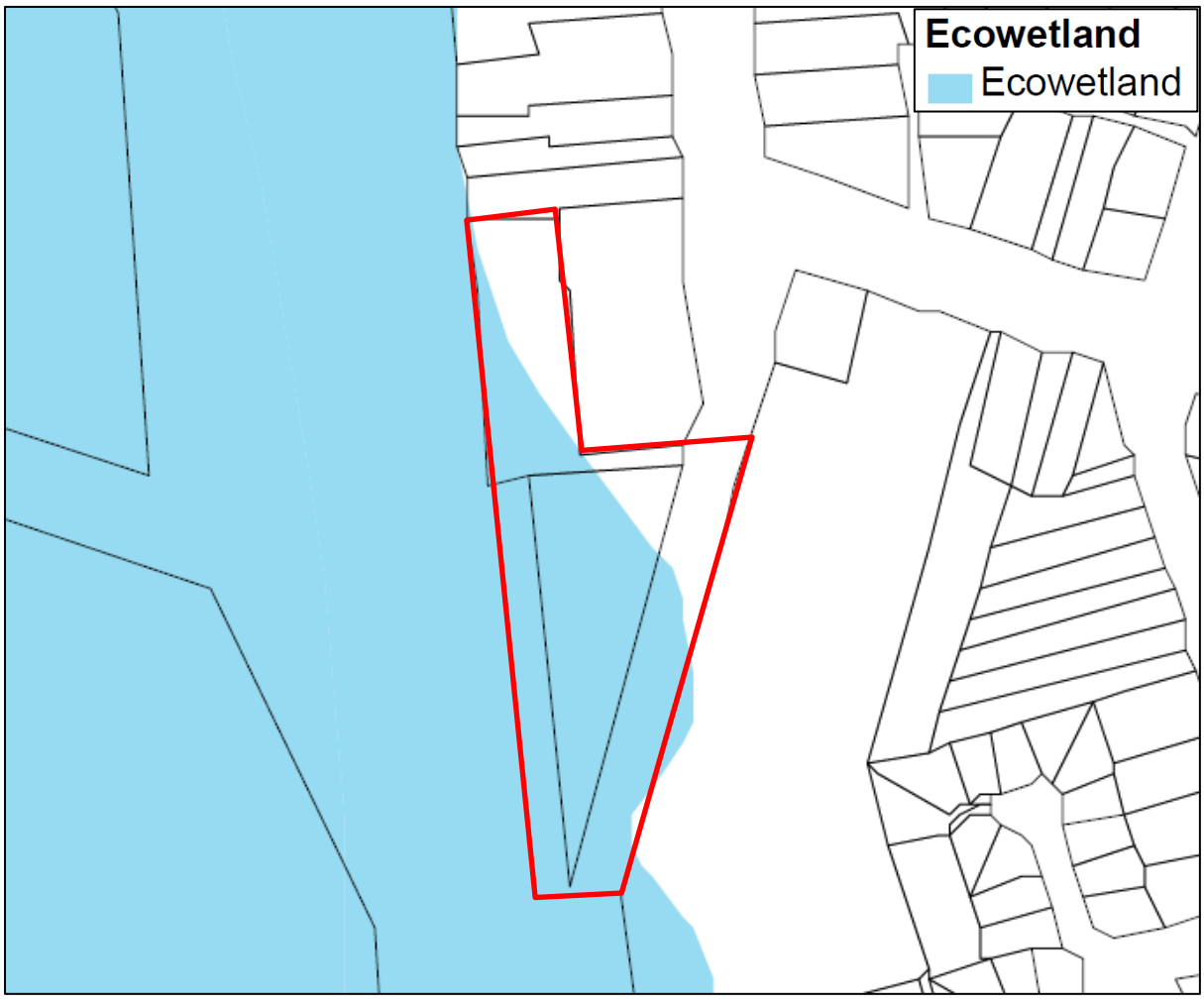


**Figure 9: Byron Shire Environmental Values Mapped [Ecowetlands] (Source: BSC, 2012)**

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|  |  |
| *Drainage line clogged with vegetation* | *Mapped 'Ecowetlands' on the site* |

*SEPP (Coastal Management) 2018*

State Environmental Planning Policy (Coastal Management) 2018, known as the Coastal Management SEPP, defines the coastal zone and establishes state-level planning priorities and development controls to guide decision making for development within the coastal zone. The Coastal Management SEPP gives effect to the objectives of the *Coastal Management Act 2016* from a land use planning perspective, by specifying how development proposals are to be assessed if they fall within the coastal zone.

A small area of 'Coastal Wetlands' has been mapped within the southern section of the subject site (refer to **Figure 10**). Site inspections within these areas revealed that the vegetation community type is reflective of swamp sclerophyll forests (paperbark).

It is noted that the entire subject site occurs within a 'Proximity Area for Coastal Wetlands' (refer to **Figure 10**).

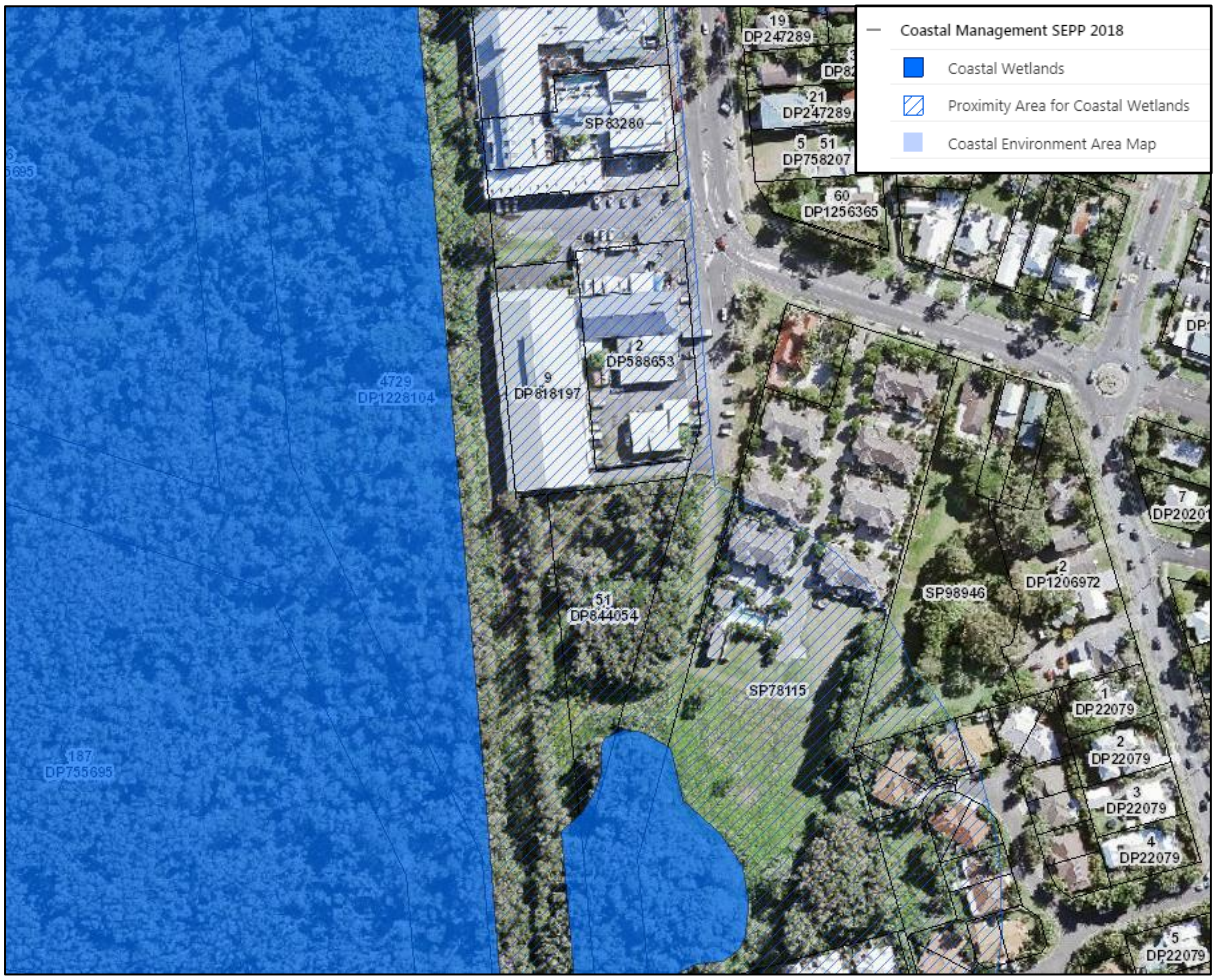


**Figure 10: Mapped Coastal Wetland Areas Surrounding the Site (Source: DPE, 2020)**

*Mapped coastal wetland within the southern areas of the site*



*Mapped coastal wetland within the southern areas of the site*

The proposal has been carefully designed to not encroach within these mapped areas (refer to **Figure 11**). The proposal does not clear native vegetation, harm marine plants or conduct activities listed in Clause 1 (c) on land identified as a 'Coastal Wetland'.

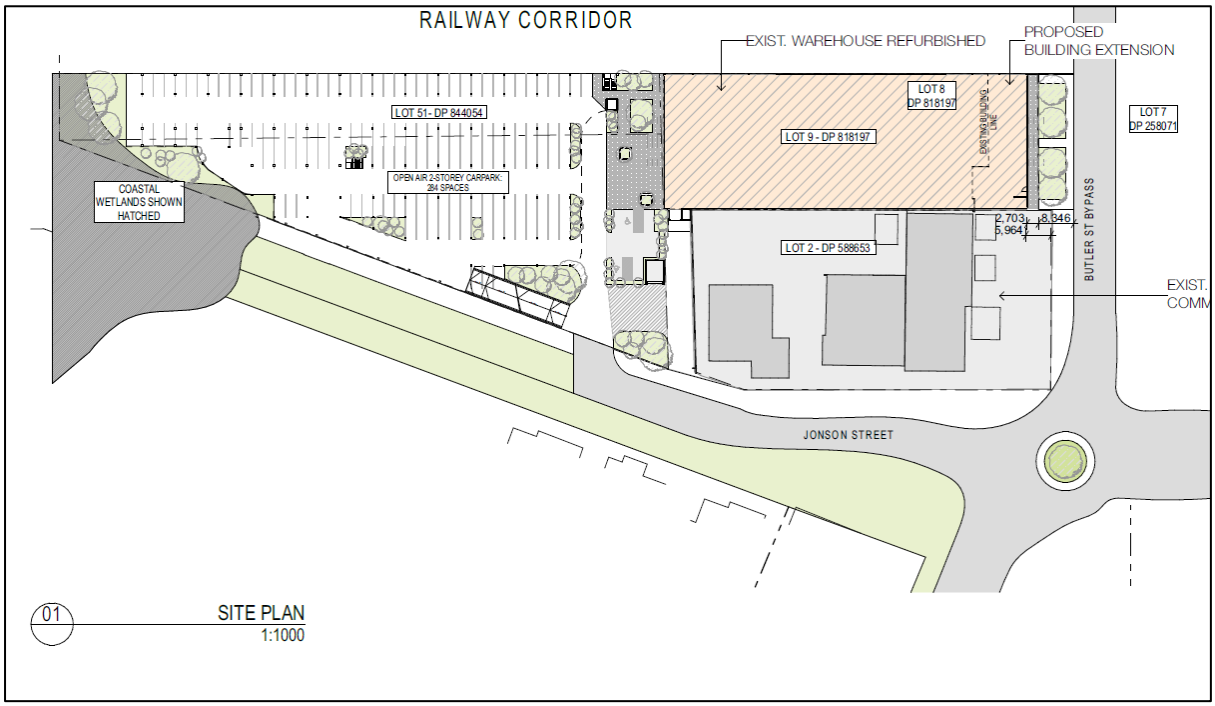


**Figure 11: Proposal Plan with Mapped Coastal Wetland Area**

As the entire subject site occurs within the proximity area (including existing constructed buildings and roadways), avoiding these areas is unachievable.

Given the already elevated platform which is generally flat, only minor earthworks are proposed in order to facilitate the construction of the carpark, and associated structures. This includes levelling the site where required, and the provision of footings for the carpark.

The existing drain which flows from Jonson Street along the western boundary of the road reserve and eventually into the mapped coastal wetland south of the subject site will be retained (refer to the Stormwater Management Plan prepared by Planit Consulting). The drain will be subject to some weed removal and profiling to ensure appropriate flow is achieved.

Mapped Coastal Wetlands west of the subject site is buffered by the railway line. This railway line is raised and acts as a 'barrier' (in terms of flow) between the development site and the mapped Coastal Wetland area to the west.

*Railway Line between the proposal site and mapped 'Coastal Wetland Area' west of the site*

Upon review of the site, it was noted that a portion of the site falls within land subject to flooding. However, BSCs DCP – Chapter C2 – Areas Affected by Flood notes that for CBD infill developments, floor levels canbe retained given that buildings comply with section C2.3.4 – Flood Proofing. Accordingly, the ground floor level shall be as per the existing levels and implement Flood Proofing in accordance with section C2.3.4 (**Figure 12** below).

**C2.3.4 Flood Proofing**

1. Flood Compatible Material

Materials located below the relevant level defined by the **flood planning matrix** must be capable of resisting damage, deterioration, corrosion or decay taking into account the likely time the material would be in contact with flood water and the likely time it would take for the material to subsequently dry out.

2. Services

Services and related equipment, other than electricity meters, must not be located below the relevant flood planning level defined by the **flood planning matrix** unless they have been designed specifically to cope with flood water inundation. The location of electricity meters is regulated by the electricity supply authority.

Unless the electricity supply authority determines otherwise, electrical switches must be placed above the relevant level defined by the **flood planning matrix**. Electrical conduits and cables installed below the relevant level defined by the **flood planning matrix** must be waterproofed or placed in waterproof enclosures.

3. Enclosures

Any enclosure located below the relevant level defined by the **flood planning matrix** must have openings to allow for automatic entry and exit of floodwater for all floods up to the relevant level defined by the **flood planning matrix**.

**Figure 12: Byron Bay Flood Proffing Requirements (BSCs DCP – Chapter C2 – Areas Affected by Flood)**

The site is mapped as having presence of Acid Sulfate Soils (Class 2 and 3) below the surface (refer to **Figure 13**). In addition, preliminary advice obtained from Regional Geotech Solutions suggest that it is likely that ASS will be encountered during excavations for carpark footings. Accordingly, an ASS investigation should be completed prior to construction to determine, if required, soil treatment specifications.

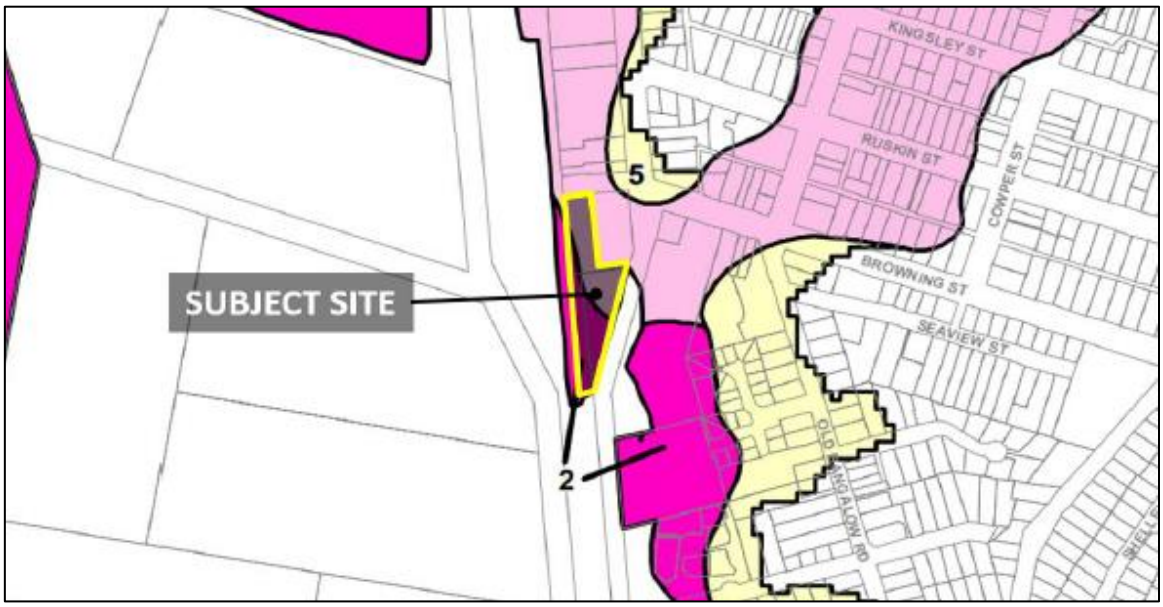


**Figure 13: Subject Site Presence of Acid Sulphate Soils in the Byron Shire Council**

A Stormwater Management Plan (prepared by Planit Consulting) has been prepared for the proposal which demonstrates that the proposed stormwater management measures are appropriate to meet Byron Shire Council's quality objectives. Additionally, appropriate sediment and erosion control measures are to be implemented during the construction phase to management the quantity and quality of stormwater generated during works. These provisions shall be in accordance with the 'Blue Book'. Additional sediment and erosion control measures have also been provided within the Stormwater Management Plan.

These management measures (in addition to other management plans prepared/proposed for the development) will ensure that the proposal does not have an impact upon the biophysical, hydrological or ecological integrity of the adjacent coastal wetland, or the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland.

Further management measures will be prepared within the Construction Environmental Management Plan (CEMP) which will assist in protecting the surrounding environment and ensure there are no significant changes in hydrology or water quality.

## 5.6 Fauna Corridors and Linkage

Wildlife corridors can be defined as 'retained and/or restored systems of (linear) habitat which, at a minimum enhance connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation' (Wilson & Lindenmayer, 1995). Corridors can assist ecological functioning at a variety of spatial and temporal scales from daily foraging movements of individuals, to broad-scale genetic gradients across biogeographical regions (Parsons Brinkerhoff, 2005).

Corridors serve a number of different functions in terms of biodiversity conservation including:

- providing increased foraging area for wide-ranging species;
- providing cover for movement between habitat patches, particularly for cover dependent species and species with poor dispersal ability and enhancing the movement of animals through sub-optimal habitats;

- reducing genetic isolation by maintaining continuity between sub-populations in a metapopulation and thereby preventing and /or reversing localised extinction;
- facilitating access to a mix of habitats and successional stages to those species which require them for different activities (for example, foraging or breeding);
- providing refuge from disturbances such as fire; and
- providing habitat in itself (Wilson, A. & Lindenmayer 1995; Lindenmayer, 1994; Bennett, 1999).

How species use the corridor network will depend largely on the home and activity ranges of the species, their habitat requirements and the ecological characteristics of the corridor. For example, some large or mobile species may make direct movements through the corridor network, moving from one patch of habitat to another. These direct movements may be on the scale of a foraging expedition or a migration (Bennett 1990b). Other species may have movements by single individuals punctuated by pauses in the corridor, which can last anything from a small foraging or resting bout to weeks and even months. If the corridor contains sufficient resources to maintain a population, then continuity through the corridor may be through gene flow through the resident population (Bennett 1990b; Wilson, A. & Lindenmayer 1995).

For example, a mobile species with a large home range (i.e. koala) may regularly traverse a corridor to move between favoured feeding grounds or in attempt to access mates, whereas a species with a comparably minor home range (i.e. antechinus) may spend its entire life within a portion of the same corridor.

The southern half of the subject site has been located as occurring within Byron Shire Council's Wildlife Corridor Mapping (refer **Figure 14**).

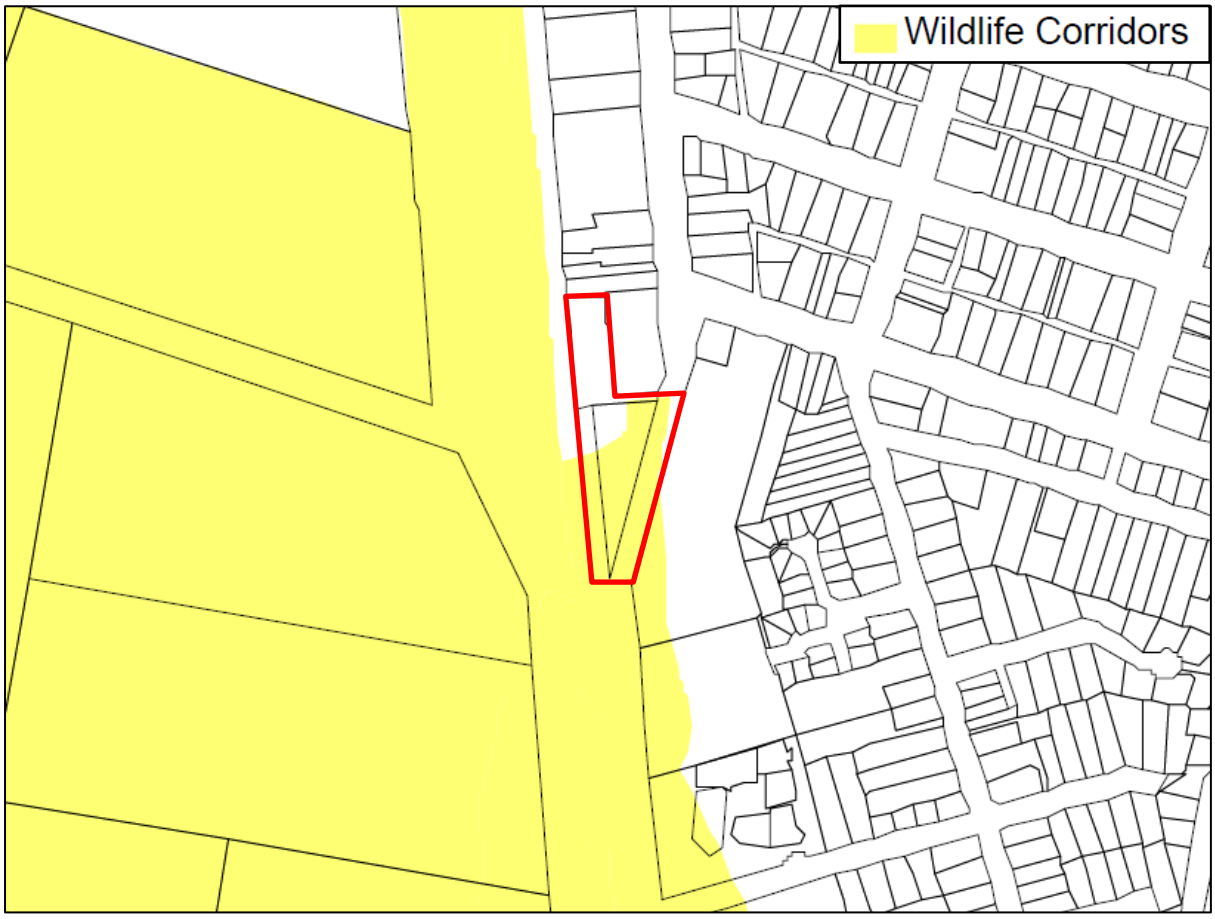


**Figure 14: Byron Shire Environmental Values Mapping [Wildlife Corridors] (Source: BSC, 2012)**

A review of the largely modified and fragmented habitats of the site indicates that the site is not likely to perform a significant terrestrial dispersal function and as such it is considered unlikely that redevelopment would create any significant dispersal barriers for terrestrial fauna species than what is already present. The subject site occurs within the very eastern extent of the mapped wildlife corridor with heavily urbanised areas occurring further to the north and east of the site. Fence lines, dwellings and roadways immediately to the north and east of the site act as a significant barrier for fauna movement.

As the proposal has been largely consolidated within an area currently dominated by exotic grassland / pasture and or existing developed areas, it is considered unlikely that the proposal will have a significant impact on local or regional fauna dispersal.

Large-scale local fauna movement within the locality occurs in association with protected areas of the locality (i.e. Cumbebin Swamp Nature Reserve, Arakwal National Park, Tyagarah Nature Reserve etc.) as well as forested areas along Belongil Creek and larger farming properties to the further to the west. It is noted that more than 1.5km of connected bushland adjoins the western boundary of the subject site (refer to **Figure 15**).

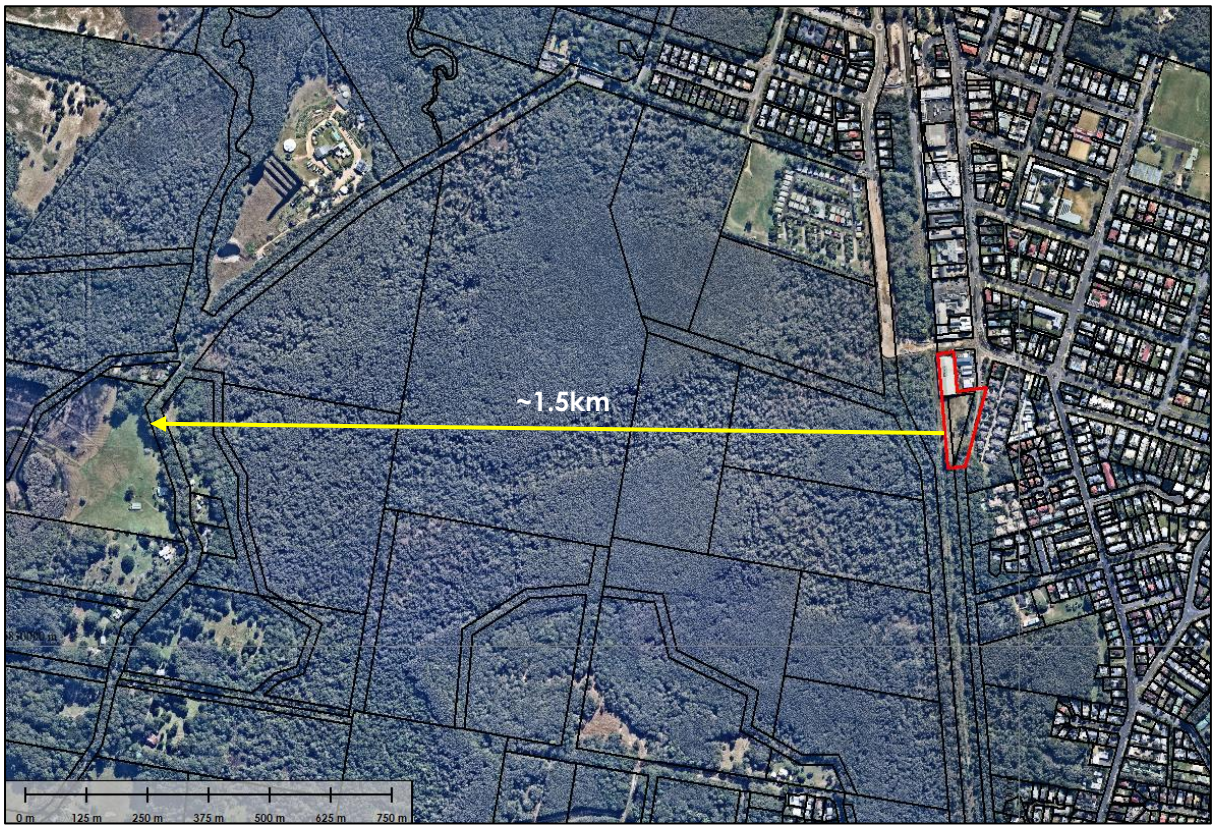


**Figure 15: Large Scale Corridor Movements**

Localised fauna movement opportunities are likely to occur along the southern and western boundaries of the site which connects to expansive areas of bushland.

With regard to the above it is considered unlikely that the proposed development will have a significant impact upon the existing fauna corridor/dispersal values of the locality such that such that its existing dispersal function is significantly diminished.

## 5.7 Other Ecologically Significant Features

*Hollow Bearing Trees*

The loss of hollow bearing trees has been identified as the most significant cause of biodiversity reduction in timber production forests of eastern Australia (Smith *et al*, 1994) with the subsequent adequate management of the hollow tree resource being critical to achieving Commonwealth and State conservation objectives (National Forest Policy Statement, 1992; Nature Conservation Act, 1992). Gibbons and Lindenmayer (2002) estimate that 303 native vertebrate species utilize tree hollows of which approximately 100 are listed as rare or threatened within State or Commonwealth Legislation. Research conducted by the Department of Natural Resources (1998) estimates that 134 of these species potentially utilize tree hollows in SE Queensland. Given that hollow bearing potential is low for Eucalypts below 120-180 years of age (with older trees required for larger fauna) and the fact that many species require a variety of different hollows within their home range (particularly arboreal mammals), hollow bearing trees represent a limited ecological resource (Gibbons & Lindenmayer, 2002; DNR, 1998-1999; Strahan, 2002; Ball, Lindenmayer & Possingham, 1999).

No hollow bearing trees were observed within the subject site.

## 5.8 Byron Shire Environmental Values Mapping

Byron Shire Council has a range of environmental mapping which is used to identify areas of environmental value for planning and conservation purposes. This mapping has been produced by Council through the Flora and Fauna Study 1999, the Biodiversity Conservation Strategy 2004 and subsequent reviews, as well as mapping data provided by organisations such as National Parks and Wildlife Service (now Office of Environment and Heritage) and Department of Primary Industries (BSC, 2012).

*High Conservation Value Vegetation*

High conservation value vegetation (HCV) is the name given to areas of land identified as containing important environmental values. These areas are calculated and mapped using the methodology adopted in Council´s Byron Biodiversity Conservation Strategy (2004). HCV often contains threatened species and Endangered Ecological Communities protected by State and/or Commonwealth legislation.

Several areas of the subject have been mapped as containing HCV Vegetation (**Figure 16**). The extent of mapped HCV is considered to be outdated, with bare/grassed areas included within the mapping. Native vegetation removed within these mapped is proposed to be compensated in accordance with *Byron Shire Development Control Plan (2014) – Chapter B2 – Preservation of Trees and Other Vegetation.*


**Figure 16: Byron Shire Environmental Values Mapping [High Conservation Value Vegetation] (Source: BSC, 2012)**

*Wildlife Corridors*

Wildlife corridors have been developed to identify important links across the landscape to encourage the movement of flora and fauna species. Byron shire wildlife corridors were developed as part of the Byron Biodiversity Conservation Strategy and are based on wildlife corridor mapping produced by National Parks and Wildlife Service (NPWS). The NPWS mapping was refined by ecologists and botanists involved in the production of the Biodiversity Conservation Strategy based on detailed knowledge of the Byron shire landscape and the ecology of local fauna and flora species (BSC, 2012).

A discussion on wildlife corridors for the subject site has been discussed in **Section 5.6** of this report.

*Koala Habitat*

A small area of the site has been mapped as containing 'tertiary habitat' for the Koala (**Figure 17**). Refer to **Section 6.1.2** and **Table 5** of this report for more detailed Koala discussions.

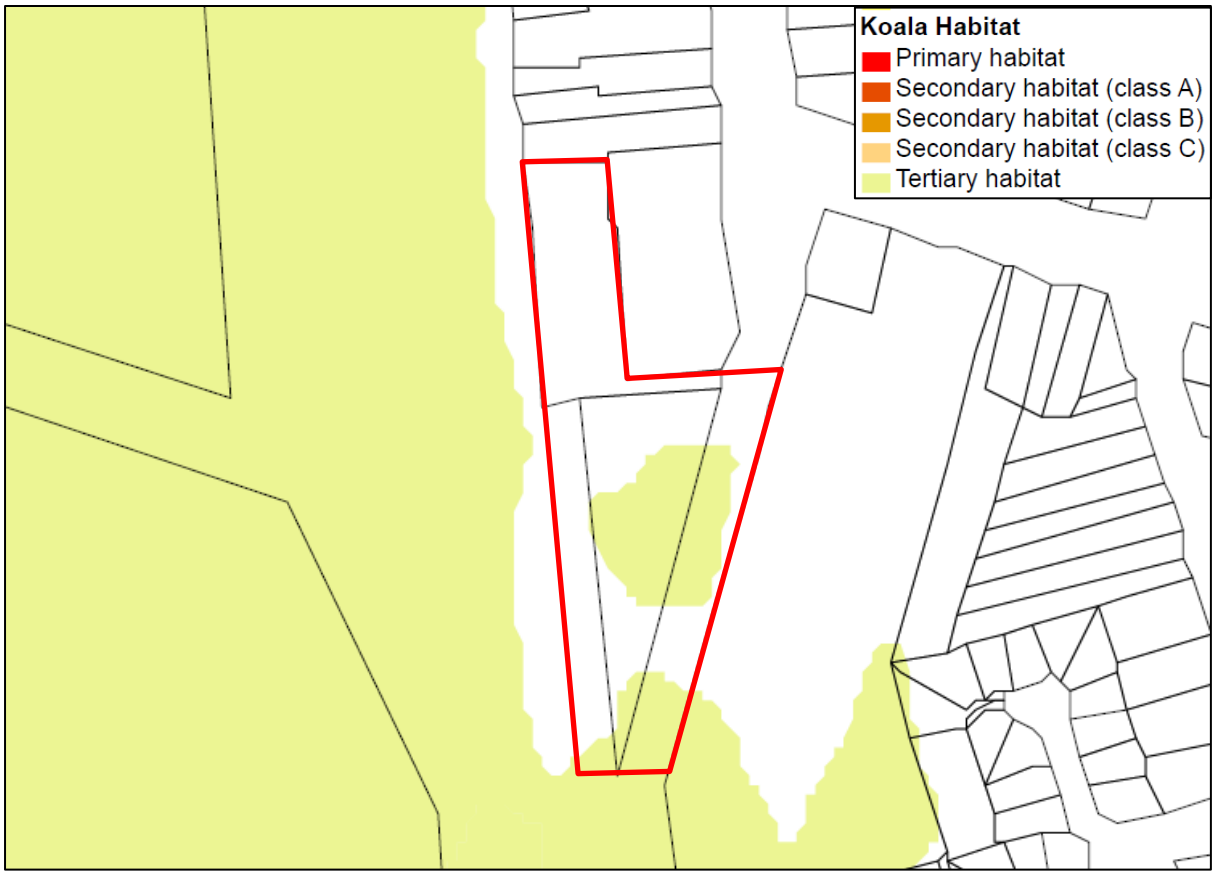


**Figure 17: Byron Shire Environmental Values Mapping [Koala Habitat] (Source: BSC, 2012)**

*Key Fish Habitats*

Key fish habitat mapping was developed in 2007 by the Department of Primary Industries across the state. Key Fish Habitats are those aquatic habitats that are important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations and the survival and recovery of threatened aquatic species. Key Fish Habitat includes all marine and estuarine habitats up to highest astronomical tide level (that reached by 'king' tides) and most permanent and semi-permanent freshwater habitats including rivers, creeks, lakes, lagoons, billabongs, weir pools and impoundments up to the top of the bank.

The majority of the site occurs within mapped key fish habitat areas (**Figure 18**), which includes areas containing existing buildings and roadways. The majority of the paddock area of the site has been historically raised and is not subject to regular ponding.

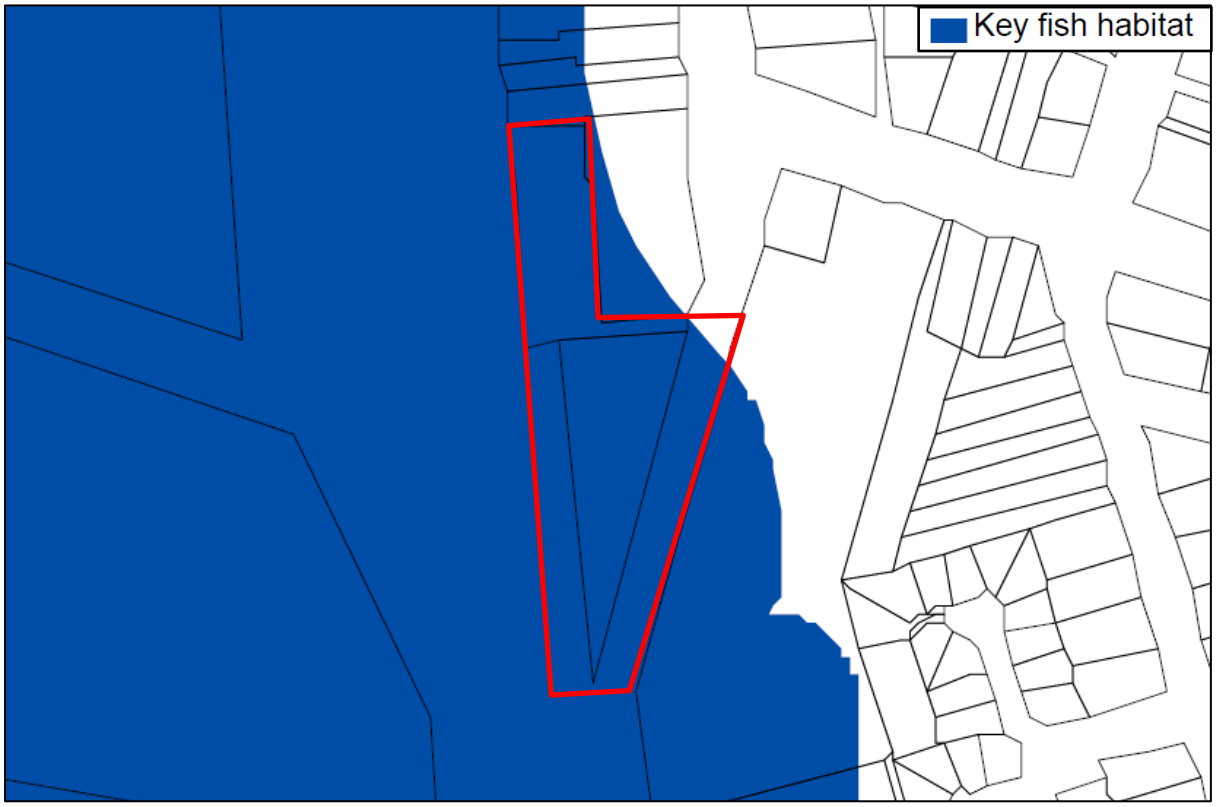


**Figure 18: Byron Shire Environmental Values Mapping [High Conservation Value Vegetation] (Source: BSC, 2012)**

*Threatened Fauna Habitat*

Threatened Fauna Habitat mapping displays areas of vegetation that provide habitat or potential habitat for key threatened fauna species. This map layer is based on Key Fauna Habitat modelling undertaken by National Parks and Wildlife Service. The map layer displays areas of vegetation with their centre located in modelled fauna habitat for select key threatened fauna species known from the Shire (BSC, 2012).

A small area within the southern portion of the site is mapped as containing threatened fauna habitat (**Figure 19**). The majority of this area is proposed to be retained with compensatory plantings proposed to compensate habitat required to be removed to facilitate the proposal.


**Figure 19: Byron Shire Environmental Values Mapping [Threatened Fauna Habitat] (Source: BSC, 2012)**

*Eco Wetland Habitat*

Eco wetlands include areas identified in the previous State Environmental Planning Policy No. 14 – Coastal Wetlands (SEPP 14) as well as other important wetland areas including mangroves, saltmarsh, swamps, lagoons, estuaries and floodplain complex forest (BSC, 2012).

As discussed within **Section 5.6**, areas of the site have been mapped as containing EcoWetland (refer **Figure 9**). Discussions regarding Coastal Wetlands have also been discussed within **Section 5.6**.

# 6 STATUTORY CONSIDERATIONS – TEST OF SIGNIFICANCE (SECTION 7.3 OF THE BIODIVERSITY CONSERVATION ACT 2016)

Further to the provisions of Section 7.3 of the *Biodiversity Conservation Act* 2016, the 'test of significance' is applied to assess any potentially adverse impacts of the site-proposal on threatened species, populations and/or communities occurring within the site or surrounding locality.

Note that threatened species, populations and/or communities have been excluded from this assessment where:

- No direct observations of threatened species, populations or communities were made on the site during survey works;
- No previous sightings of threatened species, populations or communities within a 10-kilometre radius of the site have been registered within the Bionet database and scheduled under the *Biodiversity Conservation Act 2016*;
- An abundance of primary habitat requirements for said species are not located on or within the locality of the proposal (refer previous sections); and
- Potential habitat (feeding, roosting, nesting or refuge) will not be or will be minimally affected by the proposal (refer previous sections).

As such it is considered that, of the scheduled species, populations and/or communities described previously within this report, the following 3 species of threatened are known to occur within the locality and are likely to utilize the site at some stage, and may have the potential to be significantly affected through any development of the site. Additionally, a 'test of significance' has been conducted for a potential Endangered Ecological Community (EEC).

**Table 6: Threatened Species, Populations and/or Communities Subject to the 'Test of Significance'**

| | |
|---|---|
| **Ecological Communities** | Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion (Vegetation Community 1) |
| **Populations** | N/A |
| **Flora** | N/A |
| **Fauna** | Grey-headed Flying-fox (*Pteropus poliocephalus*) |
| | Little Bent-wing Bat (*Miniopterus australis*) |
| | Koala (*Phascolarctos cinereus*) |

## 6.1 Significant impact criteria in accordance with the BC Act 2016

As previously stated within **Section 2.7**, local development proposals that do not exceed the Biodiversity Offset Threshold are still required to carry out a 'test of significance'.

(1) The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats:

*Endangered Ecological Communities*

*Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion*

***a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

N/A for Endangered Ecological Communities.

***b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:***

***i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***

***ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,***

DEC (2007) notes the following with regard to EECs:

Ecological communities are usually defined by two major components – the geographical distribution and the species composition which influences the physical structure and ecological function of the ecological community. The relative importance of the geographical distribution and the species composition varies according to the specific listed ecological community. Hence this factor provides for consideration of two criteria:
(i) local occurrence of the ecological community
(ii) modification of the ecological community's composition.

Interpretation of key terms used in this factor:
Local occurrence: the ecological community that occurs within the study area. However, the local occurrence may include adjacent areas if the ecological community on the study area forms part of a larger contiguous area of that ecological community and the movement of individuals and exchange of genetic material across the boundary of the study area can be clearly demonstrated.

Risk of extinction: similar to the meaning set out in factor (a), this is the likelihood that the local occurrence of the ecological community will become extinct either in the short-term *or* in the long-term as a result of direct or indirect impacts on the ecological community, and includes changes to ecological function.

Composition: both the plant and animal species present, and the physical structure of the ecological community. Note that while many ecological communities are identified primarily by their vascular plant composition, an ecological community consists of all plants and animals as defined under the TSC and FM Acts that occur in that ecological community.

It is considered that Vegetation Community 1: Paperbark Swamp Forest of the Coastal Lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) may be reflective of the above listed EEC as described by the Scientific Committee (subject to the limitations and discussion provided in **Section 3.2.1** above). For the purpose of this report, it will be considered that this Vegetation Community is the abovementioned EEC.

This potential EEC will be impacted through the loss of ~997sqm of Community 1 for the construction of a carpark and roadway.

Reviewing Byron Shire Council's Vegetation Mapping (refer to **Figure 20**), Paperbark communities are common within areas west of the site and throughout the locality. It is noted that >250ha of similar Paperbark Forest type communities occurs immediately adjacent the site to the west.

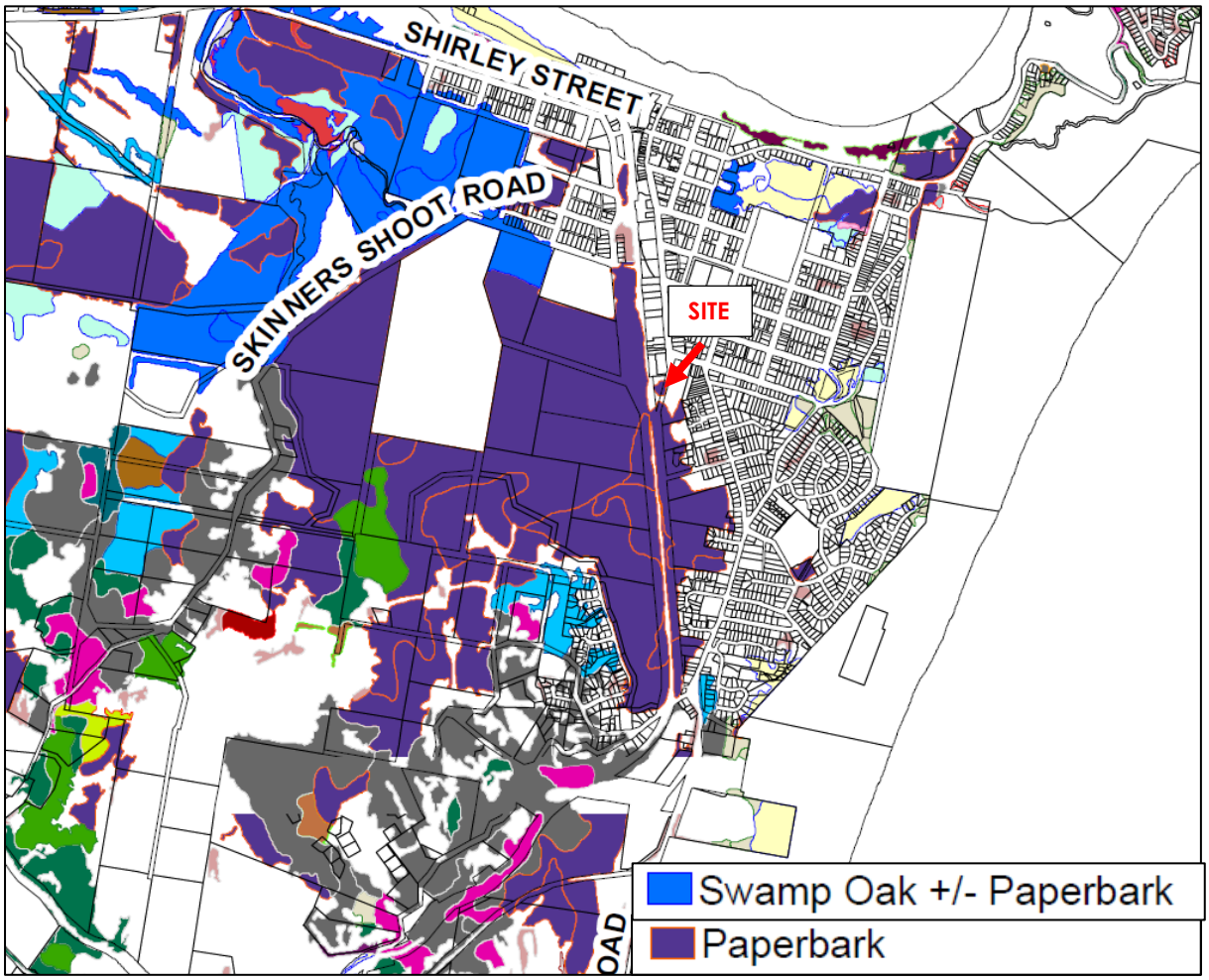


**Figure 20: Byron Shire Vegetation Mapping Illustrating Mapped Paperbark Forest within the Locality**

In addition to the above, the Byron Flora and Fauna Study (1999) prepared for Byron Shire Council notes that there is over 1750ha of Swamp Sclerophyll Forest occurring within the Shire (refer to **Figure 21**).

| SWAMP SCLEROPHYLL FOREST | |
|---|---|
| Swamp Sclerophyll Forest | 126.54 |
| Mixed Eucalypt spp. | 199.15 |
| Paperbark | 1115.05 |
| Swamp Mahogany/Swamp Box | 132.30 |
| Swamp Oak +/- Paperbark | 181.73 |

**Figure 21: Swamp Sclerophyll Forest Areas within Byron Shire (Source: Byron Flora and Fauna Study, 1999)**

As previously discussed, assessable native trees which are required to be removed to facility the development will be compensated via replacement planting in accordance with Council's *Development Control Plan – Chapter B2 – Preservation of Trees and Other Vegetation* within the locality. The compensatory plantings are proposed to occur within the road reserve east of the proposed carpark, as well as bare/denuded areas within the southern areas of the site. The proposed compensatory plantings will consist of native species typically associated with this EEC.

Given that the vegetation community proposed for removal is already suffering from edge effects (occurring as fragmented copses of vegetation within an existing grassed paddock or at the edge of

urbanised areas); extremely disturbed given the dominance of weeds within the understory (in particularly Singapore Daisy and exotic grasses), and the absence of a native shrub layer, as well as the large extent of the EEC locally (over 1750ha of Swamp Sclerophyll Forest occurring within the Shire), it is considered that the loss will not place the local occurrence of this EEC at risk of extinction, nor will the actions proposed substantially and adversely modify the composition of the community such that its local occurrence is likely to be placed at risk of extinction.

*Likelihood of Local Extinction*

With regard to the above it is therefore considered that the action proposed is unlikely to modify or adversely affect the EEC such that its local occurrence is placed at risk of extinction.

***c. in relation to the habitat of a threatened species or ecological community:***

***i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity,***

***ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***

***iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,***

Habitat for a given threatened species, community or population is considered to be an area containing similar known (documented) habitat preferences for that species within the species' geographic distribution.

In assessing whether a significant area of the habitat of a threatened species, population or ecological community is to be modified or removed the following should be considered:

- The geographic range of the threatened species, population or ecological community and its known or documented occurrence within the region and locality;
- The relative scale and value of the habitat within the region and locality;
- The importance of the habitat (i.e. relationship to life cycle, reproductive success etc.).

DEC (2005) indicates that a "quantitative and qualitative approach to assessing the extent to which habitat is likely to be removed or modified/degraded should consist of the following steps:

- an assessment of the amount of habitat of the threatened species, population or ecological community that occurs within the locality;
- an assessment of the amount of habitat of the threatened species, population or ecological community that occurs within the study area;
- an estimation of the area and quality that the habitat of the study area represents in relation to the local distribution of that habitat;
- An estimation of the area and quality of the habitat of the study area which is to be removed or modified by the proposed development or activity;
- a calculation of the amount of the habitat of the region that will be removed or modified by the proposed development, activity or action or indirectly by longer term impacts from the proposed development such as increased predation weed invasion, salinity etc;
- An estimation of the area and quality of the habitat of the region that will be removed or modified by the proposed development, activity or action; and
- an assessment of the ecological integrity of the habitat to be affected and of the habitat which will remain"

Within the site it is considered that Community 1 represent potential habitat for the recorded EEC. This community covers ~2765sqm of the subject site.

The proposed development will result in the removal/modification of ~997sqm of Community 1. It is noted that the area of Community 1 required to be removed is currently already highly fragmented with weeds abundant within the understorey.

It is noted that over 1750ha of Swamp Sclerophyll Forest occurs within the shire.

The ~997sqm of required vegetation removal is proposed to be compensated via compensatory plantings. This will ensure no net loss of this endangered ecological community within the locality.

As such, it is considered unlikely that the area of habitat to be modified represents a significant area of habitat in relation to the local and regional distribution of those listed habitats.

Reviewing the above and (a) and (c) as previously discussed, the areas to be modified are not considered to represent a 'significant area of habitat' for the recorded or potentially occurring threatened species or occurring endangered ecological communities.

In assessing the potential for habitats of threatened species, populations or ecological communities to become fragmented or isolated to such an extent that the long-term survival of the said species, population or community is at risk, the following is to be considered:

- 'Interconnecting or proximate areas of habitat' (which may be at risk of being fragmented or isolated from other habitat areas) are considered to be two or more habitat areas where currently an individual can move between the two. Such areas could become 'isolated' in the event that the development negates future potential movement of individuals between the two habitats. This could occur through the clearance of habitat, creation of physical impediments (i.e. roads, fences) or potential impacts to behaviour (fauna) which may restrict future movements.

- For threatened species, in reviewing whether isolation may occur, consideration must be given to the movement values of the site and surrounds for particular species, the mobility of threatened species, connectivity of habitats within and external to the site and the degree to which the proposal may significantly disrupt these patterns.

- Consideration should be given to the dispersal and genetic exchange mechanisms of individual species and whether the isolation of currently interconnecting or proximate areas of habitat for threatened species, communities or populations will adversely affect the maintenance of gene flow and the ability to sustain viable populations (DEC, 2005).

As previously discussed, it is considered that the works are of a small nature, occurring at the edge of a heavily urbanised area and are therefore unlikely to significantly affect the dispersal function of any terrestrial corridors or key habitats.

***d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),***

N/A. No areas of outstanding biodiversity value occur within proximity to the proposal site.

***e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.***

Refer to the Fauna section below for the Key Threatening Process Table.

*Threatened Fauna*

*FAUNA – GREY-HEADED FLYING FOX & KOALA*

***a. in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,***

The National Parks and Wildlife Service (NPWS) describe a local population as one "*that occurs within the study area, unless the existence of contiguous or proximal occupied habitat and the movement of individuals or exchange of genetic material across the boundary of the study area can be demonstrated.*"

DECC (2007) & DPI (2008) further expands the local population definition to include:

- The *local population* of a threatened *plant* species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.

- The *local population* of *resident fauna* species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.

- The *local population* of *migratory or nomadic fauna* species comprises those individuals that are likely to occur in the study area from time to time.

DECC (2007) & DPI (2008) further states that the key assessment for this component is the "risk of extinction of the local population. The risk of extinction will increase if any factor operates to reduce population size or reproduction success." It is further noted that any known or presumed local population should be assumed to be viable for the purpose of this assessment unless otherwise proven.

**Megachiropterans (Grey-headed Flying-fox)**

*Local Population*

As the noted mega-bat species is wide ranging in the region, it is considered that they are not genetically isolated on the subject site and form part of populations within the wider region.

Grey-headed Flying Fox (*Pteropus poliocephalus*)

Although not recorded during survey efforts of the site, it is considered likely that the species would utilise the site during peak flowering and fruiting periods. The Bionet database contains fifty-nine (59) records of this species within 10 kilometres from the centre of the site.

*Stages of lifecycle potentially affected by development*

| Species | Habitat Preference | Roosting/Breeding |
|---|---|---|
| Grey-headed Flying-fox | The Grey-headed Flying-fox inhabits subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps (Eby, 1995). Urban gardens and cultivated fruit crops also provide habitat for this species (NSW NPWS 1999c). Grey-headed Flying- | This species roosts in large aggregations or camps in close proximity (20 km or less) to a regular food source, often in stands of riparian rainforest, Paperbark or Casuarina forest (Eby, 1995). Camps provide resting habitat, sites of social interactions and refuge for animals during significant |

| Species | Habitat Preference | Roosting/Breeding |
|---|---|---|
| | foxes forage on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca, Banksia (Eby, 2000) and fruits of rainforest trees and vines (NSW NPWS 1999c).<br><br>During periods when native food is limited, Grey-headed Flying-foxes disperse from colonial roosts, often foraging in cultivated gardens and fruit crops (NSW NPWS 1999c). This species is a canopy-feeding frugivore, blossom-eater and nectarivore of rainforests, open forests, woodlands, Melaleuca swamps and Banksia woodlands. As such, it plays an important ecosystem function by providing a means of seed dispersal and pollination for many indigenous tree species (Eby 1996; Pallin 2000). | phases of their annual cycle, such as birth, lactation and conception (Parry-Jones and Augee 1992, 2001).<br><br>"Roosting habitat critical to survival:<br>Grey-headed Flying-foxes roost in large aggregations in the exposed branches of canopy trees (Ratcliffe 1931, Nelson 1965a, Parry-Jones and Augee 1992). The locations of camps are generally stable through time, and several sites have documented histories that exceed 100 years (Lunney and Moon 1997). Camps provide resting habitat, sites of social interactions and refuge for animals during significant phases of their annual cycle, such as birth, lactation and conception (Parry-Jones and Augee 1992, 2001).<br><br>On the basis of current knowledge, roosting habitat that meets at least one of the following criteria can be explicitly identified as habitat critical to survival, or essential habitat, for Greyheaded Flying-foxes. Roosting habitat that:<br>1. is used as a camp either continuously or seasonally in > 50% of years<br>2. has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 10 000 individuals, unless such habitat has been used only as a temporary refuge, and the use has been of limited duration (i.e. in the order of days rather than weeks or months)<br>3. has been used as a camp at least once in 10 years (beginning in 1995) and is known to have contained > 2 500 individuals, including reproductive females during the final stages of pregnancy, during lactation, or during the period of conception (i.e. September to May) (in DECCW, 2009) |

The proposal will result in a minor reduction of potential forage resources within the locality for this species (loss of ~997sqm of potential foraging material associated with Community 1). As the species is capable of travelling long distances in search of food, and similar type of foraging material are abundant within the locality (i.e. Cumbebin Swamp Nature Reserve, Arakwal National Park, Tyagarah Nature Reserves, forested areas along Belongil Creek, private properties etc.). No roosting sites occurs within, or within close proximity to the site with the nearest camp occurring ~1km northeast of the site along Middleton Street (DoEE, 2020). Compensatory planting measures as discussed within this report will ensure there is no net loss of foraging material within the locality.

*Likelihood of Local Extinction*

Reviewing the above, it is considered unlikely that the proposal will disrupt the lifecycle of the local population of the discussed megabat to the point that they are at risk of extinction.

**Microchiropterans (Little Bent-wing Bat**

*Local Population*

As the noted micro-bat species is considered to be wide ranging in the region, it is considered that they are not genetically isolated on the subject site and form part of populations within the wider region

Little Bent-wing Bat (*Miniopterus australis*)

The species is regularly encountered throughout the locality (pers obs.) and likely to utilize the site as a 'fly-zone'. The Bionet database contains thirty-four (34) records of this species within 10km of the site.

| Species | Habitat Preference | Roosting/Breeding |
|---|---|---|
| Little Bentwing Bat | This species utilises well-timbered habitats including rainforest, *Melaleuca* swamps and dry sclerophyll forests where it feeds on insects within the canopy. | DECC (2005) note the following particulars with regard to the little bentwing bat:<br>• Maternity colonies form in spring. Males and juveniles disperse in summer.<br>• Only five nursery sites /maternity colonies are known in Australia.<br>• Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas.<br>• Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day<br>• They often share roosting sites with the Common Bentwing-bat and, in winter, the two species may form mixed clusters.<br>• In NSW the largest maternity colony is in close association with a large maternity colony of Common Bentwing-bats (*M. schreibersii*) and appears to depend on the large colony to provide the high temperatures needed to rear its young. |

Habitat loss is a major threat affecting more than half of the threatened species in Australia. While bats are not necessarily dependent on large areas of uncleared habitat for their roosting habitat, they range over relatively large areas and thus require large areas of habitat for foraging (Lunney et al. 1988, Lumsden et al. 1994, Pavey 1995).

A review of existing habitats indicates that the site provides potential habitat (all forested areas of the site) for the Little Bentwing Bat. No suitable roosting sites (suitable culverts, bridges, hollows, disused buildings etc.) occurs within the development site. More than 500ha of potential foraging habitat occurs for this species in association with Arakwal National Park, Cumbebin Nature Swamp Reserve, forested areas along Belongil Creek and larger farming properties.

As the species are wide ranging and the proposal will result in only a minor modification of potential foraging habitat. It is considered unlikely that a significant impact would occur upon as a result of the proposal. Compensatory planting measures as discussed within this report will ensure there is no net loss of potential habitat within the locality.

*Likelihood of Local Extinction*

Reviewing the above, it is considered unlikely that the proposal will disrupt the lifecycle of the local population of the discussed micro-bats to the point that they are at risk of extinction.

**Koala**

*Local Population*

As the koala is considered to be wide ranging in the region, it is considered that they are not genetically isolated on the subject site and form part of populations within the wider region. The Bionet database contains six-hundred and eighteen (618) records of this species within 10km of the site.

The *Byron Coast Comprehensive Koala Plan of Management* (BCCKPOM, 2015) notes the following trees as preferred foraging resources within Byron Shire:

**Table 7: Preferred Koala Food Trees (Source: BCCKPOM, 2012)**

| | Common Name | Scientific Name |
|---|---|---|
| **Primary** | Tallowwood | *Eucalyptus microcorys** |
| | Forest Red Gum | *Eucalyptus tereticornis*** |
| | Swamp Mahogany | *Eucalyptus robusta*** |
| **Secondary** | Small fruited Grey Gum | *Eucalyptus propinqua* |
| | Scribbly Gum | *Eucalyptus racemosa subsp. racemosa* |

* Tallowwood *Eucalyptus microcorys* is considered a secondary food tree on lower nutrient erosional soils – see Habitat Study (Biolink, 2012)
** includes naturally occurring *E. tereticornis* x *E. robusta* hybrid

Although suitable habitat (eucalypt forest) is absent from the site, two (2) favoured foraging trees (*Eucalyptus robusta*) were recorded onsite.

As previously noted within **Section 5.8.3**, the Byron Shire Environmental Values Mapping only contain 'tertiary' Koala habitat. The Byron Coast Koala Habitat Study maps a small area of the site as containing 'Secondary (A)' Koala habitat (refer to **Figure 22**).

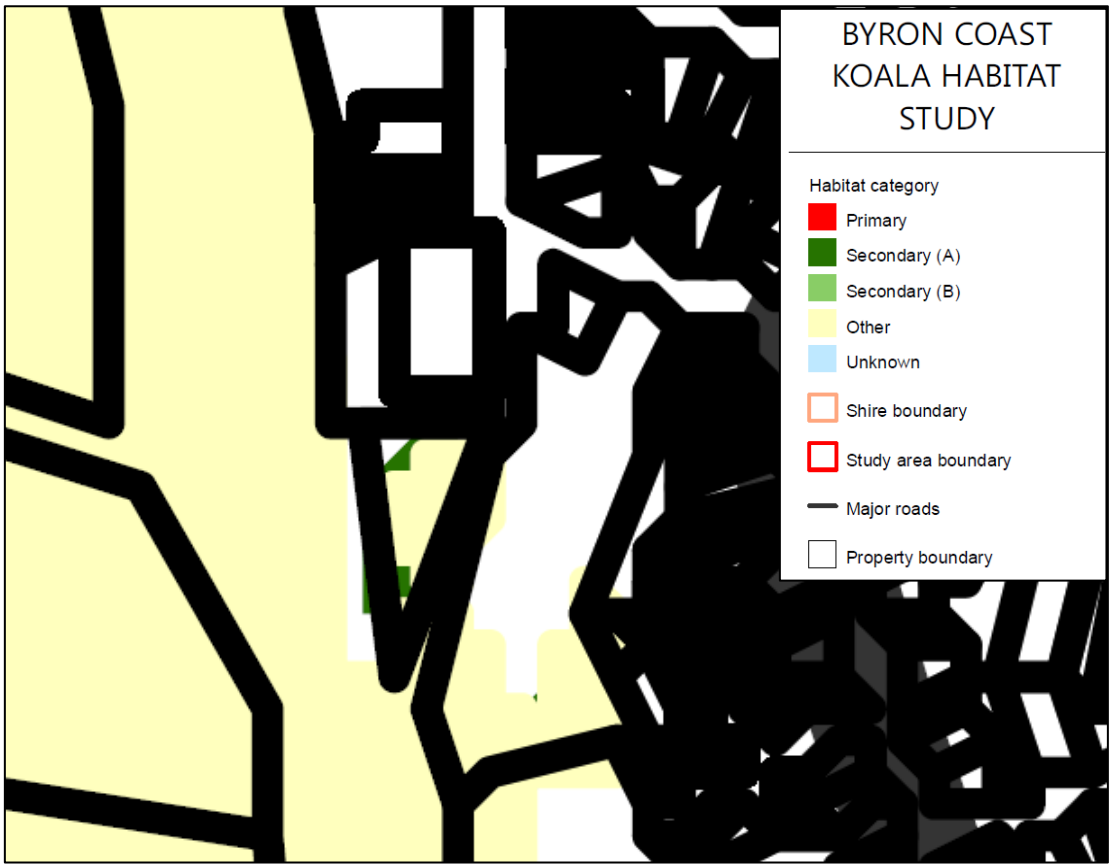


**Figure 22: Koala Habitat Mapping (Biolink, 2012)**

Additionally, The Byron Coast Comprehensive Koala Plan of Management has not mapped the site as occurring within a Koala Management Precinct (BCCKPoM, 2015).

Koala surveys conducted over the site, and areas immediately adjacent to the site failed to yield any evidence of koala usage (directly or indirectly).

To summerise the above and the site survey, evidence of koala activity was recorded as follow:

- Searches around the base of trees did not yield koala scats;
- No koalas were heard responding to amplified call playback; and
- No Koalas were observed during diurnal and nocturnal (spotlighting) searches.

Bionet Koala records within the vicinity of the site have been mapped within **Figure 23** below. Although there are several records within close proximity to the site (<200m), it is noted that no Koalas have been recorded within the subject site.

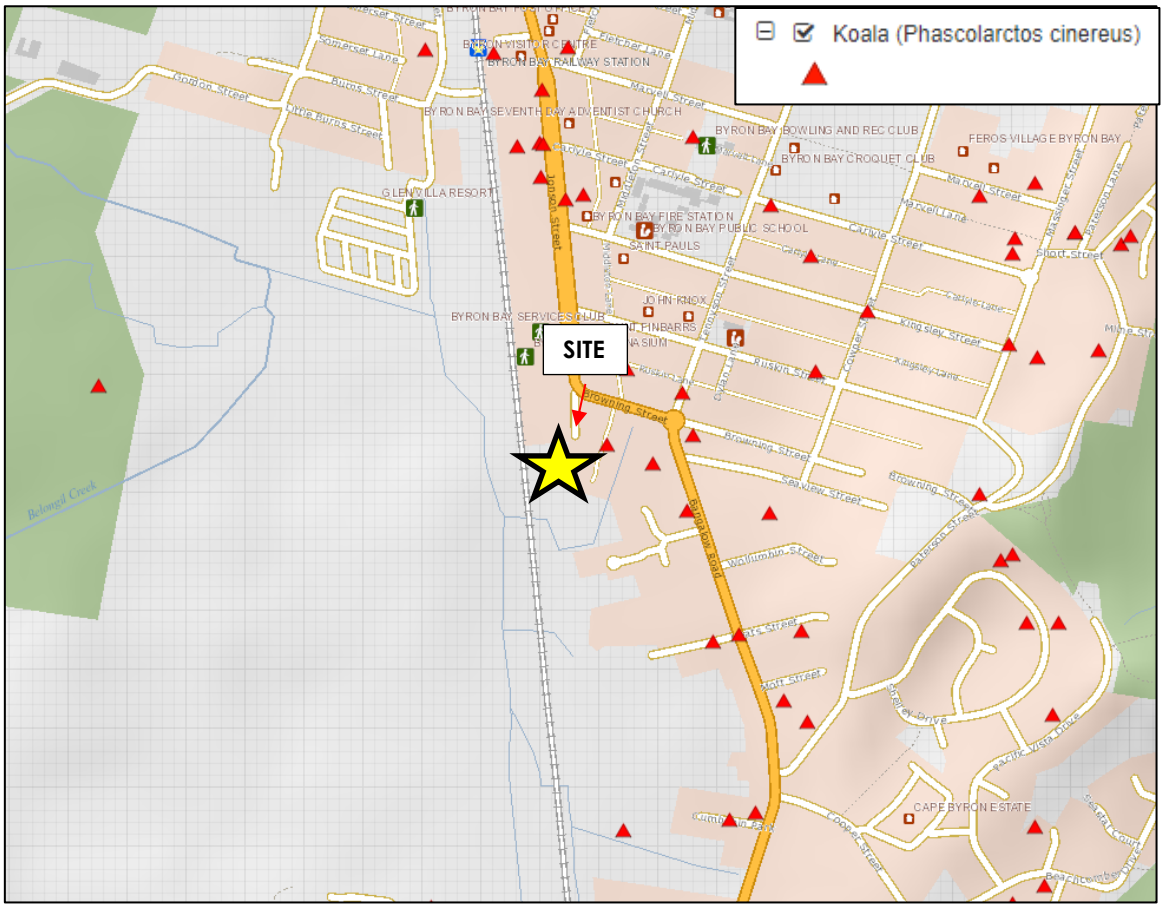


**Figure 23: Bionet Koala Records Proximate to the Site (Bionet, 2020)**

While the site is considered to not represent core koala habitat, it is considered that on the odd occasion a koala may occasionally traverse the site while traversing across the broader landscape.

Two (2) Preferred Koala Feeds Trees (*Eucalyptus robusta*) within the site are proposed to be removed in order to facilitate the proposal. It is noted that no scats (or Koalas) were recorded underneath these trees. It is also noted that these trees will be compensated via replacement planting in accordance with Council's *Development Control Plan – Chapter B2 – Preservation of Trees and Other Vegetation* within the locality.

Given the small scale of clearing within an urbanised area, limited potential koala habitat (which yielded no evidence of koala usage), and the compensatory plantings measures proposed, it is considered unlikely that the proposal will have a significant impact upon this species.

It is considered that the below potential threatening impacts/processes may be associated with the development of the site if uncontrolled:

*Removal of Key Habitat, Potential Foraging Trees*

It is widely accepted that removal of eucalypt forest/woodland and individual refuge and/or foraging trees within areas occupied by Koalas can lead to a decline in population viability due to a reduction in potential habitat. McAlpine et al (2007) notes that:

> *The tree is the basic unit of koala survival and therefore habitat quality within koala habitat patches will depend largely on the nature of the trees present in that patch. Koalas demonstrate regional*

> *preferences for particular tree species…. Forests that have high densities of preferred tree species potentially have greater carrying capacity and could support more viable koala populations, compared to forests that have low densities of preferred tree species. Hence, forests with low proportions of preferred tree species, or low densities of trees, tend to constitute poorer quality koala habitat. At least for the coastal areas of Queensland and New South Wales, once the proportion of preferred koala food trees falls below around 30% of total trees, the habitat appears to be lower-secondary to marginal quality for koalas. For corridors, the spacing between mature trees should be no greater than 20- 30 m apart, although for breeding habitat higher densities will certainly be more appropriate (page 26).*

Substantial removal of habitat and/or foraging trees for the proposed development and by the future residents may be associated with the development if uncontrolled.

*Disruption to Potential Dispersal/Movement Patterns and Habitat Fragmentation*

Removal of habitat or creation of impediments (i.e. impenetrable roadways, fencing, buildings etc) can fragment existing connected koala habitats resulting in poor access to alternative foraging sites and breeding resources.

> *"Where fragmentation reduces or prevents successful dispersal and recruitment between populations, the number of animals in a population may decrease over time due to threats such as predation, stress related disease and death on roads. This potentially creates a genetic bottleneck resulting in inbreeding depression and it leaves the population vulnerable to extinction from chance events, such as wildfire or extreme weather conditions" (NPWS, 2003).*

Uncontrolled development of the site has the potential to disrupt koala dispersal patterns and isolate individuals through the creation of barriers between habitats on the site, and between the habitats of the site and external sites.

*Degredation of Existing Habitat*

The degradation of currently utilised habitat as a result of weed invasion, tree dieback and poor native species recruitment may reduce the potential use of the habitat by koala. For example, weed invasion may reduce potential koala movement (i.e. thick lantana, blackberry, prickly pear, morning glory). Thickets of herbaceous and woody weeds within the lower strata of a forest may also reduce native recruitment of preferred foraging species. Tree dieback will also reduce the potential forage base of a forest as well as altering the canopy cover and changing the microclimate of the forest floor. This can lead to the prevalence of weed invasion which, as discussed, can hamper koala movement and reduce recruitment potential of native trees. The causes of tree dieback may include:

- reduced water availability through diversion of water away from native vegetation, soil compaction and drought;
- insects and pathogens;
- frequent fire and grazing by stock and introduced herbivores which reduce regeneration and destroy regrowth;
- fragmentation of vegetation into small patches;
- pasture improvement;
- salinisation; and
- the use of fertilizers and chemicals, particularly aerial application (Pahl et al, 1990 in NPWS, 2003).

The following impacts could potentially be associated with the uncontrolled development of the site:

- Continued increase of weeds across the site;
- Inappropriate fire management regimes or indiscriminate burning;
- Degradation associated with introduced stock or hobby animals; and
- Improvement for pasture, recreational grassland (i.e. turf), garden areas and hobby agriculture.

*Predation/Disruption by Feral / Domestic Animals*

Mortality of koalas as a result of dog attacks is considered to be a key conservation concern for koala management with some studies reporting that dog attacks account for between 5% and 40% of total recorded mortalities (McAlpine et al, 2007). Within the 'koala coast' of SEQLD an average of 300 koalas each year die as a result of dog attacks (EPA, 2006). Studies into dispersal patterns of koalas undertaken by Dique et al (2003) indicates that in addition to mortality the presence of dogs within or proximate to koala habitats is likely to disrupt behaviour and associated dispersal options which can lead to those impacts discussed in **Section 5.2** above.

While not as widely studied it is considered that presence of feral species such as dingoes or foxes within utilised habitat may have a similar impact to koala mortality and dispersal behaviour as domestic dogs. The recovery plan for koalas (NPWS, 2003) lists the key threatening process 'Predation by the Red Fox *Vulpes vulpes*' as being relevant to the koala.

Impacts associated with the introduction of domestic dogs may potentially be occasioned by uncontrolled development of the site.

*Mortality Associated With Roadways*

It is widely accepted that koala mortality associated with vehicle strike on roadways intersecting or proximate to habitat represents a serious through to the ongoing viability of populations (Dique et al, 2003; NPWS, 2003; McAlpine et al, 2007; EPA, 2006). Vehicle strikes are heightened where arterial and other roads bisect bushland, remnant bushland or urban habitat areas, resulting in high mortality of resident koalas, or limited success of dispersing animals that must cross roads to reach suitable habitat and mates (Dique *et al*. 2003 in EPA, 2007). NPWS (2003) note that habitat bisecting roadways are particularly likely to lead to increased vehicle strike on koalas where traffic volume is high, speeds exceed 60km/hr, where visibility of road edges is reduced and/or where lighting is absent.

In accordance with the *Draft Byron Coast Comprehensive Koala Plan of Management* it notes that "*Road design standards and/or approved vehicle calming devices must be incorporated such that motor vehicles are restricted to a maximum speed of 40km/hour within the development area*".

*Mortality Associated With Bushfire*

High-intensity wildfires pose a threat to koalas, particularly where refuge habitat is not available. High-intensity fires burn the canopy and can cause the death or injury of koalas and a reduction in the availability of foraging habitat. In addition, fast-moving fires fanned by strong winds reduce the ability for koalas to escape to refuge areas (NPWS, 2003: 23).

Uncontrolled development of the site may potentially increase the risk of bushfire to potential koala habitat areas in association with inappropriate onsite burning of materials (i.e. garden waste, debris etc.).

*Mortality Associated With Drowning In Swimming Pools*

Although swimming pools are not considered to be a major threat to koala populations they can lead to occasional deaths due to individuals falling into the pool and being unable to climb out (NPWS, 2003, AKF, undated). Potential uncontrolled development of the site may result in koala drowning due to the installation of swimming pools.

*AVOIDANCE AND AMELIORATION OF IMPACTS IN ASSOCIATION WITH CONTROLLED DEVELOPMENT OF THE SITE AS OUTLINED WITHIN THIS REPORT*

*Avoidance of Clearing Significant Areas of Habitat & Potential Foraging Trees*

The proposed tree clearing footprint required to facilitate the development has been designed to minimize native trees loss. External to the works footprint all residual eucalypt trees, swamp sclerophyll forest and associated and potential habitat trees shall be retained and protected. As a result of this proposal, two (2) koala feed trees (both *E. robusta*) will be required to be removed to facilitate the proposal. These trees will be compensated through the proposed restoration works which will include preferred Koala food tree plantings.

*Retention of Dispersal Routes/Corridors*

In association with the proposal it is considered that the potential impacts associated with barrier effects on koala dispersal and koala habitat will be minor given the abundance of available habitat surround the proposed development footprint. This is due to the proposed development being located within predominately cleared areas. As discussed within **Section 5.7** above, the proposed development will not result in a significant barrier or will affect dispersal routes for the Koala (or all other non-volant species). Substantial areas of connected bushland occurs immediately west of the subject site which is sufficient in size to retain koala movement opportunities throughout the locality, even if the site were to be developed.

*Protection of Existing Habitats and Enhancement of Degraded Areas*

The following design and management measures are proposed to ensure the protection and enhancement of the existing koala habitats to be retained:

- Restricting all tree clearing to the designated development envelope
- The weed infestation within proximity to the development envelope is to be eradicated
- Replanting of koala foraging trees in areas external to the development envelope within an area where koala foraging trees are currently scarce
- Prohibition of lighting of fires external to the proposed development footprint.

*Restrictions on Domestic Animals*

Given the nature of the proposal, the proposal will not increase the abundance of dogs on the site as it does not include a residential component.

*Road Design to Minimise Potential of Mortality*

In this instance, it is considered that whilst additional daily vehicle movements will occur on the site and associated roadways, the roadways will not traverse a significant terrestrial fauna habitat or movement corridor. The proposed roads are low speed (<20km/h) with the majority of traffic proposed during daylight hours.

*Restriction on Open Fires*

To reduce the potential risk of fire spread from inappropriate burning of waste/garden refuse following measures are proposed:

- Prohibition of lighting of fires within the site.

*Design of Swimming Pool*

No swimming pools (or a similar type of constructed waterbody) is proposed as a part of this proposal.

*Likelihood of Local Extinction*

Reviewing the above, it is considered unlikely that the proposal will disrupt the lifecycle of the local population of the Koala to the point that it is at risk of extinction.

***b. in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:***

***i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or***

***ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,***

N/A for threatened fauna.

***c. in relation to the habitat of a threatened species or ecological community:***

***i. the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity,***

***ii. whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and***

***iii. the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,***

The proposed development will result in the removal of ~997sqm of vegetation (Community 1). It is noted that an additional ~8103sqm of modified/cleared areas (Community 2) of the site will also be impacted upon/modified as a result of the proposal. The majority of these areas are existing buildings and associated structures.

The entire site provides potential foraging habitat for the Little Bent-wing Bat, as does the majority of the locality, in particularly the surrounding Reserves/Conservation Areas, and expansive areas of forested areas. No roosting site were recorded or will be impacted upon as a result of the proposal.

All forested areas of the site (~997sqm) is considered to provide potential foraging material for the Grey-headed Flying Fox, although similar type flowering and fruiting species are abundant within the locality, in particularly areas immediately west of the site.

The proposal will result in the removal of two (2) Preferred Koala Feed Trees (all Swamp Mahogany). As previously stated, the site is not considered to represent significant koala habitat given the modified and fragmented nature of the bushland with limited koala feed trees.

As previously discussed, it's considered that the proposal will not isolate potential habitat for the discussed occurring or potentially occurring threatened fauna or introduce a barrier to dispersal such that the long-term survival of the reviewed species is at risk.

The proposed tree removal is proposed to be compensated via replacement trees in accordance with Council's Tree Preservation Order. Further details regarding the proposed compensatory plantings measures are provided within **Section 7.2** below.

These areas (to be modified) are not considered to represent a 'significant area of habitat' for potentially occurring threatened species.

Reviewing the above, it is considered that the proposed development will not result in the removal or modification of a significant area of habitat for threatened fauna species.

***d. whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),***

N/A. No areas of outstanding biodiversity value occur within proximity to the proposal site.

***e. whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.***

The *Biodiversity Conservation Act 2016* defines a 'threatening process' as 'a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities.' Accordingly, Key Threatening Processes are nominated within Schedule 4 of the Act and include the following (online @ https://www.legislation.nsw.gov.au/#/view/act/2016/63/sch4):

**Table 8: BCA Key Threatening Processes**

| THREATENING PROCESS | COMMENT |
|---|---|
| Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners, *Manorina melanocephala* | Not applicable |
| Alteration of habitat following subsidence due to longwall mining | Not applicable |
| Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands | Not applicable |
| Anthropogenic climate change | Not applicable |
| Bushrock removal | Not applicable |
| Clearing of native vegetation | The proposed development will involve clearing of some native vegetation (including clearing of one or more strata within a stand of native vegetation). The NSW Scientific Committee notes in their final determination that 'clearing of native vegetation' is recognised as a major factor contributing to the loss of biological diversity and includes impacts such as the following:<br>• Destruction of habitat results in loss of local populations of individual species<br>• Fragmentation<br>• Expansion of dryland salinity<br>• Riparian zone degradation<br>• Increased greenhouse gas emissions<br>• Increased habitat for invasive species<br>• Loss of leaf litter layer<br>• Loss or disruption of ecological function<br>• Changes to soil biota (NSW Scientific Committee, 2001) |

| | |
|---|---|
| | However, a review of this report notes that clearance will primarily occur in an area which has already been largely cleared/modified with residual native vegetation and ornamental plantings also proposed to be removed.<br><br>These clearing works will be compensated via offset plantings as per Council's Tree Preservation Order. There will be no 'net loss of vegetation' as a result of the proposal.<br><br>It is considered that the level of clearing proposed is unlikely to significantly impact upon the viability of threatened fauna species and habitat values available within the site and surrounding locality. |
| Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) | Not applicable |
| Competition and habitat degradation by feral goats (*Capra hircus*) | Not applicable |
| Competition from feral honey bees (*Apis mellifera*) | Not applicable |
| Death or injury to marine species following capture in shark control programs on ocean beaches | Not applicable |
| Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments | Not applicable. |
| Forest Eucalypt dieback associated with over-abundant psyllids and bell miners | Not applicable |
| High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition | Not applicable |
| Herbivory and environmental degradation caused by feral deer | Not applicable |
| Importation of red imported fire ants (*Solenopsis invicta*) | Not applicable |
| Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations | Not applicable |
| Infection of frogs by amphibian chytrid causing the disease chytridiomycosis | Not applicable |
| Infection of native plants by *Phytophthora cinnamomi* | Not applicable |
| Introduction and Establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae | Not applicable |
| Introduction of the large earth bumblebee (*Bombus terrestris*) | Not applicable |
| Invasion and establishment of exotic vines and scramblers | Several exotic vines were recorded onsite. These species should be removed in association with the proposal where they occur within the work zone or during routine restoration works (i.e. weed control). |
| Invasion and establishment of Scotch broom (*Cytisus scoparius*) | Not applicable |
| Invasion and establishment of the cane toad (*Bufo marinus*) | The cane toad was recorded onsite during survey works. The proposal is unlikely to increase the impacts of this listed threatening process. |
| Invasion of native plant communities by African Olive *Olea europaea* L. subsp. *cuspidata* | Not applicable |
| Invasion, establishment and spread of *Lantana camara* | Not applicable |

| | |
|---|---|
| Invasion of native plant communities by *Chrysanthemoides monilifera* (bitou bush and boneseed) | Not applicable |
| Invasion of native plant communities by exotic perennial grasses | Several exotic grass species were recorded on site. These should be removed in association with the proposal where it occurs within the works zone. |
| Invasion of the yellow crazy ant (*Anoplolepis gracilipes* (Fr. Smith)) into NSW | Not applicable |
| Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants | Not applicable |
| Loss of hollow-bearing trees | Not applicable |
| Loss or degradation (or both) of sites used for hill-topping by butterflies | Not applicable |
| Predation and hybridisation of feral dogs (*Canis lupus familiaris*) | Dogs are well known from the locality. The proposal is unlikely to increase the impacts of this listed threatening process. |
| Predation by the European red fox (*Vulpes vulpes*) | Not applicable |
| Predation by the feral cat (*Felis catus*) | Cats are well known within the locality. The proposal is unlikely to increase the impacts of this listed threatening process. |
| Predation by *Gambusia holbrooki* Girard, 1859 (plague minnow or mosquito fish) | Not applicable |
| Predation by the ship rat (*Rattus rattus*) on Lord Howe Island | Not applicable |
| Predation, habitat degradation, competition and disease transmission by feral pigs (*Sus scrofa*) | Not applicable |
| Removal of dead wood and dead trees | Not applicable |

Reviewing the above, it is considered that the proposed works will not have any significant impacts in accordance with the 'test of significance'.

A Species Impact Statement (SIS) would not be required for the proposal.

## 6.2 SEPP Koala Habitat Protection 2019 Assessment

On 1st March 2020 the new 2019 Koala SEPP (Koala Habitat Protection) commenced which replaces the previous SEPP 44 Koala Habitat Protection (1995).

The majority of the site is mapped as occurring within the 'Koala Development Application Map' and 'Site Investigation Area for Koala Plans of Management' (refer to **Figure 24**).

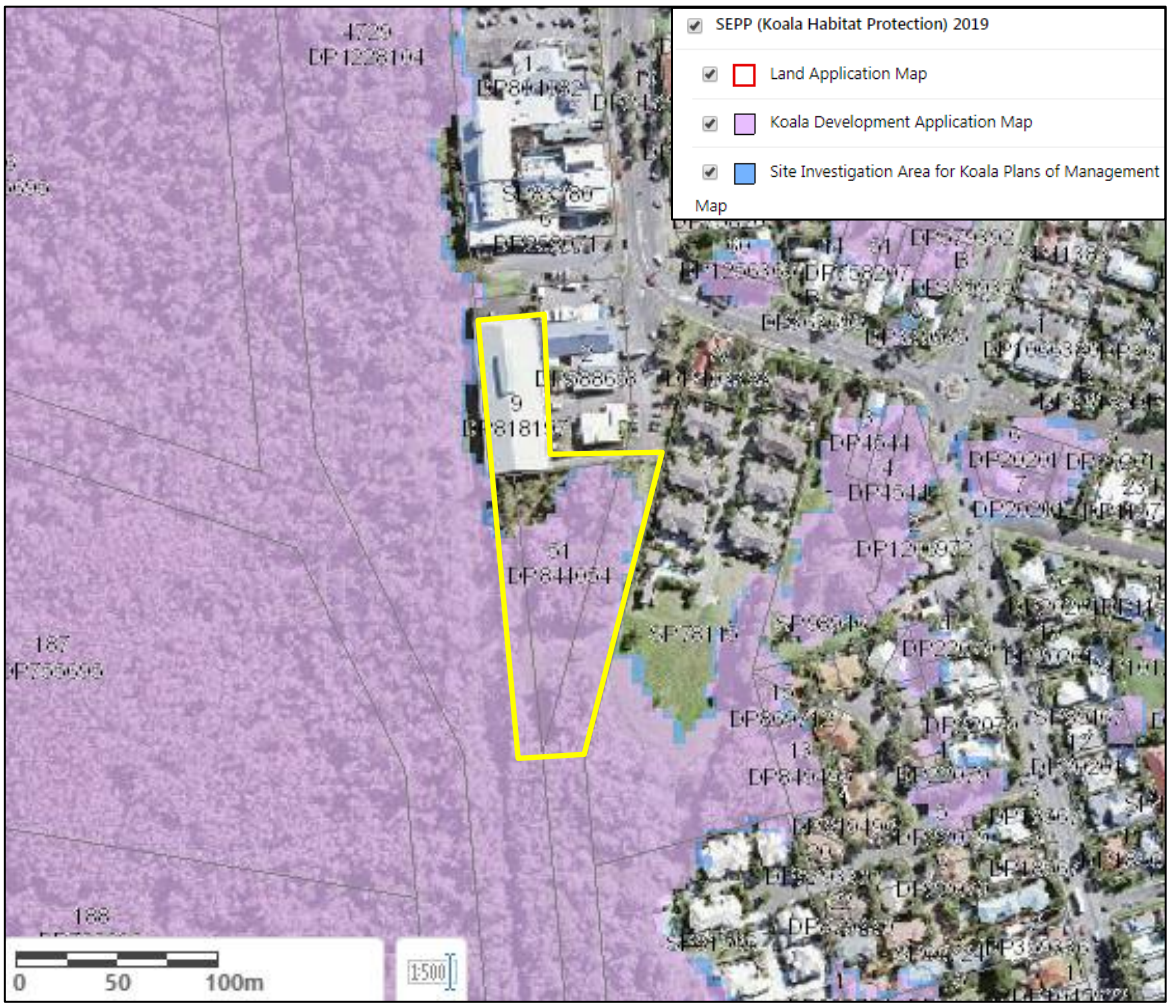


**Figure 24: SEPP Koala Habitat Protection 2019 Mapping**

The SEPP requires the following with regard to development proposals:
9 Development assessment process—no approved koala plan of management for land
(1) This clause applies to land to which this Policy applies if the land—
(a) is identified on the Koala Development Application Map, and
(b) has an area of at least 1 hectare (including adjoining land within the same ownership), and
(c) does not have an approved koala plan of management applying to the land.

SITE ASSESSMENT:

The site (land) is identified on the Koala Development Application Map and has an area of at least one hectare and does not have an approved KPOM. Therefore, the development assessment process applies.
(2) Before a council may grant consent to a development application for consent to carry out development on the land, the council must take into account—
(a) the requirements of the Guideline, or
(b) information, prepared by a suitably qualified and experienced person in accordance with the Guideline, provided by the applicant to the council demonstrating that—
(i) the land does not include any trees belonging to the feed tree species listed in Schedule 2 for the relevant koala management area, or
(ii) the land is not core koala habitat.

*core koala habitat* means—
(a) an area of land where koalas are present, or
(b) an area of land—
(i) which has been assessed by a suitably qualified and experienced person in accordance with the Guideline as being highly suitable koala habitat, and
(ii) where koalas have been recorded as being present in the previous 18 years.

Comment: the site is >1ha in area.

*Core koala habitat* is defined by the SEPP as:

1. An area of land where koalas are present; or

2. An area of land (i) which has been assessed by a suitably qualified and experienced person in accordance with the Guideline as being highly suitable koala habitat, and (ii) where koalas have been recorded as being present in the last 18 years

Fauna survey efforts of the site failed to directly, or indirectly record the koala onsite (refer to **Section 4** regarding details). Additionally, there are no BioNet koala records occurring within the site in the past 18 years (refer to **Figure 25** below).

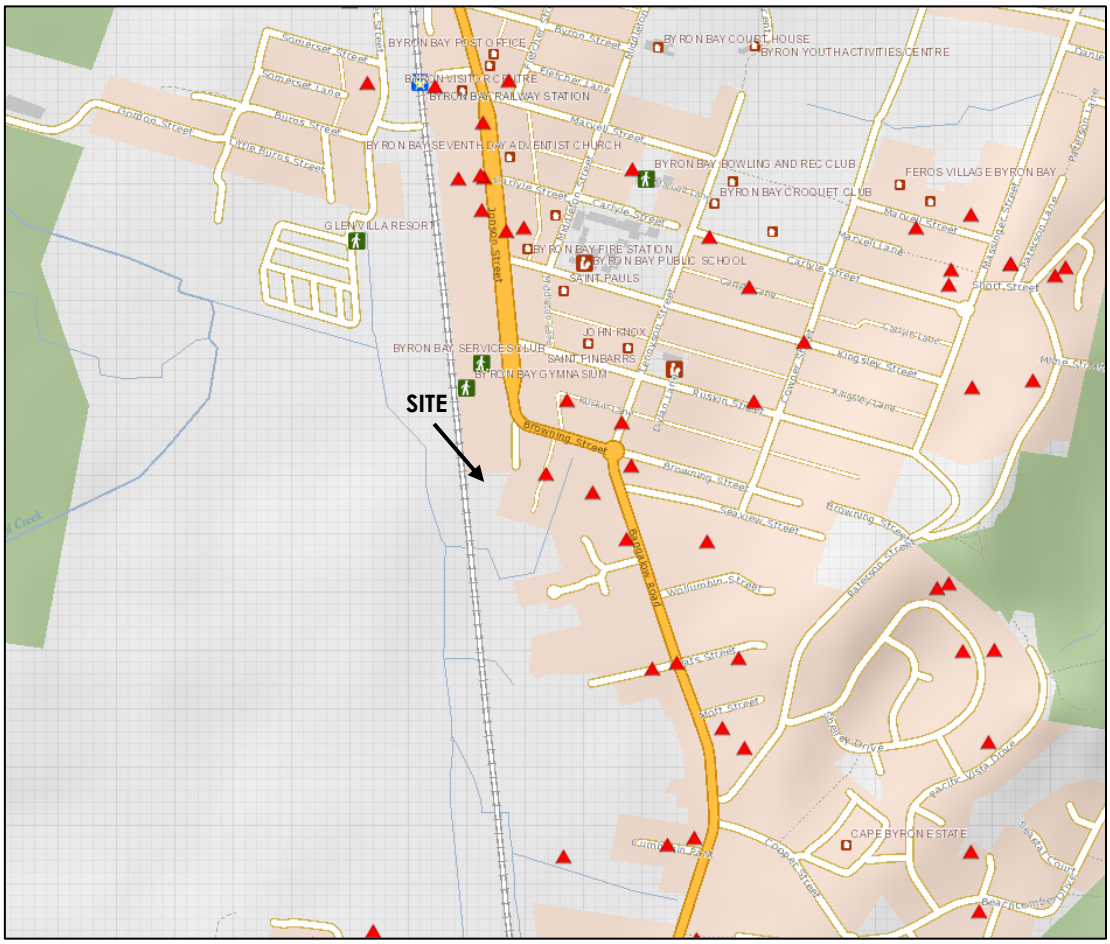


**Figure 25: Bionet Atlas Koala Records within Locality (2002 - Present)**

Reviewing the above, it is considered that the site does not represent 'core koala habitat' in regard to the SEPP Koala Habitat Protection.

It is noted that the Byron Shire Council has an adopted KPoM titled *Byron Coast Comprehensive Koala Plan of Management 2014* which was adopted by Council in 2015.

The proposed development has adopted Development Standards as provided within the BCCKPM.

The removal of koala feed trees, as well as the removal of other assessable native trees will be compensated via replacement planting in accordance with Council's *Development Control Plan – Chapter B2 – Preservation of Trees and Other Vegetation*. These will provide a net gain of potential koala habitat occurring within the locality. Additional potential impact and mitigation measures for the Koala have been provided within **Section 6.1** above.

# 7 SITE IMPACTS

This section of the report reviews the development proposal and likely resultant impact to flora, fauna and habitat value.

## 7.1 Significance of Impacts to Threatened Species and/or Communities

DEC (2005 & 2008) outline assessments relating to the significance of impacts of actions to threatened species, communities and populations. DEC (2005) notes that evaluation of impacts should involve not only the magnitude and extent of impacts, but also the significance of the impacts as related to the conservation importance of the habitat, individuals and populations likely to be affected.

Impacts are considered more significant if:

- Areas of high conservation value are affected.
- Individual animals and/or plants and/or subpopulations that are likely to be affected by a proposal play an important role in maintaining the long-term viability of the species, population or ecological community.
- Habitat features that are likely to be affected by a proposal play an important role in maintaining the long-term viability of the species, population or ecological community.
- The impacts are likely to be long-term in duration.
- The impacts are likely to be permanent and irreversible.

In this instance it is noted that the development will occur on a largely modified area which has been largely maintained over the years with residual areas of fragmented remnant vegetation remaining. Consequently, no threatened flora or fauna, or EECs are expected to be significantly impacted upon as a result of the development. Additionally, no endangered populations or AOBVs occur on site. Given its small size, historical modification and scarcity of tree cover it is considered that the site does not to represent significant habitat. Compensatory plantings measures will ensure there is no net loss of vegetation occurring within the locality.

## 7.2 Impacts to Vegetation

Clearing of vegetation (both native and exotic) will be the major direct impact associated with the intended development although this clearing will be restricted to largely modified areas with fragmented pockets of residual Paperbark Swamp Forest community requiring clearing to facilitate the proposal.

The vegetation proposed to be removed are considered to provide potential foraging resources for locally occurring fauna, although it is noted that similar type vegetation occurs in abundance throughout

the locality and greater region. As discussed in this report it is considered that these works will not have a significant environmental impact in the context of the planning scheme.

A summary of the proposed clearing rates for described communities associated with the proposal is tabulated below:

**Table 9: Clearing of Vegetation Communities as a Result of the Proposal**

| Mapped Community | EEC? | Approx. extent within subject site (sqm) | Approx. extent to be cleared (sqm) |
|---|---|---|---|
| Vegetation Community 1: Paperbark Swamp Forest of the Coastal Lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064) | Yes* | 2765 | 997 |
| Vegetation Community 2: Modified / Cleared Areas with Garden Beds, Ornamental Species and Weeds | No | 9661 | 8,103 |

*subject to the limitations and discussions of Section 3.2.1

A Vegetation Clearing Plan has been prepared and illustrated within **Figure 26**.


**Figure 26: Proposed Vegetation Clearing Plan**

As discussed in this report, it is considered that these works will not have a significant environmental impact given that the majority of the development footprint occurs in existing modified/cleared areas and the proposed vegetation to be removed is largely fragmented and/or occur within areas at the edge of existing contagious remnant. Compensatory measures in accordance with Chapter B2 – Preservation of Trees and Other Vegetation of *Byron Development Control Plan 2014* is proposed to occur as a part of the proposed landscape works within the site. Alternately, some of the compensatory plantings could occur within bare/cleared areas south of the subject site. Weed control in addition to revegetation within currently bare/denuded areas (i.e. drainage lines, areas currently heavily infested with weeds etc.) will enhance the ecological values in these areas.

## 7.3 Impacts to Fauna Habitat

The proposal will involve the clearing of ~997sqm of native vegetation (Community 1) and ~8103sqm of largely disturbed/modified vegetation (Community 2) to deliver the residential development as proposed. These proposed vegetation removal/modification works are not considered to represent a significant impact upon the endemic fauna assemblage of the study area, site or locality. The area to be modified has been selected to minimize tree removal and occupy a very small percentage of habitat occurring within the locality.

Due to the small size of the dwelling envelope, significant area of habitat to be retained and the existence of extensive areas of similar habitat augmenting the habitats of the site in adjacent areas, the proposed vegetation disturbance is not considered to represent a significant impact to fauna values.

It is acknowledged that the clearing of vegetation will impact upon fauna habitat elements including loss of feeding resources, removal of dead timber (fallen and standing), removal of low levels of ground strata, debris and leaf-litter. Such elements are necessary (depending upon species) for shelter, refuge from predators, feeding, temperature regulation and breeding. Typical additional impacts associated with vegetation clearing on fauna and associated habitat include:

- Overall loss of standing biomass and reduction in flora species abundance/diversity
- Mortality as a result of construction activities (removal/disturbance of nests, hollows, burrows and general habitat)
- Loss of habitat complexity from the clearance zones including loss of potential foraging and nesting/roosting resources
- Increased potential from 'edge effects' to retained remnants (on or offsite)
- Disturbance of species behaviour (i.e. some species are less tolerant to human presence or a higher level of human activity and may abandon currently utilized habitats)
- Reduction of potential fauna movement linkages throughout the overall landscape
- Alteration to the fauna assemblage (some species tolerant to modified habitats (i.e. rats, minors, crows etc.) may dominant the newly created niches and displace species from adjacent vegetated remnants)

In this instance, it is considered that only a minor loss of native foraging resources, potential refuge habitat and potential nesting/breeding sites will occur as the development footprint will be restricted to a relatively small area of largely disturbed/modified vegetation, with no hollow bearing trees will be removed. Vegetation proposed to be removed are currently highly fragmented and dominated by weed species in the lower strata.

The site adjoins a significant area of expansive forested wetland type vegetation communities. Taking into account the minor extent of habitat to be cleared, it is considered unlikely that a significant impact to the site's fauna habitat and associated assemblage will be occasioned by the proposal.

Proposed weed removal and compensatory plantings works within currently bare/cleared areas will provide fauna habitat. This is in addition to the proposed landscape works associated with the proposal.

It is also considered that a significant increase in 'edge effects' (and potential associated behavioural alteration through the establishment of a new edge) or significant reduction of terrestrial fauna movement through the landscape is unlikely to be significant due to the currently fragmented nature of

the vegetation within the development site, the absence of significant fauna corridors and the surrounding areas of urbanisation.

## 7.4 Fauna Mortality/Injury

Any level of construction undertaken has the potential to kill or injure fauna species. Whilst potential does exist for dispersal of numerous species (particularly avifauna) to retained habitats, less dispersive species or species not tolerant to a surrounding human interface may become trapped within the construction zone.

## 7.5 Mortality Associated with Roadways / Vehicle Strikes

Roads and traffic are widely accepted as having impacts upon terrestrial wildlife. "Roads cut across landscape features and divide wildlife habitats. Consequently, they are one of the main obstacles to the movement of land vertebrates (Yanes *et al.* 1995). The implications of movement barriers to wildlife populations are considerable. Barriers tend to create metapopulations (subpopulations) where a road divides a large continuous population into smaller, partially isolated local populations (Forman and Alexander 1998). Small populations fluctuate in size more widely and have a higher probability of extinction than do large populations (van der Zande *et al.* 1980). In addition, disruption of population dispersal (Mansergh and Scotts 1989) and recolonisation (Mader 1984; Andrews 1990) may result from the barrier-effect of roads.

Roads also result in vehicle collisions with wildlife (road-kill) and can represent a significant source of mortality for declining populations of some wildlife species (Harris and Gallagher 1989; Saunders 1990; Sheridan 1991; Scott *et al.* 1999).

It is widely accepted that terrestrial fauna (in particular koala) mortality associated with vehicle strike on roadways intersecting or proximate to habitat represents a serious through to the ongoing viability of populations (Dique et al, 2003; NPWS, 2003; McAlpine et al, 2007; EPA, 2006). Vehicle strikes are heightened where arterial and other roads bisect bushland, remnant bushland or urban habitat areas, resulting in high mortality of resident koalas, or limited success of dispersing animals that must cross roads to reach suitable habitat and mates (Dique *et al*. 2003 in EPA, 2007). NPWS (2003) note that habitat bisecting roadways are particularly likely to lead to increased vehicle strike where traffic volume is high, speeds exceed 60km/hr, where visibility of road edges is reduced and/or where lighting is absent.

Larger species or species with restricted distributions, or those regularly in contact with roads (e.g. migration paths or home ranges), are those most affected by road-kill (Bennett 1991; Forman and Alexander 1998) [in Taylor and Goldingay, 2003]". Morality rates can also be particularly high for species which are slow moving (i.e. arboreal mammals), those which become distracted by vehicle lights (i.e. kangaroos) and those which require many individual movements to cross the roadway (i.e. small reptiles and amphibians).

While it is noted that additional vehicle movement will occur onsite, the proposed roads within the site are low speed (<20kmh) and unlikely to cause a significant fauna mortality risk. The proposed roadways do not traverse significant areas of fauna habitat where a high risk of vehicle strikes may occur. Barriers such as the railway line to the west, commercial areas to the north, and heavily urbanised areas and fencing to the east are likely to restrict fauna movement throughout the site.

It is considered unlikely that the proposed roads will cause ongoing wildlife impacts.

## 7.6 Establishment of Weeds

Weed invasion occurs when unwanted or exotic plants become established in native bushland via natural dispersal vectors such as wind, water, insects, birds and other animals, however, humans are by far the most effective and efficient vector of plants (Coutts-Smith and Downey, 2006; Randall, 2007 in TSSC, 2010). Humans may facilitate the direct introduction weeds by inappropriate garden dumping, via vehicles, imported agricultural products and stock rotation/movement. The potential impacts of weed invasion in Australia are well documented and summarized in TSSC (2010) including:

*Genetic effects*
Environmental weeds cause a decline in the number of genetically distinct sub-populations that make up a native species. It is reasonable to conclude that an associated reduction in the genetic diversity of the affected species is likely to result. The invasion of weeds may also affect the genetic diversity of native species through cross breeding or hybridisation, whereby foreign genes are introduced into local plant populations

*Introduction of diseases*
The introduction of weeds often results in the introduction of pathogens (fungi, nematodes, bacteria and viruses) that are associated with these plants in their natural range (ILDA, 2009).

*Competition for resources*
Competition between species is inevitable when more than one species occupy the same niche and have similar requirements for a limited resource (Cadotte, 2007). Weeds are known to compete with native plants for limited resources such as moisture, nutrients, sunlight, pollinators and space (Csurches and Edwards, 1998; Blood, 2001; Brunskill, 2002).

*Prevention of recruitment*
Growth of weeds can be sufficiently vigorous to reduce or prevent the establishment of native plant species (Csurches and Edwards, 1998).

*Alteration of ecosystem processes*
Invasive weeds are also capable of altering various ecosystem processes such as geomorphological processes, hydrological cycles, nutrient dynamics and disturbance regimes (Csurches and Edwards, 1998). Alterations to ecosystem processes can potentially influence many if not all species within a community (Vranjic et al., 2000).

*Changes to abundance of indigenous fauna*
Weeds that become invasive can both directly and indirectly change the abundance of indigenous fauna. Fauna such as the Richmond Birdwing Butterfly and *Petrogale persephone* (Proserpine Rock Wallaby) are directly impacted by escaped garden plants, Dutchman's Pipe (*Aristolochia elegans*) and Pink Periwinkle (*Catharanthus roseus*), respectively, both of which are attractive as a food source and yet toxic to them when consumed (Watts and Vidler, 2006). Indirectly, weeds impact indigenous fauna by altering the availability of suitable habitat, including food and shelter, and by creating habitats that harbour other pest species that can, in turn, have a detrimental effect.

As discussed in this report, weeds are abundant within, and proximate to the site. To minimise the potential future impact of unmitigated continued spread of these species it is considered appropriate that the existing infestation be eradicated in association with the proposed works where they occur within the development footprint, or areas proposed for compensatory plantings. A Weed Management Plan should be prepared and implemented as a part of the contractor's CEMP.

# 8 MEASURES TO AVOID AND MINIMISE ECOLOGICAL IMPACTS

## 8.1 Protection and Avoidance

Reviewing the ecological integrity of vegetation associations and fauna habitat present on the site, the proposed development is unlikely to impose a significant impact on the environmental values of the locality. No significant habitats, significant flora species or significant fauna species (or associated important habitat) were recorded onsite which would warrant redesign of the proposal to include covenants or parkland for ecological protection purposes.

## 8.2 Mitigation Measures

The following measures are proposed to mitigate potential impacts associated with the proposed development:

*Impact of Vegetation and Habitat Clearing*

Disturbance to vegetation as described in this report will be unavoidable to deliver the development as proposed. To ensure that clearing impacts do not occur outside of the designated clearance zones (i.e. within offsite areas) it will be necessary to clearly identify and mark the boundaries of the clearance zone prior to construction similar to the below:

Retained native vegetation (individual trees and copses of vegetation) proximate to works which are not subject for removal are to be clearly managed during construction activities generally in accordance with the *Australian Standard 'AS 4970 Protection of Trees on Development Sites'* to avoid any potential impacts.

The site manager should ensure the proposal avoids any of the following during construction and/or operational phase upon retained vegetation:

- Compaction of the root plate including parking of any vehicles;
- Filling of soil within the tree protection zone (tpz) and/or drip zone; and
- Storage of any building materials within the drip zone.


LEGEND:

1 Chain wire mesh panels with shade cloth (if required) attached, held in place with concrete feet.

2 Alternative plywood or wooden paling fence panels. This fencing material also prevents building materials or soil entering the Tree Protection Zone (TPZ).

3 Mulch installation across surface of TPZ (at the discretion of the project arborist). No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.

4 Bracing is permissible within the TPZ. Installation of supports should avoid damaging roots.

**Figure 27: Tree Protection Fencing Examples**

Within the designated clearance zone identification of areas to be cleared are to be pre-assessed by an experienced wildlife spotter/catcher. This pre-assessment shall allow for an inventory of trees bearing birds nests and/or hollows to be undertaken prior to felling works [none noted during ecological assessment]. A wildlife spotter catcher is to be utilized during clearing of the site to ensure safe dispersal and relocation of any encountered native fauna within the construction footprint.

*Offsets and Compensatory Works*

No offsets are triggered in accordance with the Biodiversity Offsets Scheme.

Compensatory planting measures are proposed as per *Byron Shire Development Control Plan (2014) – Chapter B2 – Preservation of Trees and Other Vegetation*. This has been discussed within **Section 7.2** of this report.

No nest boxes are required to be installed as no hollow-bearing trees will be removed as a part of the proposal.

# 9 Summary and Conclusions

Planit Consulting have been engaged by 156 Jonson Street P/L to undertake a Basic Terrestrial Flora and Fauna Assessment for a proposed mixed used development for commercial purposes including the provision of a two-storey parking structure located at 156 – 158 Jonson Street, Byron Bay.

The assessment has included the following:

- Survey, ground-truthing and mapping of vegetation communities and determining conservation status reflective of reference reports and onsite condition
- Survey for faunal species including an assessment of the site's habitat value
- Survey for threatened flora species
- Providing an ecological site assessment report identifying development constraints, impacts and mitigation methods for proposed activities
- Addressing statutory requirements including 'Test of Significance' in accordance with Section 7.3 of the *Biodiversity Conservation Act 2016* and SEPP (Koala Habitat Protection) 2019.

The flora survey of the study area identified two (2) vegetation communities. No flora species recorded within the site has been listed as endangered or vulnerable under the TSCA (1995) or the EPBCA (1999). One (1) recorded vegetation community is considered to potentially be reflective of an Endangered Ecological Community under the BCA (2016). No threatened ecological communities scheduled under the EPBCA (1999) were recorded.

The fauna survey of the site (and immediately adjacent areas) conducted by Planit resulted in the recording of forty (40) species of birds, five (5) species of mammals, three (3) species of reptiles and four (4) species of amphibians.

While no threatened species were recorded during the site survey, three species (Grey-headed Flying-fox, Little Bent-wing Bat & Koala) were subject to a 'Test of Significance'. The assessment concludes that the impacts of the proposed development are unlikely to threaten the viability of any local populations of the nominated species/communities. A species impact statement is therefore not required.

The proposed development will result in the removal/modification of ~997sqm of Community 1 (Paperbark Swamp Forest of the Coastal Lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion (PCT 1064)) and ~8103sqm of Community 2 (Modified / Cleared Areas with Garden Beds, Ornamental Species and Weeds).

To offset impacts associated with the proposal, compensatory plantings are proposed. Additionally, weed removal is proposed within areas of the site which will allow for natural regeneration to occur.

Recommended mitigation measures have been incorporated within the report which identified possible impacts and how to rectify them. This includes other management plans which have been prepared for the proposal.

Reviewing the above information, it is considered unlikely that the proposed development will have an unacceptable environmental impact.

# 10 References


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# Attachment 1

Proposal Plans (Prepared by Harley Graham)

# 156 JONSON STREET - BYRON BAY

# 10/9/20


01 LOCATION PLAN
1:1000

HARLEY GRAHAM ARCHITECTS
LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481
F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com
ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
|---|---|---|
| DRAFT DA - 10/9/20 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 156 JONSON ST (JOB NAME) | 156 Jonson St, Byron Bay (ADDRESS) | NORTH | SHEET TITLE: LOCATION PLAN | | | |
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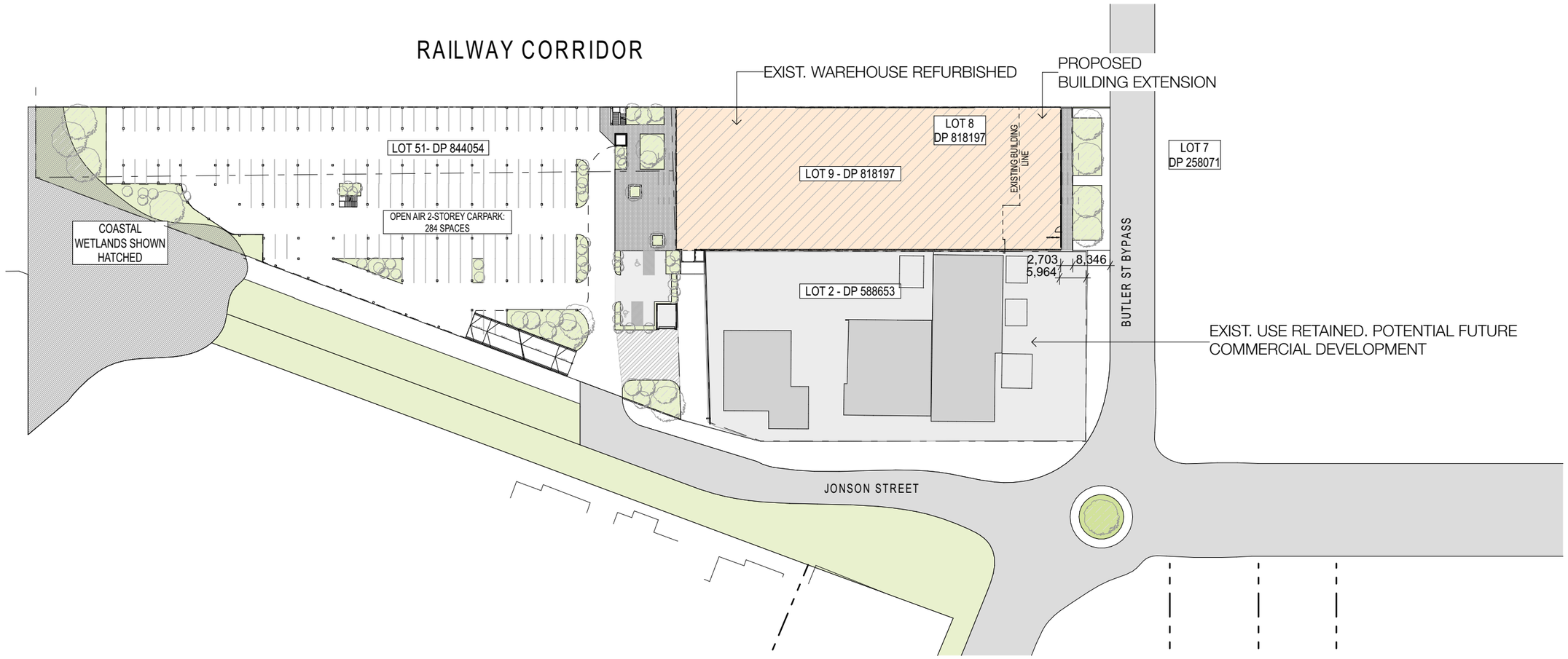


01 SITE PLAN
1:1000

HARLEY GRAHAM ARCHITECTS
LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481
F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com
ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
|---|---|---|
| | | DRAFT DA - 10/9/20 |

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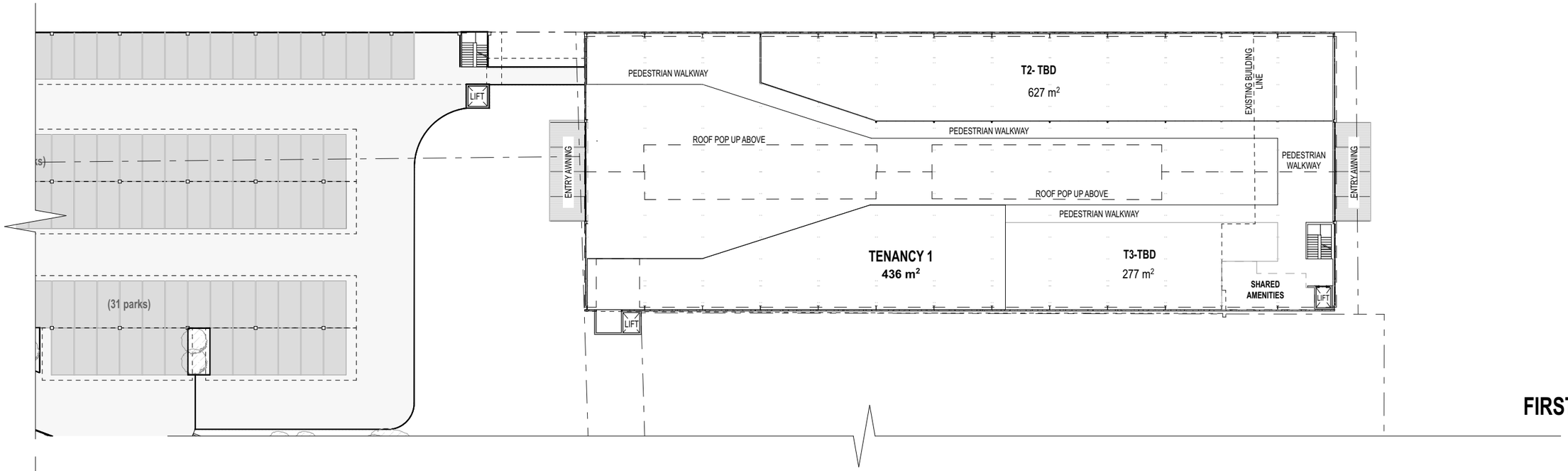
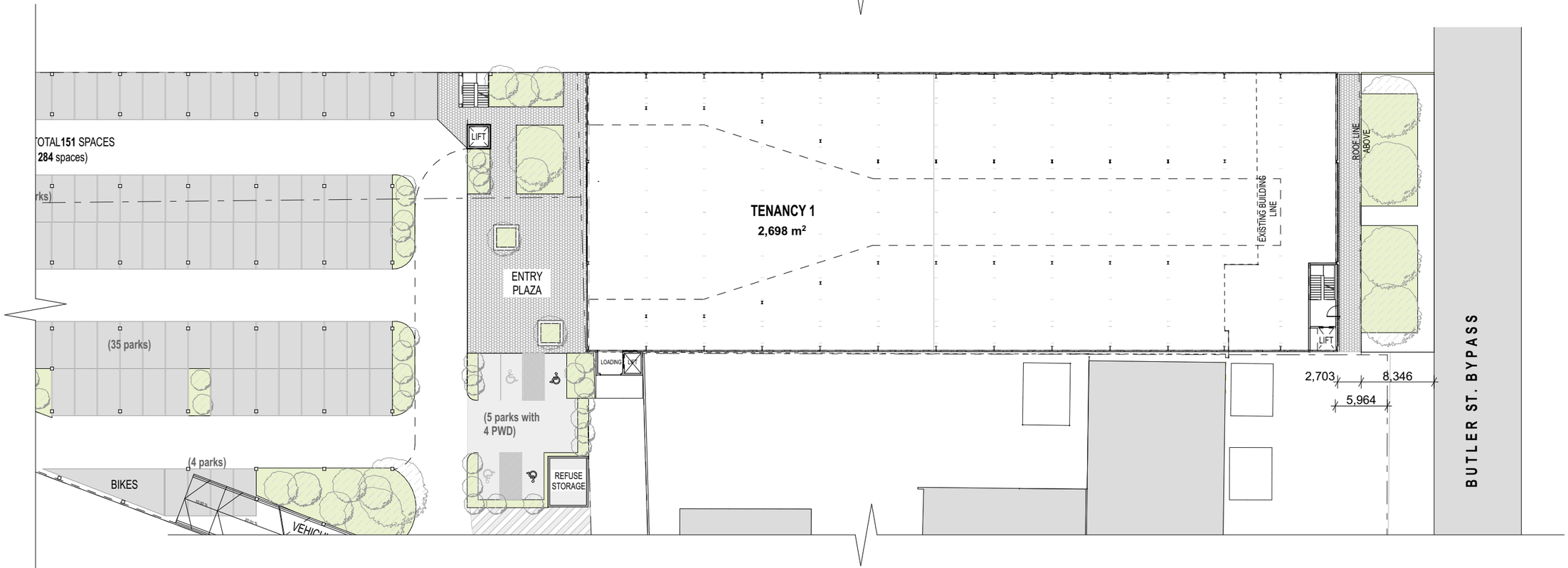
|---|---|---|---|---|---|---|
| 156 JONSON ST (JOB NAME) | | | 156 Jonson St, Byron Bay (ADDRESS) | NORTH | SHEET TITLE: SITE PLAN | |
| HGA194 (JOB NO.) | SW (DRAWN) | HG (APPROVED) | (SCALE) | PAPER: A3 | DWG NO.: CP.02 | STATUS: NOT FOR CONSTRUCTION / REV |




FIRST FLOOR 1:500




GROUND FLOOR 1:500

HARLEY GRAHAM ARCHITECTS
LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481
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| DRAFT DA - 10/9/20 | | |

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| 156 JONSON ST (JOB NAME) | | | 156 Jonson St, Byron Bay (ADDRESS) | NORTH | SHEET TITLE | |
| HGA194 (JOB NO.) | SW (DRAWN) | HG (APPROVED) | (SCALE) | PAPER A3 | DWG NO. CP.03 | STATUS NOT FOR CONSTRUCTION / REV |

# BUILDING FLOOR PLANS


01 GROUND FLOOR
1:500

HARLEY GRAHAM ARCHITECTS
LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481
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ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
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| DRAFT DA - 10/9/20 | | |

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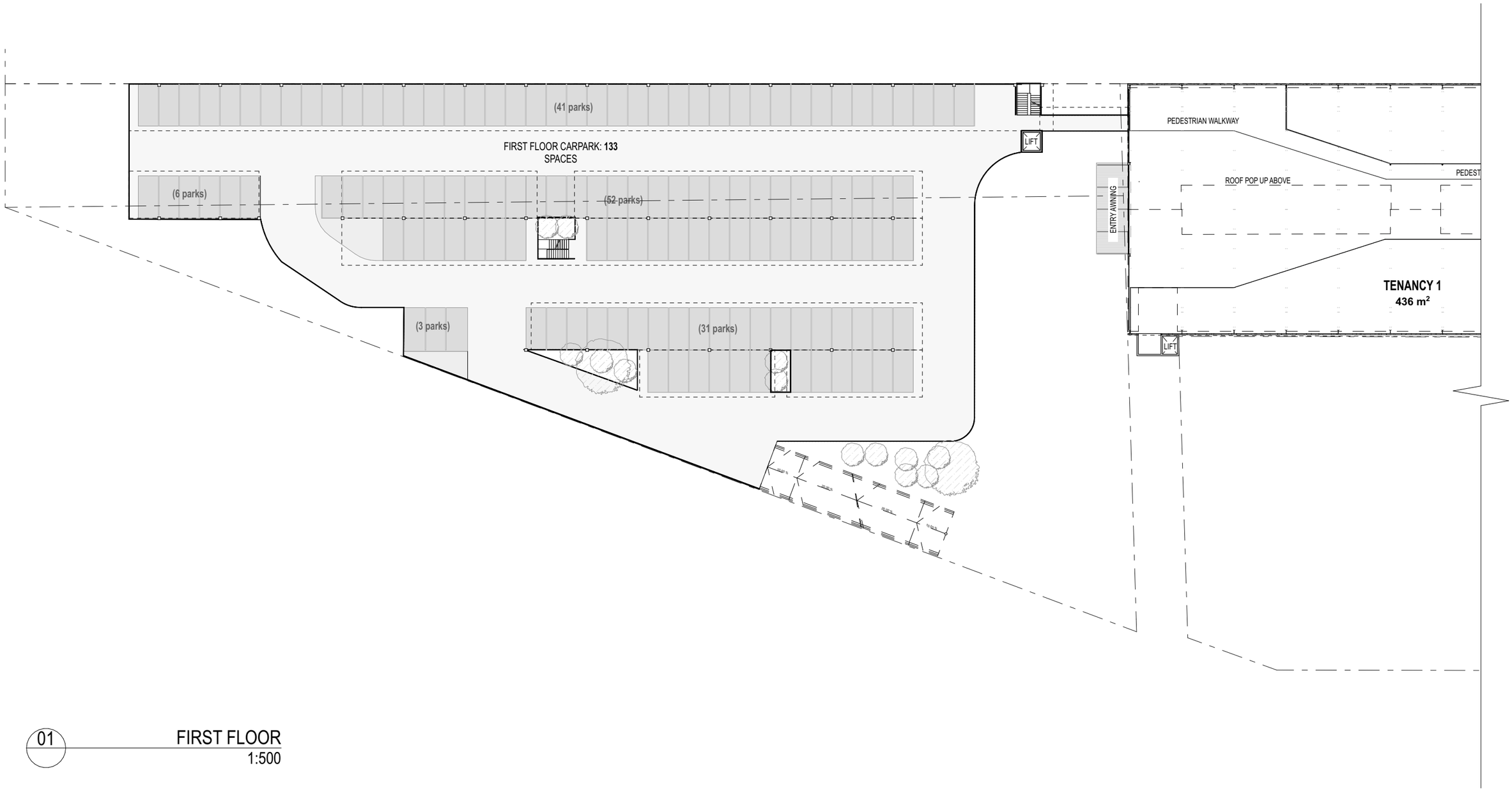
|---|---|---|---|---|---|
| 156 JONSON ST (JOB NAME) | | | 156 Jonson St, Byron Bay (ADDRESS) | NORTH | SHEET TITLE: CAR PARKING PLAN - GROUND FLOOR |
| HGA194 (JOB NO.) | SW (DRAWN) | HG (APPROVED) | (SCALE) | PAPER: A3 | DWG NO.: CP.04 / STATUS: NOT FOR CONSTRUCTION / REV |




01 FIRST FLOOR
1:500

HARLEY GRAHAM ARCHITECTS
LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481
F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com
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| Issue Date | Issue ID | Issue Name |
|---|---|---|
| DRAFT DA - 10/9/20 | | |

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|---|---|---|---|---|---|
| 156 JONSON ST (JOB NAME) | | | 156 Jonson St, Byron Bay (ADDRESS) | NORTH | SHEET TITLE: FIRST FLOOR - CARPARK |
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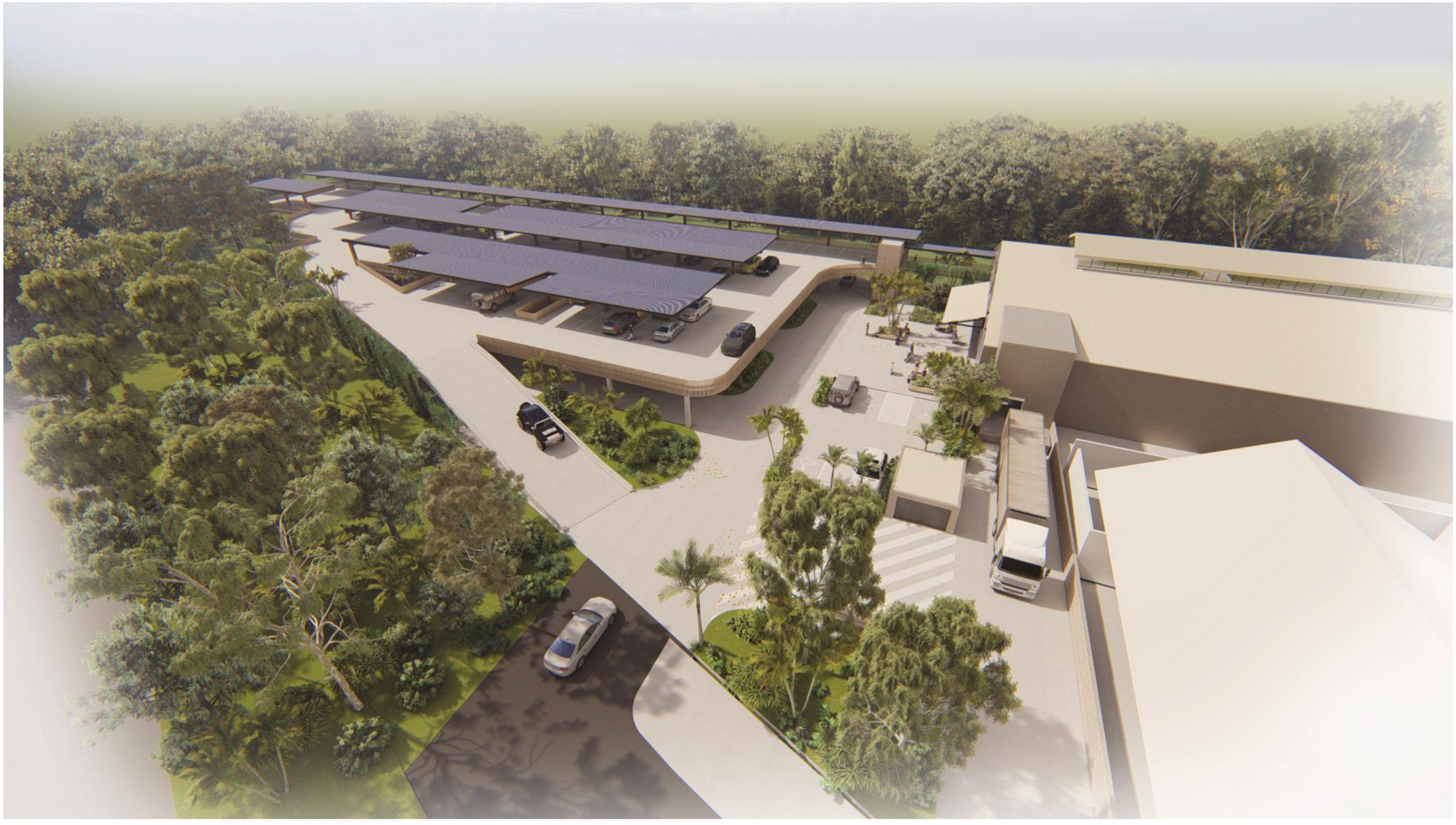

# PROPOSED CARPARK - AERIAL VIEW

HARLEY GRAHAM ARCHITECTS

LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481

F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com

ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
|---|---|---|
| DRAFT DA - 10/9/20 | | |

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|---|---|---|---|---|---|---|
| 156 JONSON ST<br>JOB NAME | | | 156 Jonson St, Byron Bay<br>ADDRESS | | NORTH | SHEET TITLE<br>PERSPECTIVE - CARPARK ENTRY |
| HGA194<br>JOB NO. | SW<br>DRAWN | HG<br>APPROVED | <br>SCALE | PAPER<br>A3 | DWG NO.<br>CP.06 | STATUS<br>NOT FOR CONSTRUCTION | REV |

# PROPOSED CARPARK - ENTRY FROM JONSON ST

HARLEY GRAHAM ARCHITECTS

LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481

F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com

ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
|---|---|---|
| DRAFT DA - 10/9/20 | | |

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|---|---|---|---|---|---|---|
| 156 JONSON ST<br>JOB NAME | | | 156 Jonson St, Byron Bay<br>ADDRESS | NORTH | SHEET TITLE<br>PERSPECTIVE - CARPARK OVERVIEW | |
| HGA194<br>JOB NO. | SW<br>DRAWN | HG<br>APPROVED | SCALE | PAPER<br>A3 | DWG NO.<br>CP.07 | STATUS<br>NOT FOR CONSTRUCTION | REV |


## SOUTHERN FACADE

HARLEY GRAHAM ARCHITECTS

LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481

F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com

ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
|---|---|---|
| DRAFT DA - 10/9/20 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 156 JONSON ST (JOB NAME) | | | 156 Jonson St, Byron Bay (ADDRESS) | NORTH | SHEET TITLE: 3D PERSPECTIVE - SOUTH FACADE | |
| HGA194 (JOB NO.) | SW (DRAWN) | HG (APPROVED) | (SCALE) | PAPER: A3 | DWG NO.: CP.08 | STATUS: NOT FOR CONSTRUCTION / REV |


## NORTHERN FACADE - BUTLER STREET

HARLEY GRAHAM ARCHITECTS
LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481
F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com
ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
|---|---|---|
| DRAFT DA - 10/9/20 | | |

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|---|---|---|---|---|---|---|
| 156 JONSON ST<br>JOB NAME | | | 156 Jonson St, Byron Bay<br>ADDRESS | | NORTH | SHEET TITLE<br>3D PERSPECTIVE - NORTH FACADE |
| HGA194<br>JOB NO. | SW<br>DRAWN | HG<br>APPROVED | SCALE | PAPER<br>A3 | DWG NO.<br>CP.09 | STATUS<br>NOT FOR CONSTRUCTION | REV |

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# Attachment 2

## NSW Bionet Database Records (2020)

Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory, and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°C; ^^ rounded to 0.01°C. Copyright the State of NSW through the Department of Planning, Industry and Environment. Search criteria : Public Report of all Valid Records of Threatened (listed on BC Act 2016) Entities in selected area [North: -28.60 West: 153.56 East: 153.66 South: -28.70] returned a total of 3,647 records of 99 species.

Report generated on 10/07/2020 4:13 PM

| Kingdom | Class | Family | Species Code | Scientific Name | Exotic | Common Name | NSW status | Comm. status | Records |
|---|---|---|---|---|---|---|---|---|---|
| Animalia | Amphibia | Myobatrachidae | 3137 | *Crinia tinnula* | | Wallum Froglet | V,P | | 128 |
| Animalia | Amphibia | Hylidae | 3166 | *Litoria aurea* | | Green and Golden Bell Frog | E1,P | V | 3 |
| Animalia | Amphibia | Hylidae | 3202 | *Litoria olongburensis* | | Olongburra Frog | V,P | V | 37 |
| Animalia | Reptilia | Cheloniidae | 2004 | *Caretta caretta* | | Loggerhead Turtle | E1,P | E | 104 |
| Animalia | Reptilia | Cheloniidae | 2007 | *Chelonia mydas* | | Green Turtle | V,P | V | 114 |
| Animalia | Aves | Phaethontidae | 0107 | *Phaethon rubricauda* | | Red-tailed Tropicbird | V,P | C,J | 1 |
| Animalia | Aves | Columbidae | 0025 | *Ptilinopus magnificus* | | Wompoo Fruit-Dove | V,P | | 10 |
| Animalia | Aves | Columbidae | 0021 | *Ptilinopus regina* | | Rose-crowned Fruit-Dove | V,P | | 14 |
| Animalia | Aves | Columbidae | 0023 | *Ptilinopus superbus* | | Superb Fruit-Dove | V,P | | 2 |
| Animalia | Aves | Podargidae | 0314 | *Podargus ocellatus* | | Marbled Frogmouth | V,P | | 3 |
| Animalia | Aves | Procellariidae | 0929 | *Macronectes giganteus* | | Southern Giant Petrel | E1,P | E | 39 |
| Animalia | Aves | Procellariidae | 0937 | *Macronectes halli* | | Northern Giant-Petrel | V,P | V | 6 |
| Animalia | Aves | Procellariidae | 8684 | *Pterodroma leucoptera leucoptera* | | Gould's Petrel | V,P | E | 1 |
| Animalia | Aves | Procellariidae | 8993 | *Pterodroma neglecta neglecta* | | Kermadec Petrel (west Pacific subspecies) | V,P | V | 1 |
| Animalia | Aves | Procellariidae | 0955 | *Pterodroma nigripennis* | | Black-winged Petrel | V,P | | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Animalia | Aves | Ciconiidae | 0183 | *Ephippiorhynchus asiaticus* | Black-necked Stork | E1,P | 33 |
| Animalia | Aves | Ardeidae | 0197 | *Botaurus poiciloptilus* | Australasian Bittern | E1,P E | 3 |
| Animalia | Aves | Ardeidae | 0196 | *Ixobrychus flavicollis* | Black Bittern | V,P | 14 |
| Animalia | Aves | Accipitridae | 0226 | *Haliaeetus leucogaster* | White-bellied Sea-Eagle | V,P | 11 |
| Animalia | Aves | Accipitridae | 0225 | *Hieraaetus morphnoides* | Little Eagle | V,P | 1 |
| Animalia | Aves | Accipitridae | 0230 | *^^Lophoictinia isura* | Square-tailed Kite | V,P,3 | 3 |
| Animalia | Aves | Accipitridae | 8739 | *^^Pandion cristatus* | Eastern Osprey | V,P,3 | 25 |
| Animalia | Aves | Gruidae | 0177 | *Grus rubicunda* | Brolga | V,P | 1 |
| Animalia | Aves | Rallidae | 0053 | *Amaurornis moluccana* | Pale-vented Bush-hen | V,P | 34 |
| Animalia | Aves | Burhinidae | 0174 | *Burhinus grallarius* | Bush Stone-curlew | E1,P | 19 |
| Animalia | Aves | Burhinidae | 0175 | *Esacus magnirostris* | Beach Stone-curlew | E4A,P | 15 |
| Animalia | Aves | Haematopodidae | 0131 | *Haematopus fuliginosus* | Sooty Oystercatcher | V,P | 4 |
| Animalia | Aves | Haematopodidae | 0130 | *Haematopus longirostris* | Pied Oystercatcher | E1,P | 37 |
| Animalia | Aves | Jacanidae | 0171 | *Irediparra gallinacea* | Comb-crested Jacana | V,P | 13 |
| Animalia | Aves | Scolopacidae | 0161 | *Calidris ferruginea* | Curlew Sandpiper | E1,P CE,C,J,K | 1 |
| Animalia | Aves | Scolopacidae | 0165 | *Calidris tenuirostris* | Great Knot | V,P CE,C,J,K | 3 |
| Animalia | Aves | Laridae | 0972 | *Gygis alba* | White Tern | V,P | 1 |
| Animalia | Aves | Laridae | 0120 | *Onychoprion fuscata* | Sooty Tern | V,P | 2 |
| Animalia | Aves | Laridae | 9926 | *Procelsterna cerulea* | Grey Ternlet | V,P | 1 |
| Animalia | Aves | Laridae | 0117 | *Sternula albifrons* | Little Tern | E1,P C,J,K | 12 |
| Animalia | Aves | Cacatuidae | 0265 | *^Calyptorhynchus lathami* | Glossy Black-Cockatoo | V,P,2 | 4 |
| Animalia | Aves | Psittacidae | 8028 | *^Cyclopsitta diophthalma coxeni* | Coxen's Fig-Parrot | E4A,P,2 E | 1 |
| Animalia | Aves | Psittacidae | 0260 | *Glossopsitta pusilla* | Little Lorikeet | V,P | 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Animalia | Aves | Tytonidae | 0252 | ^^*Tyto longimembris* | Eastern Grass Owl | V,P,3 | | 15 |
| Animalia | Aves | Tytonidae | 0250 | ^^*Tyto novaehollandiae* | Masked Owl | V,P,3 | | 5 |
| Animalia | Aves | Tytonidae | 9924 | ^^*Tyto tenebricosa* | Sooty Owl | V,P,3 | | 1 |
| Animalia | Aves | Monarchidae | 0376 | *Carterornis leucotis* | White-eared Monarch | V,P | | 7 |
| Animalia | Aves | Estrildidae | 0652 | *Stagonopleura guttata* | Diamond Firetail | V,P | | 46 |
| Animalia | Mammalia | Dasyuridae | 1008 | *Dasyurus maculatus* | Spotted-tailed Quoll | V,P | E | 3 |
| Animalia | Mammalia | Dasyuridae | 1045 | *Planigale maculata* | Common Planigale | V,P | | 20 |
| Animalia | Mammalia | Phascolarctidae | 1162 | *Phascolarctos cinereus* | Koala | V,P | V | 478 |
| Animalia | Mammalia | Potoroidae | 1175 | *Potorous tridactylus* | Long-nosed Potoroo | V,P | V | 9 |
| Animalia | Mammalia | Pteropodidae | 1280 | *Pteropus poliocephalus* | Grey-headed Flying-fox | V,P | V | 59 |
| Animalia | Mammalia | Pteropodidae | 1294 | *Syconycteris australis* | Common Blossom-bat | V,P | | 11 |
| Animalia | Mammalia | Emballonuridae | 1321 | *Saccolaimus flaviventris* | Yellow-bellied Sheathtail-bat | V,P | | 1 |
| Animalia | Mammalia | Molossidae | 1329 | *Micronomus norfolkensis* | Eastern Coastal Free-tailed Bat | V,P | | 1 |
| Animalia | Mammalia | Vespertilionidae | 1357 | *Myotis macropus* | Southern Myotis | V,P | | 31 |
| Animalia | Mammalia | Vespertilionidae | 1336 | *Nyctophilus bifax* | Eastern Long-eared Bat | V,P | | 29 |
| Animalia | Mammalia | Vespertilionidae | 1361 | *Scoteanax rueppellii* | Greater Broad-nosed Bat | V,P | | 5 |
| Animalia | Mammalia | Muridae | 1466 | *Pseudomys gracilicaudatus* | Eastern Chestnut Mouse | V,P | | 2 |
| Animalia | Mammalia | Dugongidae | 1558 | *Dugong dugon* | Dugong | E1,P | | 3 |
| Animalia | Mammalia | Otariidae | 1543 | *Arctocephalus forsteri* | New Zealand Fur-seal | V,P | | 1 |
| Animalia | Mammalia | Otariidae | 1882 | *Arctocephalus pusillus doriferus* | Australian Fur-seal | V,P | | 1 |
| Animalia | Mammalia | Balaenopteridae | 1575 | *Megaptera novaeangliae* | Humpback Whale | V,P | V | 6 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Animalia | Insecta | Noctuidae | I021 | *Phyllodes imperialis southern subspecies* | Southern Pink Underwing Moth | E1 | E | 8 |
| Animalia | Insecta | Nymphalidae | I024 | *Argynnis hyperbius* | Laced Fritillary | E1 | CE | 1 |
| Animalia | Insecta | Petaluridae | I007 | *Petalura gigantea* | Giant Dragonfly | E1 | | 2 |
| Animalia | Insecta | Petaluridae | I138 | *Petalura litorea* | Coastal Petaltail | E1 | | 7 |
| Animalia | Gastropoda | Camaenidae | I002 | *Thersites mitchellae* | Mitchell's Rainforest Snail | E1 | CE | 178 |
| Plantae | Flora | Apocynaceae | 1233 | *Marsdenia longiloba* | Slender Marsdenia | E1 | V | 2 |
| Plantae | Flora | Casuarinaceae | 8980 | *Allocasuarina defungens* | Dwarf Heath Casuarina | E1 | E | 1146 |
| Plantae | Flora | Cunoniaceae | 10943 | *^Davidsonia jerseyana* | Davidson's Plum | E1,2 | E | 38 |
| Plantae | Flora | Elaeocarpaceae | 2575 | *^^Elaeocarpus williamsianus* | Hairy Quandong | E1,3 | E | 5 |
| Plantae | Flora | Euphorbiaceae | 9851 | *Chamaesyce psammogeton* | Sand Spurge | E1 | | 1 |
| Plantae | Flora | Fabaceae (Caesalpinioideae) | 1877 | *Caesalpinia bonduc* | Knicker Nut | E1 | | 1 |
| Plantae | Flora | Fabaceae (Faboideae) | 2833 | *Desmodium acanthocladum* | Thorny Pea | V | V | 1 |
| Plantae | Flora | Fabaceae (Mimosoideae) | 7757 | *Archidendron hendersonii* | White Lace Flower | V | | 50 |
| Plantae | Flora | Flacourtiaceae | 3114 | *Xylosma terrae-reginae* | Queensland Xylosma | E1 | | 22 |
| Plantae | Flora | Lauraceae | 3477 | *Cryptocarya foetida* | Stinking Cryptocarya | V | V | 228 |
| Plantae | Flora | Lauraceae | 8948 | *Endiandra floydii* | Crystal Creek Walnut | E1 | E | 36 |
| Plantae | Flora | Lauraceae | 3491 | *Endiandra hayesii* | Rusty Rose Walnut | V | V | 9 |
| Plantae | Flora | Lauraceae | 8480 | *Endiandra muelleri subsp. bracteata* | Green-leaved Rose Walnut | E1 | | 23 |
| Plantae | Flora | Meliaceae | 3682 | *Owenia cepiodora* | Onion Cedar | V | V | 5 |
| Plantae | Flora | Menispermaceae | 3691 | *Tinospora tinosporoides* | Arrow-head Vine | V | | 20 |

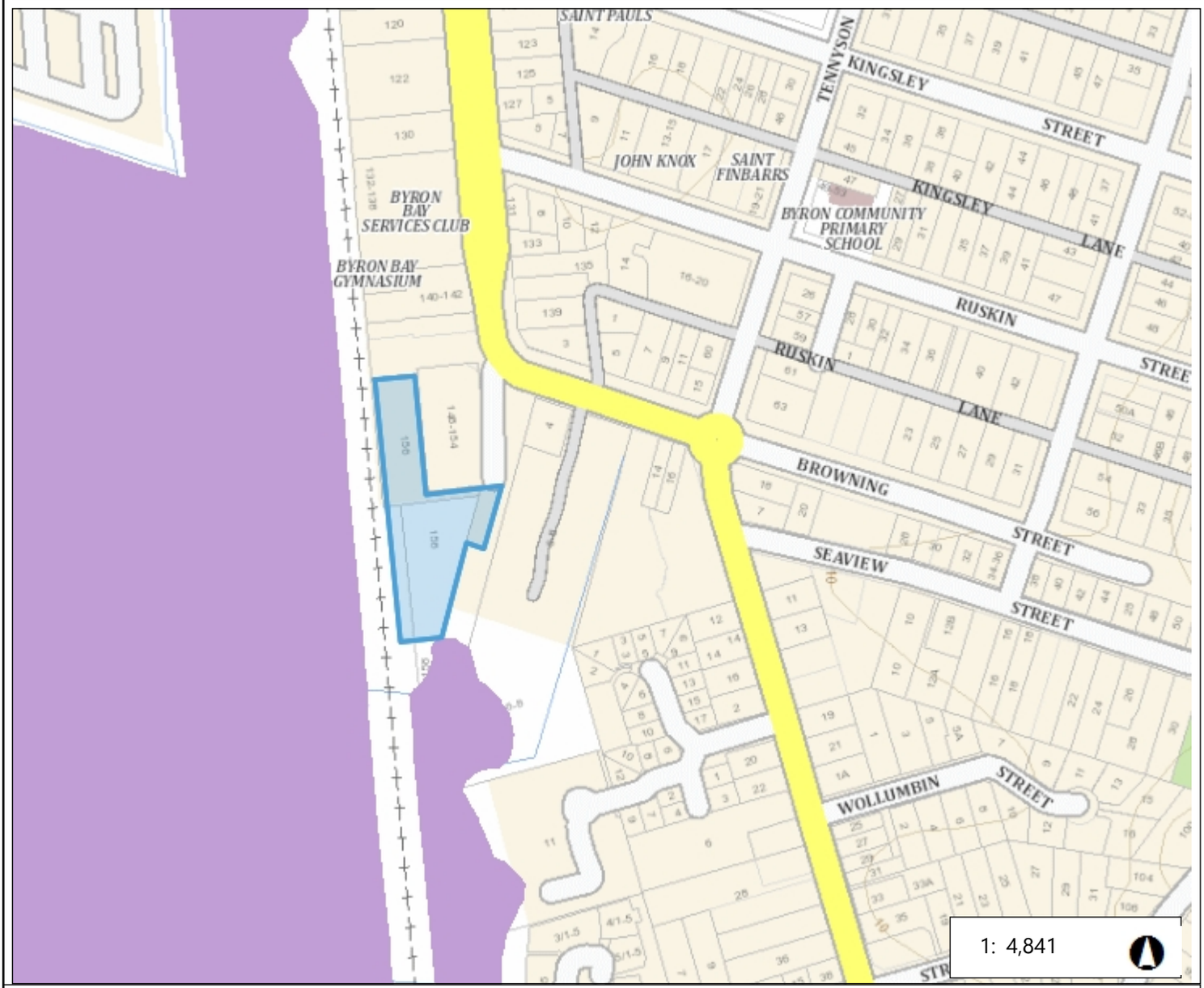
| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Plantae | Flora | Myrtaceae | 4283 | *Rhodamnia rubescens* | Scrub Turpentine | E4A | | 23 |
| Plantae | Flora | Myrtaceae | 4284 | *Rhodomyrtus psidioides* | Native Guava | E4A | | 14 |
| Plantae | Flora | Myrtaceae | 4290 | *Syzygium hodgkinsoniae* | Red Lilly Pilly | V | V | 10 |
| Plantae | Flora | Myrtaceae | 4292 | *Syzygium moorei* | Durobby | V | V | 54 |
| Plantae | Flora | Orchidaceae | 14732 | *^Diuris byronensis* | Byron Bay Diuris | E1,P,2 | | 58 |
| Plantae | Flora | Orchidaceae | 6672 | *^Geodorum densiflorum* | Pink Nodding Orchid | E1,P,2 | | 124 |
| Plantae | Flora | Orchidaceae | 6990 | *^Oberonia complanata* | Yellow-flowered King of the Fairies | E1,P,2 | | 1 |
| Plantae | Flora | Orchidaceae | 4480 | *^Phaius australis* | Southern Swamp Orchid | E1,P,2 | E | 11 |
| Plantae | Flora | Orchidaceae | 7324 | *^Pterostylis nigricans* | Dark Greenhood | V,P,2 | | 26 |
| Plantae | Flora | Poaceae | 4776 | *Arthraxon hispidus* | Hairy Jointgrass | V | V | 1 |
| Plantae | Flora | Polypodiaceae | 8156 | *^^Drynaria rigidula* | Basket Fern | E1,3 | | 2 |
| Plantae | Flora | Proteaceae | 5354 | *Floydia praealta* | Ball Nut | V | V | 3 |
| Plantae | Flora | Proteaceae | 5372 | *Grevillea hilliana* | White Yiel Yiel | E1 | | 1 |
| Plantae | Flora | Proteaceae | 5446 | *Macadamia tetraphylla* | Rough-shelled Bush Nut | V | V | 27 |
| Plantae | Flora | Psilotaceae | 8164 | *^^Psilotum complanatum* | Flat Fork Fern | E1,3 | | 1 |
| Plantae | Flora | Rutaceae | 6457 | *Acronychia littoralis* | Scented Acronychia | E1 | E | 19 |
| Plantae | Flora | Rutaceae | 8658 | *Melicope vitiflora* | Coast Euodia | E1 | | 2 |
| Plantae | Flora | Sapotaceae | 11957 | *Niemeyera whitei* | Rusty Plum, Plum Boxwood | V | | 9 |
| Animalia | Mammalia | Miniopteridae | 1346 | *Miniopterus australis* | Little Bent-winged Bat | V,P | | 35 |
| Animalia | Mammalia | Miniopteridae | 3330 | *Miniopterus orianae oceanensis* | Large Bent-winged Bat | V,P | | 5 |

PLANIT
CONSULTING

# Attachment 3

## BOSET Report Prepared for the Site

# Biodiversity Offset Scheme (BOS) Entry Threshold Map




245.9 0 122.96 245.9 Metres

WGS_1984_Web_Mercator_Auxiliary_Sphere

This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable.

THIS MAP IS NOT TO BE USED FOR NAVIGATION

Legend

- Biodiversity Values that have been mapped for more than 90 days
- Biodiversity Values added within last 90 days

Notes

# Biodiversity Values Map and Threshold Report

**Results Summary**

| | | | |
|---|---|---|---|
| **Date of Calculation** | 23/09/2020 5:44 AM | | **BDAR Required*** |
| **Total Digitised Area** | 0.76 | ha | |
| **Minimum Lot Size Method** | LEP | | |
| **Minimum Lot Size** | 0.02 | ha | |
| **Area Clearing Threshold** | 0.25 | ha | |
| **Area clearing trigger**<br>Area of native vegetation cleared | Unknown # | | Unknown # |
| **Biodiversity values map trigger**<br>Impact on biodiversity values map(not including values added within the last 90 days)? | no | | no |
| **Date of the 90 day Expiry** | N/A | | |

*If BDAR required has:

- at least one 'Yes': you have exceeded the BOS threshold. You are now required to submit a Biodiversity Development Assessment Report with your development application. Go to https://customer.lmbc.nsw.gov.au/assessment/AccreditedAssessor to access a list of assessors who are accredited to apply the Biodiversity Assessment Method and write a Biodiversity Development Assessment Report
- 'No': you have not exceeded the BOS threshold. You may still require a permit from local council. Review the development control plan and consult with council. You may still be required to assess whether the development is '"likely to significantly affect threatened species' as determined under the test in s. 7.3 of the Biodiversity Conservation Act 2016. You may still be required to review the area where no vegetation mapping is available.

# Where the area of impact occurs on land with no vegetation mapping available, the tool cannot determine the area of native vegetation cleared and if this exceeds the Area Threshold. You will need to work out the area of native vegetation cleared - refer to the BOSET user guide for how to do this.

On and after the 90 day expiry date a BDAR will be required.

## Disclaimer

This results summary and map can be used as guidance material only. This results summary and map is not guaranteed to be free from error or omission. The State of NSW and Office of Environment and Heritage and its employees disclaim liability for any act done on the information in the results summary or map and any consequences of such acts or omissions. It remains the responsibility of the proponent to ensure that their development application complies will all aspects of the *Biodiversity Conservation Act 2016.*

The mapping provided in this tool has been done with the best available mapping and knowledge of species habitat requirements. This map is valid for a period of 30 days from the date of calculation (above).

## Acknowledgement

I as the applicant for this development, submit that I have correctly depicted the area that will be impacted or likely to be impacted as a result of the proposed development.

Signature_____ Date:23/09/2020 05:44 AM

**Planit Consulting**

# Proposed Two Story Car Park

**158 Jonson Street, Byron Bay**

## Geotechnical Report

Report No. RGS32328.1 - AB

25 September 2020

REGIONAL GEOTECHNICAL SOLUTIONS

REGIONAL GEOTECHNICAL SOLUTIONS

Manning-Great Lakes
Port Macquarie
Coffs Harbour

RGS32328.1 - AB

25 September 2020

Planit Consulting
PO Box 161
LENNOX HEAD NSW 2478

**Attention: Niek van Oers**

Dear Niek,

**RE: Proposed Two Story Car Park - 158 Jonson Street, Byron Bay**

**Geotechnical Report**

Regional Geotechnical Solutions Pty Ltd (RGS) has completed a geotechnical investigation and assessment for the Proposed Two Story Car Park to be constructed at 158 Jonson Street, Byron Bay.

The development is currently in the concept stage. Drawings supplied show an on grade carpark with shade structures, however, it is understood that the construction of a two storey a park is proposed if approvals can be obtained. Based on similar sized developments structural loads for a two storey car park are anticipated to be high.

This report presents the results of the investigation and assessment and provides comments and recommendations site conditions.

If you have any questions regarding this project or require any further assistance, please do not hesitate to contact the undersigned.

For and on behalf of **Regional Geotechnical Solutions Pty Ltd**

Prepared by

**Louis Davison**

Geotechnical Engineer

Reviewed by

**Simon Keen**

Senior Geotechnical Engineer

**Table of Contents**



**Figures**



**Appendices**

# 1 INTRODUCTION

This report presents the results of the preliminary geotechnical investigations and assessment at the site of the proposed two storey carpark development to be constructed at 158 Jonson Street, Byron Bay.

The proposed development is to include the construction of a two storey carpark on the triangular shaped site that is to comprise a ground floor level and one above ground level. There is no basement carparking proposed.

The purpose of the assessment was to provide comments and recommendations on the following:

- Subsurface conditions, including the presence of fill and groundwater;
- Subgrade CBR values for pavement design (design to be undertaken by others);
- Foundation options and design parameters; and
- Presence of Acid Sulfate Soils (ASS) and the need for an acid sulfate soil management plan.

# 2 METHODOLOGY

## 2.1 Field work

Field work was undertaken on 3 August 2020 and comprised a site walkover assessment and intrusive investigations. The site walkover included the observation and assessment of the site in the relation to the surrounding landscape, structures and existing site surface features.

Intrusive investigations included:

- The drilling of three boreholes - BH1 to BH3 to depths of up to 10.95m with a truck mounted drill rig using a combination of auger drilling and wash boring methods over the site. Standard penetration tests (SPT) were carried out throughout the soil profile at approximately 1.5m intervals to aid in the assessment of the soil strength profile and density of the sands;
- The drilling of one shallow borehole (BH4) to a depth of 1.0m on the edge of the road leading into the site; and
- Collection of samples for subsequent laboratory testing as outlined in Section 2.2.

The field work was undertaken by a Geotechnical Engineer from RGS. Engineering logs of the boreholes are presented in Appendix A.

## 2.2 Laboratory Testing

Samples obtained during the field work were sent to NATA accredited laboratories for analysis. The following testing was undertaken:

- One 4 day soaked CBR;
- 16 Acid sulfate soil screening tests; and
- Five (5) Chromium Reducible Sulfur (CRS) tests.

The results of the testing are presented and discussed in the relevant sections of this report. A copy of the laboratory test results sheets are provided in Appendix B.

## 3 SITE CONDITIONS

### 3.1 Surface Conditions

The site is bound by the unformed Johnson Street Road reserve to the east, a disused railway line and bushland to the west, and an industrial lot to the north. A satellite photograph that illustrates the site location and setting is reproduced below.

*Satellite photograph that illustrates the site location. The site boundaries are shown by a blue triangle.*

The site is located within low lying alluvial terrain. The northern end of the site is at/near grade, while the southern portion has been raised above the natural surface by about 1 to 1.5m.

There is a large portal frame industrial shed to the north of the site. The shed appears to be supported on piles and is in fair condition. There is dense bushland to the west and south, and residential housing to the east.

Vegetation comprises grass across the whole site and a row of trees running north to south near the eastern boundary. There is a natural drainage path through the tree line that extends past the site to the south.

### 3.2 Subsurface Conditions

The NSW Government '*MinView*' Geological Survey of NSW indicates that the site is underlain by coastal deposits that include sand, indurated sand, silt, clay, gravel, organic mud and peat, which are underlain by the Neranleigh – Fernvale Group comprising greywacke, slate, phyllite, and quartzite.

A summary of the conditions encountered is provided in Table 1.

**Table 1: Summary of Subsurface Conditions**

| Unit | Material Name | Material Description | Depth to Base of Material Layer (m) | | |
|---|---|---|---|---|---|
| | | | BH1 | BH2 | BH3 |
| 1 | Fill | Sand, fine to medium grained, with a trace of medium grained gravel | 1.5 | 0.6 | -- |
| 2A | Upper Alluvial Sand | Silty Sand and Sandy SILT, fine to medium grained, very loose to loose | 2.5 | 3.1 | 1.65 |
| 2B | Alluvial Indurated Sand | Sand, fine to medium grained, weakly cemented, very dense | 6.0 | 4.8 | 4.9 |
| 2C | Alluvial Sandy Clay | Sandy Clay, medium plasticity, very soft to soft | 7.0 | 5.4 | 5.5 |
| 2D | Lower Alluvial Sand | Silty Sand and sand, fine to medium grained, medium dense to dense | ≥10.95 | 7.8 | 7.8 |
| 2E | Alluvial Gravel | Gravel, fine to medium grained, angular, dense | -- | -- | ≥7.95 |
| 3 | Weathered Rock | Extremely Weathered Meta-Siltstone, recovered as Clayey Silt, hard/friable | -- | ≥9.45 | -- |

**Note:** 1. ≥ Indicates that base of material layer was not encountered.
2. -- Indicates that layer was not encountered in that borehole.

BH4 was drilled near the northern end of the site within the Johnson Street road reserve and encountered 0.3m of pavement gravel overlying alluvial SAND to a depth of 1m.

Groundwater inflows were encountered at depths of 1.5m, 0.5m and 1.0m in BH1 to BH3 respectively. It should be noted that the ground water level may fluctuate in response to periods of increased rainfall and therefore it is recommended that ingoing monitoring be undertaken to assess potential fluctuations in groundwater levels.

## 4 FOOTINGS

### 4.1 Shallow Footings

The use of shallow footings to support the proposed two storey carpark is not recommended due to the low strength of the Unit 2A materials and due to the shallow groundwater table. It is recommended that all structures be supported on piles as discussed in Section 4.2.

### 4.2 Piles

It is recommended that the proposed carpark be supported on piles that found within either the Unit 2B very dense Indurated sand, or Unit 2D medium dense to dense sand.

Suitable pile types include bored and cased piles, Continuous Flight Auger (CFA) piles, or screw piles. Bored piles will require either temporary or permanent liners.

Option 1 – Piles at 3m

This option involves founding the proposed structure at a depth of 3m (no deeper) within the Unit 2B indurated sands. Piles with a diameter of no greater than 300mm may be proportioned based on an allowable end bearing capacity of 100kPa.

Option 2 – Piles at >7m Depth

This option involves installing piles at a depth of at least 7m within the Unit 2D, 2E or 3 materials (i.e. below the overlying very soft alluvial clay). If screw piles are to be adopted it is likely that pre-drilling will be required within the Unit 2B very dense indurated sands. Piles for this option may be proportioned based on the parameters presented in Table 2.

**Table 2: Pile Design Parameters for Option 2**

| Geotechnical Unit | Ultimate End Bearing, $f_b$ | Ultimate Skin Friction, Compression $f_{m,s}$ | Young's Modulus, $E'$ |
|---|---|---|---|
| Unit 2B Indurated | -- | 100 kPa | 80 MaPa |
| Unit 2C Clay | -- | 5 kPa | 5 MPa |
| Unit 2D Sand | 1,600 kPa | 20 kPa | 20 MPa |
| Unit 2E Gravel | 2,000 kPa | 50 kPa | 50 MPa |
| Unit 3 XW Rock | 3,000 kPa | 50 kPa | 40 MPa |

In accordance with AS2159-2009, when assessing the geotechnical reduction factor ($\Phi_g$) an assignment of an Average Risk Rating (ARR) is required which takes into account the redundancy of the pile system and the quantity and type of pile testing. This process necessarily requires the consideration of a number of factors which are beyond the direct control of a geotechnical consultant during the site investigation stage. In order for a recommendation to be provided the assumptions listed below have been made. In the event that these assumptions change, the geotechnical reduction factor would need to be modified in accordance with the requirements of AS2159-2009 Clause 4.3.

- Design of piles and pile groups will be undertaken in accordance with the recommendations presented in this report;
- Neither static, rapid or dynamic load testing is undertaken on any of the piles;
- Limited degree of professional geotechnical involvement in the supervision of the installation of the piles; and
- No performance monitoring of the supported structure during or after construction.

Based on the above and in accordance with AS2159-2009 a risk rating of 2.72 is estimated. Therefore, assuming the pile configuration will have low redundancy a Geotechnical Strength Reduction Factor of $\Phi_g$=0.52 would be appropriate for the site.

# 5 ACID SULFATE SOILS

## 5.1 Presence of Acid Sulfate Soils

An extract of the acid sulfate soils risk map for Byron Bay is presented below, the map indicates the northern portion of the site is within areas of low probability of acid sulfate soils 1m to 3m depth, and the southern portion of the lot is within areas of high probability 1 - 3 m below ground surface.

**Diagram 2: Acid Sulfate Soil Risk Map for Site**


*Sourced from the NSW Government Environment and Heritage eSPADE website.*

## 5.2 Sampling and Analysis

Sixteen samples from the site were submitted to a contract laboratory for ASS screening. The results are summarised below:

- The samples revealed $pH_F$ values between 5.22 and 9.02 in distilled water. $pH_F$ less than 4 is an indicator of Actual ASS;
- The samples revealed $pH_{FOX}$ values between 1.72 and 6.81in hydrogen peroxide. Values less than 3 can be an indicator of Potential ASS but can also be the result of high organic content in the soil.

To provide a more comprehensive assessment, four samples were submitted for Chromium Reducible Sulphur (CRS) analysis. A summary of the test results is presented in Table 4.

**Table 3: Summary of ASS CRS Test Results**

| Test location | Depth (m) | Texture | Action Criteria[1] (mol $H^+$ / t) | Actual Acidity – TAA (mol $H^+$ / t) | Potential Sulfidic Acidity–CRS (mol $H^+$/t) | Net Acidity (mol $H^+$ / t) | KCl-extractable sulfur (mol $H^+$ / t) |
|---|---|---|---|---|---|---|---|
| BH1 | 0.4-0.5 | Medium | 36 | 12 | 0 | 12 | 1 |
| BH1 | 1.4-1.5 | Medium | 36 | 5 | 5 | 10 | 1 |
| BH2 | 3.2-3.25 | Medium | 36 | 28 | **49** | **76** | 3 |
| BH3 | 2.9-3.0 | Medium | 36 | 16 | **57** | **73** | 6 |
| BH4 | 0.9-1.0 | Medium | 6 | 3 | 0 | 3 | 0 |

NOTE:

1. *Action criteria is based on less than 1000 tonnes of soil being disturbed*
2. *Values in Bold exceed the action criteria.*

### 5.3 Results of Analysis

The results of the analysis were compared to Table 5.4 of the '*National Acid Sulfate Soil Guidance: National Acid Sulfate Soils Sampling and Identification Methods Manual*' (2018). The laboratory test results indicate:

- Titratable Actual acidity is below the adopted action criteria and the samples are therefore not considered to be actual acid sulfate soils; and
- Net acidity and potential sulfidic acidity exceed the adopted action criteria for two samples of Unit 2B indurated sand, and the materials are therefore considered to be potential acid sulfate soils.

On the basis of the above, the Unit 2B indurated sands are considered to be Potential Acid Sulfate Soils and an Acid Sulfate Soils Management Plan is required for the proposed development if these materials are to be disturbed. As a guide, based on the current test results the material will be required to be blended with lime at a rate of 6kg of lime per tonne of excavated material.

## 6 PAVEMENT SUBGRADE

One laboratory CBR test was undertaken on a sample of Alluvial SAND recovered from BH4 which indicates that the material has a laboratory CBR of 30%. Previous experience with Alluvial Sandy SILT similar to that encountered within the upper profile of BH3 indicates that the material is likely to have a CBR of between about 4% and 8%. A design CBR of 5% is therefore recommended for the design of pavements at the site.

## 7 LIMITATIONS

This report comprises the results of an investigation carried out for a specific purpose and client as defined in the document. The report should not be used by other parties or for purposes or projects other than those assumed and stated within the report, as it may not contain adequate or appropriate information for applications other than those assumed or advised at the time of its preparation. The contents of the report are for the sole use of the client and no responsibility or

liability will be accepted to any third party. The report should not be reproduced either in part or in full, without the express permission of Regional Geotechnical Solutions Pty Ltd.

Geotechnical site investigation is based on data collection, judgment, experience, and opinion. By its nature, it is less exact than other engineering disciplines. The findings presented in this report and used as the basis for the recommendations presented herein were obtained using normal, industry accepted geotechnical design practises and standards. To our knowledge, they represent a reasonable interpretation of the general condition of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

The recommended depth and properties of any soil, rock, groundwater, or other material referred to in this report is an engineering estimate based on the information available at the time of its writing. The estimate is influenced and limited by the fieldwork method and testing carried out in the site investigation, and other relevant information as has been made available. In cases where information has been provided to Regional Geotechnical Solutions for the purposes of preparing this report it has been assumed that the information is accurate and appropriate for such use. No responsibility is accepted by Regional Geotechnical Solutions for inaccuracies within any data supplied by others.

If site conditions encountered during construction vary significantly from those discussed in this report, Regional Geotechnical Solutions Pty Ltd should be contacted for further advice.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any questions regarding this project, or require any additional consultations, please contact the undersigned.

For and on behalf of **Regional Geotechnical Solutions Pty Ltd**

Prepared by

**Louis Davison**

Geotechnical Engineer

Reviewed by

**Simon Keen**

Senior Geotechnical Engineer

# Figures


| | | | |
|---|---|---|---|
| REGIONAL GEOTECHNICAL SOLUTIONS | **Client:** | Planit Consulting | Job No. RGS32328.1 |
| | **Project:** | Proposed Carpark<br>158 Jonson Street, Byron Bay | Drawn By: SK<br>Scale: NTS<br>Date: 25-Sep-20 |
| | **Title:** | Borehole Location Plan | Drawing No. **Figure 1** |

# Appendix A

## Results of Field Investigations

REGIONAL GEOTECHNICAL SOLUTIONS

# ENGINEERING LOG - BOREHOLE

**BOREHOLE NO:** BH1

**CLIENT:** Planit Consulting
**PAGE:** 1 of 2
**PROJECT NAME:** Proposed Two Storey Car Park
**JOB NO:** RGS32328.1
**SITE LOCATION:** Byron Bay
**LOGGED BY:** LD
**TEST LOCATION:** Refer to Figure 1
**DATE:** 3/8/20

**DRILL TYPE:** Truck Mounted Drill Rig
**EASTING:**
**SURFACE RL:**
**BOREHOLE DIAMETER:** 100 mm
**INCLINATION:** 90°
**NORTHING:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| AD/TC | | 0.50m<br>SPT 1,1,5 N=6<br>0.95m | | 1.0 | | SP | **FILL:** SAND, fine to medium grained, dark brown, with some silt, trace gravel, medium grained | M | L | | | FILL |
| | ▶ | 1.50m<br>SPT 1,0,0 N=0<br>1.95m | | 2.0 | | SM | **Silty SAND:** Fine to medium grained, dark brown | W | VL | | | ALLUVIAL SOIL |
| | | 3.00m<br>SPT 30/130 N=R | | 3.0 | | SP | **SAND:** Fine to medium grained, brown, iron, indurated, weakly cemented | M | VD | | | COFFEE ROCK |
| | | 4.50m<br>SPT 7,20,30/50mm N=R<br>4.80m | | 4.0<br>5.0 | | | | | | | | |
| | | 6.00m | | | | | | | | | | |

RG LIB 1.04.4.GLB Log RG NON-CORED BOREHOLE - TEST PIT RGS32328.1 LOGS.GPJ <<DrawingFile>> 24/08/2020 16:51 8.30.004 Datgel Lab and In Situ Tool

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample |
| ASS | Acid Sulfate Soil Sample |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

REGIONAL GEOTECHNICAL SOLUTIONS

# ENGINEERING LOG - BOREHOLE

**BOREHOLE NO:** BH1

**CLIENT:** Planit Consulting
**PAGE:** 2 of 2
**PROJECT NAME:** Proposed Two Storey Car Park
**JOB NO:** RGS32328.1
**SITE LOCATION:** Byron Bay
**LOGGED BY:** LD
**TEST LOCATION:** Refer to Figure 1
**DATE:** 3/8/20

**DRILL TYPE:** Truck Mounted Drill Rig
**EASTING:**
**SURFACE RL:**
**BOREHOLE DIAMETER:** 100 mm
**INCLINATION:** 90°
**NORTHING:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| WB-RR | | SPT 0,0,0 N=0 | | | | CL | **Sandy CLAY:** Medium plasticity, brown | M > $w_P$ | VS | HP | 20 | ALLUVIAL SOIL<br>Casing pushed to 6.6m lifting rig at 6.6m |
| | | 6.45m | | 7.0 | | | 7.00m | | | | | |
| | | | | | | SP | **SAND:** Fine to medium grained, pale grey | W | MD | | | AEOLIAN SAND |
| | | 7.50m | | | | | 7.80m | | | | | |
| | | SPT 7,8,2 N=10 | | | | SP | **SAND:** Fine to medium grained, brown, with some silt | | L | | | |
| | | 7.95m | | 8.0 | | | 8.00m | | | | | |
| | | | | | | SP | **SAND:** Fine to medium grained, pale grey, with trace rounded gravel, fine to medium grained | | D | | | |
| | | 9.00m | | 9.0 | | | | | | | | |
| | | SPT 8,13,13 N=26 | | | | | | | | | | |
| | | 9.45m | | 10.0 | | | | | | | | |
| | | 10.50m | | | | | | | | | | |
| | | SPT 5,11,17 N=28 | | 11.0 | | | 10.95m | | | | | |
| | | 10.95m | | | | | Hole Terminated at 10.95 m | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample |
| ASS | Acid Sulfate Soil Sample |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

REGIONAL GEOTECHNICAL SOLUTIONS

# ENGINEERING LOG - BOREHOLE

**BOREHOLE NO:** BH2

**CLIENT:** Planit Consulting
**PAGE:** 1 of 2
**PROJECT NAME:** Proposed Two Storey Car Park
**JOB NO:** RGS32328.1
**SITE LOCATION:** Byron Bay
**LOGGED BY:** LD
**TEST LOCATION:** Refer to Figure 1
**DATE:** 3/8/20

**DRILL TYPE:** Truck Mounted Drill Rig
**EASTING:**
**SURFACE RL:**
**BOREHOLE DIAMETER:** 100 mm
**INCLINATION:** 90°
**NORTHING:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| AD/TC | | 0.50m | | | | GC | **FILL:** Gravelly CLAY, medium plasticity, grey/brown | M < $w_P$ | F - St | | | FILL |
| | | SPT 8,14,15 N=29 | | | | ML | 0.60m **Sandy SILT:** Low plasticity, dark brown, with organics/tree roots | W | L | | | ALLUVIAL SOIL Tree root and organics from 0.6m-1.5m |
| | | 0.95m | | 1.0 | | | | | | | | |
| | | 1.50m | | | | SM | 1.50m **Gravelly SAND:** Fine to medium grained, dark brown, with some silt, some tree roots/other organics, fine to medium grained gravel | | | | | |
| | | SPT 8,7,3 N=10 | | | | | | | | | | |
| | | 1.95m | | 2.0 | | | | | | | | |
| | | 3.00m SPT 8,25/130 N=R | | 3.0 | | | | | | | | |
| WB-RR | | | | | | SP | 3.10m **SAND:** Fine to medium grained, brown, organics, iron, indurated, cemented | M | VD | | | COFFEE ROCK |
| | | 4.50m | | 4.0 | | | | | | | | |
| | | SPT 3,2,0 N=2 | | | | | | | | | | |
| | | 4.80m | | | | CL | 4.80m **Sandy CLAY:** Medium plasticity, dark grey, fine grained sand | M > $w_P$ | VS | | | ALLUVIAL SOIL |
| | | | | 5.0 | | | | | | | | |
| | | | | | | SP | 5.40m **SAND:** Fine to medium grained, pale grey | W | L | | | |
| | | 6.00m | | | | | | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample |
| ASS | Acid Sulfate Soil Sample |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

REGIONAL GEOTECHNICAL SOLUTIONS

# ENGINEERING LOG - BOREHOLE

**BOREHOLE NO:** BH2

**CLIENT:** Planit Consulting
**PAGE:** 2 of 2
**PROJECT NAME:** Proposed Two Storey Car Park
**JOB NO:** RGS32328.1
**SITE LOCATION:** Byron Bay
**LOGGED BY:** LD
**TEST LOCATION:** Refer to Figure 1
**DATE:** 3/8/20

**DRILL TYPE:** Truck Mounted Drill Rig
**EASTING:**
**SURFACE RL:**
**BOREHOLE DIAMETER:** 100 mm
**INCLINATION:** 90°
**NORTHING:**
**DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| WB-RR | | SPT 5,4,6 N=10 | | | | SP | **SAND:** Fine to medium grained, pale grey *(continued)* | W | MD | | | ALLUVIAL SOIL |
| | | 6.45m | | | | | | | | | | |
| | | | | 7.0 | | | | | | | | |
| | | 7.50m | | | | | | | | | | |
| | | SPT 6,13,26 N=39 | | | | | 7.80m | | | | | |
| | | 7.95m | | 8.0 | | ML | **Clayey SILT:** Low plasticity, pale grey | M < $w_P$ | H / Fb | | | EXTREMELY WEATHERED METASILTSTONE |
| | | 9.00m | | | | | | | | | | |
| | | SPT 10,11,14 N=25 | | 9.0 | | | 9.45m | | | | | |
| | | 9.45m | | | | | Hole Terminated at 9.45 m | | | | | |
| | | | | 10.0 | | | | | | | | |
| | | | | 11.0 | | | | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample |
| ASS | Acid Sulfate Soil Sample |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

REGIONAL GEOTECHNICAL SOLUTIONS

# ENGINEERING LOG - BOREHOLE

**BOREHOLE NO:** BH3

**CLIENT:** Planit Consulting | **PAGE:** 1 of 2

**PROJECT NAME:** Proposed Two Storey Car Park | **JOB NO:** RGS32328.1

**SITE LOCATION:** Byron Bay | **LOGGED BY:** LD

**TEST LOCATION:** Refer to Figure 1 | **DATE:** 3/8/20

**DRILL TYPE:** Truck Mounted Drill Rig | **EASTING:** | **SURFACE RL:**

**BOREHOLE DIAMETER:** 100 mm | **INCLINATION:** 90° | **NORTHING:** | **DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| AD/TC | | | | | | SM | 0.10m **TOPSOIL:** Sandy SILT, low plasticity, dark brown, fine grained sand | | | | | TOPSOIL:GRASS |
| | | 0.50m | | | | ML | **Sandy SILT:** Low plasticity, dark brown | M > $w_P$ | VS | | | ALLUVIAL SOIL |
| | | SPT 1,0,1 N=1 | | | | | | | | | | |
| | ▶ | 0.95m | | 1.0 | | | | | | | | |
| | | 1.50m | | | | | | | | | | |
| | | SPT 18,30/100 N=R | | | | | 1.65m | | | | | |
| | | 1.95m | | 2.0 | | SP | **SAND:** Fine to medium grained, brown/orange, iron, indurated, cemented | M | VD | | | COFFEE ROCK |
| | | SPT 19,25/60 N=R | | 3.0 | | | | | | | | |
| WB-RR | | 3.00m | | | | | | | | | | |
| | | | | 4.0 | | | 4.00m | | | | | |
| | | | | | | SP | **SAND:** Fine to medium grained, grey, with some fine to medium grained gravel, angular, subrounded | | | | | ALLUVIAL SOIL |
| | | 4.50m | | | | | | | | | | |
| | | SPT 3,7,8 N=15 | | | | | | | | | | |
| | | 4.80m | | | | | 4.90m | | | | | |
| | | | | 5.0 | | CL | **Sandy CLAY:** Medium plasticity, dark grey | M > $w_P$ | S | | | |
| | | | | | | | 5.50m | | | | | |
| | | | | | | SP | **SAND:** Fine to medium grained, grey, with some gravel, angular | W | MD | | | |
| | | 6.00m | | | | | | | | | | |

**LEGEND:**

**Water**
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**
- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample |
| ASS | Acid Sulfate Soil Sample |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

REGIONAL GEOTECHNICAL SOLUTIONS

# ENGINEERING LOG - BOREHOLE

**BOREHOLE NO:** BH3

**CLIENT:** Planit Consulting | **PAGE:** 2 of 2

**PROJECT NAME:** Proposed Two Storey Car Park | **JOB NO:** RGS32328.1

**SITE LOCATION:** Byron Bay | **LOGGED BY:** LD

**TEST LOCATION:** Refer to Figure 1 | **DATE:** 3/8/20

**DRILL TYPE:** Truck Mounted Drill Rig | **EASTING:** | **SURFACE RL:**

**BOREHOLE DIAMETER:** 100 mm | **INCLINATION:** 90° | **NORTHING:** | **DATUM:** AHD

| Drilling and Sampling | | | | | Material description and profile information | | | | | Field Test | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| METHOD | WATER | SAMPLES | RL (m) | DEPTH (m) | GRAPHIC LOG | CLASSIFICATION SYMBOL | MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components | MOISTURE CONDITION | CONSISTENCY DENSITY | Test Type | Result | Structure and additional observations |
| WB-RR | | SPT 1,3,9 N=12 | | | | SP | **SAND:** Fine to medium grained, grey, with some gravel, angular *(continued)* | W | MD | | | ALLUVIAL SOIL |
| | | 6.45m | | | | | | | | | | |
| | | | | 7.0 | | | | | | | | |
| | | 7.50m | | | | | | | | | | |
| | | SPT 10,22,29 N=51 | | | | | | | | | | |
| | | | | | | | 7.80m | | | | | |
| | | | | | | GP | 7.95m **GRAVEL:** Fine to medium grained, grey, angular | W | D | | | |
| | | 7.95m | | 8.0 | | | Hole Terminated at 7.95 m | | | | | |
| | | | | 9.0 | | | | | | | | |
| | | | | 10.0 | | | | | | | | |
| | | | | 11.0 | | | | | | | | |

**LEGEND:**

**Water**

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

**Strata Changes**

- Gradational or transitional strata
- Definitive or distict strata change

**Notes, Samples and Tests**

| | |
|---|---|
| $U_{50}$ | 50mm Diameter tube sample |
| CBR | Bulk sample for CBR testing |
| E | Environmental sample |
| ASS | Acid Sulfate Soil Sample |
| B | Bulk Sample |

**Field Tests**

| | |
|---|---|
| PID | Photoionisation detector reading (ppm) |
| DCP(x-y) | Dynamic penetrometer test (test depth interval shown) |
| HP | Hand Penetrometer test (UCS kPa) |

**Consistency**

| | | UCS (kPa) |
|---|---|---|
| VS | Very Soft | <25 |
| S | Soft | 25 - 50 |
| F | Firm | 50 - 100 |
| St | Stiff | 100 - 200 |
| VSt | Very Stiff | 200 - 400 |
| H | Hard | >400 |
| Fb | Friable | |

**Density**

| | | |
|---|---|---|
| V | Very Loose | Density Index <15% |
| L | Loose | Density Index 15 - 35% |
| MD | Medium Dense | Density Index 35 - 65% |
| D | Dense | Density Index 65 - 85% |
| VD | Very Dense | Density Index 85 - 100% |

**Moisture Condition**

| | |
|---|---|
| D | Dry |
| M | Moist |
| W | Wet |
| $W_p$ | Plastic Limit |
| $W_L$ | Liquid Limit |

# Appendix B

## Laboratory Test results

# RESULTS OF ACID SULFATE SOIL ANALYSIS

16 samples supplied by Regional Geotechnical Solutions Pty Ltd on 5/08/2020 . Lab Job No. J6840.
Analysis requested by Louis Davidson. Your Job: RGS32328.1.

1/21 Cook Drive COFFS HARBOUR NSW 2450

| Sample Identification | EAL Lab Code | Texture | Moisture Content | | $pH_F$ and $pH_{FOX}$ | | | | KCl-extractable sulfur ($S_{KCl}$) | | Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS) | | $pH_{KCl}$ | Actual Acidity (Titratable Actual Acidity - TAA) | Retained Acidity | | Non-treated soil: Acid Neutralising Capacity ($ANC_{BT}$) | | Non-treated soil: Net Acidity | Non-treated soil: Lime Calculation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | (% moisture of total wet weight) | (g moisture / g of oven dry soil) | $pH_F$ | $pH_{FOX}$ | pH change | Reaction | (% $S_{KCl}$) | (equiv. mol $H^+$/t) | (% $S_{cr}$) | (mol $H^+$/t) | | (mol $H^+$/t) | (%$S_{NAS}$) | (mol $H^+$/t) | (% $CaCO_3$) | (mol $H^+$/t) | (mol $H^+$/t) | (kg $CaCO_3$/t DW) |
| *Method Info.* | | ** | ** | | *(In-house method S21)* | | | | ** | | *(In-house method S20)* | | *(In-house method 16b)* | | ** | | *(In-house method S14)* | | ** | ** |
| **BH1 0.4-0.5** | *J6840/1* | Medium | 10.7 | 0.12 | 6.43 | 2.82 | -3.61 | Medium | 0.002 | 1 | < 0.005 | 0 | 5.68 | 12 | .. | .. | .. | .. | 12 | 1 |
| **BH1 0.9-1.0** | *J6840/2* | Medium | 11.9 | 0.14 | 6.52 | 3.39 | -3.13 | Medium | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH1 1.4-1.5** | *J6840/3* | Medium | 20.7 | 0.26 | 6.64 | 2.73 | -3.91 | Medium | 0.002 | 1 | 0.008 | 5 | 6.06 | 5 | .. | .. | .. | .. | 10 | 1 |
| **BH1 3.4-3.5** | *J6840/4* | Medium | 22.9 | 0.30 | 5.74 | 1.75 | -3.99 | Medium | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH1 5.9-6.0** | *J6840/5* | Fine | 21.0 | 0.27 | 5.27 | 6.33 | 1.06 | Medium | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH2 0.4-0.5** | *J6840/6* | Medium | 15.0 | 0.18 | 8.09 | 6.39 | -1.70 | Medium | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH2 1.4-1.5** | *J6840/7* | Medium | 24.6 | 0.33 | 9.02 | 6.81 | -2.21 | Volcanic | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH2 2.4-2.5** | *J6840/8* | Medium | 23.1 | 0.30 | 6.26 | 2.60 | -3.66 | High | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH2 3.2-3.25** | *J6840/9* | Medium | 20.2 | 0.25 | 6.58 | 1.79 | -4.79 | Medium | 0.005 | 3 | 0.078 | 49 | 5.03 | 28 | .. | .. | .. | .. | 76 | 6 |
| **BH2 4.9-5.0** | *J6840/10* | Fine | 15.8 | 0.19 | 5.22 | 1.94 | -3.28 | Volcanic | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH3 0.4-0.5** | *J6840/11* | Medium | 26.2 | 0.36 | 6.45 | 4.36 | -2.09 | Volcanic | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH3 0.9-1.0** | *J6840/12* | Medium | 51.2 | 1.05 | 5.91 | 2.93 | -2.98 | Volcanic | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH3 1.4-1.5** | *J6840/13* | Medium | 26.3 | 0.36 | 6.01 | 2.19 | -3.82 | High | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH3 2.9-3.0** | *J6840/14* | Medium | 20.0 | 0.25 | 5.48 | 1.72 | -3.76 | Medium | 0.010 | 6 | 0.092 | 57 | 5.15 | 16 | .. | .. | .. | .. | 73 | 5 |
| **BH4 0.4-0.5** | *J6840/15* | Medium | 10.5 | 0.12 | 6.76 | 4.46 | -2.30 | Low | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| **BH4 0.9-1.0** | *J6840/16* | Medium | 14.0 | 0.16 | 6.88 | 4.99 | -1.89 | Low | 0.001 | 0 | < 0.005 | 0 | 6.45 | 3 | .. | .. | .. | .. | 3 | 0 |

**NOTES:**

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity** (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity)** (Eq. 3.3; Sullivan et al. 2018 - full reference above).
   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an Initial Acid Neutralising Capacity if verification testing is planned post-liming.
   **The Inital Acid Neutralising Capacity must be provided by the client to enable EAL to produce Verification Net Acidity and Liming calculations for post-limed soil materials.**
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the $pH_{KCl}$ < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during intial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the intial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the intial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol $H^+$/t; medium texture ≥ 0.06% S or 36 mol $H^+$/t; fine texture ≥ 0.1% S or 62 mol $H^+$/t)** (Table 1.1; Sullivan et al. 2018 - full reference above)
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol $H^+$/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where $pH_{KCl}$ is < 4.5 or > 6.5, zero is reported for $S_{NAS}$ and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
21. Results relate to the samples tested.
22. This report was issued on 18/08/2020 and replaces the results published 7/08/2020. Net Acidity has been added to selected samples.

NATA
WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing



checked: .....
Graham Lancaster
Laboratory Manager

# Material Test Report

AC TESTING SERVICES
SOILS | AGGREGATES | CONCRETE
P 0438 857 377 E info@actestingservices.com.au ABN 41 634 083 793
Nambucca Heads Laboratory 2/1 Monro St, Nambucca Heads NSW 2448
Armidale Laboratory Shop 11/215 Mann St, Armidale NSW 2350

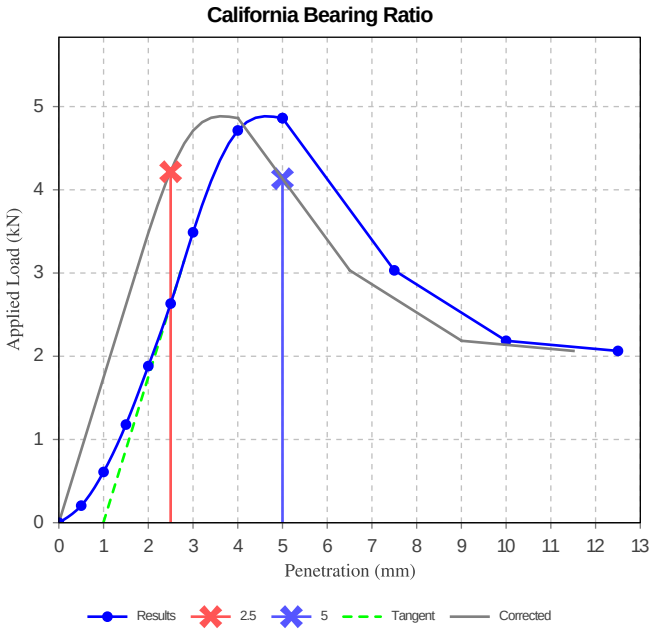
A C Testing Services
2/1 Monro St Nambucca Heads NSW 2448
Phone: 0438 857 377
Email: adam@actestingservices.com.au

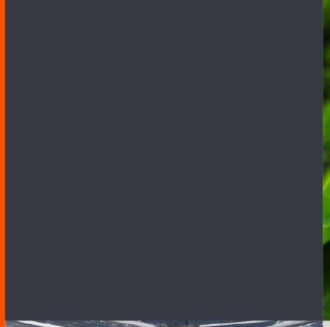
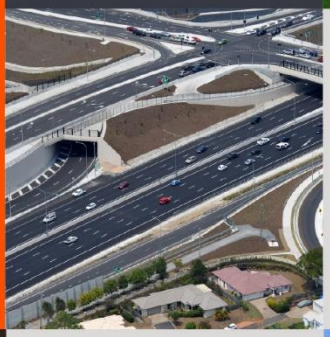
Accredited for compliance with ISO/IEC 17025 - Testing

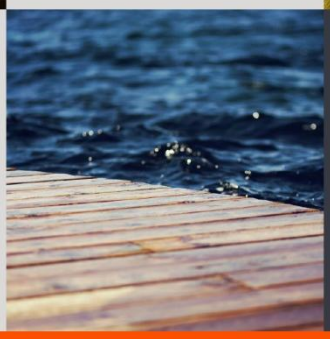
Approved Signatory: Adam Crawford
Lab Manager
NATA Accredited Laboratory Number: 19604

**Report Number:** **RGS-263-1**
**Issue Number:** 1
**Date Issued:** 20/08/2020
**Client:** Regional Geotechnical Solutions
14/25-27 Hurley Drive, Coffs Harbour NSW 2450
**Contact:** Louis Davidson
**Project Number:** RGS-263
**Project Name:** Proposed 2 Storey Car Park
**Project Location:** Byron Bay
**Client Reference:** RGS32328.1
**Work Request:** 1691
**Sample Number:** ACTS20-1691A
**Date Sampled:** 05/08/2020
**Dates Tested:** 10/08/2020 - 13/08/2020
**Sampling Method:** Sampled by Client
*The results apply to the sample as received*
**Site Selection:** Selected by Client
**Sample Location:** **BH4, Depth: 0.3 - 0.8m**

| California Bearing Ratio (AS 1289 6.1.1 & 2.1.1) | | Min | Max |
|---|---|---|---|
| CBR taken at | 2.5 mm | | |
| CBR % | **30** | | |
| Method of Compactive Effort | Standard | | |
| Method used to Determine MDD | AS 1289 5.1.1 & 2.1.1 | | |
| Method used to Determine Plasticity | Visual/Tactile | | |
| Maximum Dry Density (t/m$^3$) | 1.67 | | |
| Optimum Moisture Content (%) | 16.0 | | |
| Laboratory Density Ratio (%) | 99.5 | | |
| Laboratory Moisture Ratio (%) | 99.5 | | |
| Dry Density after Soaking (t/m$^3$) | 1.66 | | |
| Field Moisture Content (%) | 13.8 | | |
| Moisture Content at Placement (%) | 15.9 | | |
| Moisture Content Top 30mm (%) | 16.8 | | |
| Moisture Content Rest of Sample (%) | 17.0 | | |
| Mass Surcharge (kg) | 4.5 | | |
| Soaking Period (days) | 4 | | |
| Curing Hours | 24 | | |
| Swell (%) | 0.0 | | |
| Oversize Material (mm) | 19 | | |
| Oversize Material Included | Excluded | | |
| Oversize Material (%) | 0.8 | | |



# Civil Engineering
## TRAFFIC IMPACT STUDY

156-158 Jonson Street Mixed Use Development
156- 158 Jonson Street, Byron Bay, NSW,2481 | Lot 51 DP844054 and Lot 9 DP818197

By Planit Consulting Pty Ltd

September 2020
J6799 | TIS01



This report has been written by

Planit Consulting Pty Ltd
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Project Details

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|---|---|
| Project Name | 156-158 Jonson Street Mixed Use Development |
| Client | 156 Jonson Street Pty Ltd |
| Client Project Manager | Maxime Beaur (HGA) |
| Authors | CW |
| Planit Reference | J6799-TIS01 |

Disclaimer

# Content

# Executive Summary

This Traffic Impact Study has been prepared on behalf of 156 Jonson Street Pty Ltd in support of the proposed mixed-use development located at 156-158 Jonson street on Lots 9 (DP818197) and Lot 51(DP844054) in Byron Bay, NSW,2481. It presents an assessment of the potential traffic impact associated with the proposed development on the surrounding road network.

The subject site currently consists of three (3) existing lots with one lot containing a portal frame warehouse, the second lot consisting of vacant vegetated land and the remaining lot forming part of a rail corridor. The proposed site layout consists of retail and mixed commercial space with an approximate GFA of 4000m$^2$. A 2-storey carpark accessed from Jonson Street is proposed to service the development as well as provide parking credits for potential future developments in the area. The purpose of this report is to outline opportunities and constraints regarding the proposed development including:

- Existing traffic conditions;
- Access and parking for cars, service vehicles, mobility impaired, bicycles $ pedestrians;
- Safety associated with the exiting, entering and internal manoeuvring; and
- Impact on the surrounding road network.

The assessment in accordance with Section B4 of Byron Shire Council's (BSC) DCP and therein referenced documents including the RMS Guide to Traffic Generating Developments.

It is proposed to provide a 2-storey carpark to service the development. The access to the site will be via Jonson Street. It is proposed to extend Jonson street to cater for two-way traffic and the simultaneous entering and exiting of cars within the development. The access point to the site has been designed to be suitable for MRV and HRV access. Carparking provisions are summarised in the table below;

| Item | Minimum Required |
|---|---|
| Total car parking spaces | 200 |
| Accessible parking spaces | 4 |
| Bicycle spaces | 23 |
| Motorbike spaces | 16 |
| HRV loading bay | 1 (combined) |
| MRV loading bays | 2 (combined) |

Based on Table B4.2 of Chapter B4 of the 2014 DCP, one (1) HRV and two (2) MRV loading bays are required for the proposed development. A configuration is proposed where either two MRVs or one HRV can service the site simultaneously. An operational management plan should be prepared prior to occupation.

Trip generation rates have been derived from multiple sources including RMS's 'Guide to Generating Traffic Development' *and* ITE'S Trip 'Generation Manual'. This report adopts a merit-based assessment for trip generation to ensure that an accurate representation of the proposed site is adopted. It is anticipated that the development will generate 309 AM/ PM peak hour trips, and 2942 vehicle trips/ day.

Internal manoeuvring has been assessed for the design vehicles for the site, using Autodesk Vehicle Tracking software and was deemed suitable the relevant design vehicles.

The future Byron Bay Bypass (currently under construction) will begin at the corner of Jonson Street and Browning Street and connect into the end of Butler Street and continue to the existing roundabout adjacent to the Shirley St/Lawson St intersection to the north of the CBD. A new roundabout will be located at the corner of Jonson Street and Browning Street. This roundabout has been assumed as part of the 'pre-development' scenario.

SIDRA intersection modelling shows a suitable level of service at the nearest intersection.

# 1 Introduction

## 1.1 Project Background

This Traffic Impact Study (TIS) has been prepared to provide an assessment on the potential impact the proposed development has on the surrounding road network. The proposed development is located at 156-158 Jonson street on Lots 9 (DP818197) and Lot 51(DP844054). Planit was engaged by 156 Jonson Street Pty Ltd to prepare a Traffic Impact Study to support the development application (DA) for the proposed development.

The subject site currently consists of three (3) existing lots with one lot containing a portal frame warehouse, the second lot consisting of vacant vegetated land and the remaining lot forming part of a rail corridor. The proposed site layout consists of retail and mixed commercial space with an approximate GFA of 4000m$^2$. A 2-storey carpark accessed from Jonson Street is proposed to service the development as well as provide parking credits for potential future developments in the area.

## 1.2 Project Scope

The purpose of this report is to outline opportunities and constraints regarding the proposed development including:

- Existing traffic conditions;
- Access and parking for cars, service vehicles, mobility impaired, bicycles $ pedestrians;
- Safety associated with the exiting, entering and internal manoeuvring; and
- Impact on the surrounding road network.

## 1.3 Standards, Policies and Guidelines

This assessment is based on requirements from the following standards, policies and guidelines:

- Byron Shire Development Control Plan 2014-Chapter B4- Traffic Planning, Vehicle;
- 2002 RTA Guide to Traffic generating Developments;
- Australian/New Zealand Standard 2890.1 to 2890.6;
- Austroads Guide to Road Design;
- Austroads Guide to Traffic Management;
- ITE Trip Generation Manual; and
- National Construction Code- Building Code of Australia-Class 2 to Class 9 Buildings.

## 1.4 Strategic Environment

Byron Shire Council published a Strategic Transport Statement (Transport Policy) that aims to integrate a shire-wide transport network and network approach that improves mobility, accessibility, and choice for all road users. The Shire aims to mitigate the use of non-renewable energy and improve sustainability, amenity, and opportunities for environmental health. Council have many mechanisms to implement these actions and they can be identified as either supply or demand.

Council's supply techniques that are currently in place are;

- Council adopted bike plan: This identifies the needs for off-road paths, on-road bicycle lanes, bicycle parking and end of trip facilities.
- Proposed Pedestrian Access and Mobility Plan (PAMP) and car parking studies: This will be influenced by development of a transport strategy to ensure an integrated and coordinated approach is adopted for future road network. The first step of this process is assessing the existing infrastructure and transport supply.
- Disability and Inclusion Action Plan: This was developed for people with a disability through a stakeholder engagement process and a whole-of-council process. This action plan was Council's commitment to reducing the barrier for people with disabilities by improving the access for disabled people. The plan facilitated an inclusion and participation process across the Byron Shire.

The Byron Shire Bike Strategy and Action Plan 2008 provides an assessment of existing conditions in each town within the Byron Shire by reviewing the pedestrian and cyclists needs of the different user groups. Byron Shire Council currently accommodates for bicycle users and pedestrians by providing cycle ways

and pedestrian footpaths combined with the road system. This offers opportunity for locals, workers, and visitors to utilise these facilities for recreation access. The plan facilitates the expansion of the existing network of bicycles facilities within the Byron Shire. The plan analyses the current bike needs and demands within the Shire and aims to predict the future demand on the bicycle network.

Provision of pedestrian and bicycle facilities such as signage, bicycle storage racks and special kerb crossings will be undertaken as part of the road network improvements. The purpose of these proposed pedestrian and cycle facilities will be for commuter access as well as for recreational purposes.

## 1.5 Byron Bay Bypass

The subject site is located on the southern end of Jonson Street. As part of the construction of the Byron Bay Bypass, this intersection shall be upgraded and a roundabout shall be provided. Planit understands that works for the Bypass commenced in July 2019 and be completed by December 2020.

## 1.6 Definitions

- Annual Average Daily Traffic (AADT) is the total volume of vehicle traffic for a year divided by 365 days. Sometimes also referred to as "Average Annual Daily Traffic" it provides a rudimentary traffic volume;
- Carriage is the portion of the road assigned to the use of vehicles, inclusive of shoulder and auxiliary lanes;
- SRV, Small rigid vehicle as defined in AS 2890.2-2004;
- MRV, Medium rigid vehicle as defined in AS 2890.2-2004;
- Custom Waste HRV, Custom Waste Heavy Rigid Vehicle as received by Solo Richmond Waste.
- AV, Articulated vehicle as defined in AS 2890.2-2004;
- Design year, standard practise in traffic engineering is to determine the impact of a development 10 years after the date of the assessment. For a 2019 assessment, the design year is 2029;
- Classification of buildings, the classification of a building or part of a building is determined designed, constructed, or adapted to be used; and
- Level of Service, (in accordance with the Austroads definition), is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of factors such as speed and travel time, delay, density, freedom to manoeuvre, traffic interruptions, comfort and convenience, and delay. Levels of service can be described for interrupted and uninterrupted flow facilities. Descriptions are provided in Table 1.

Table 1 - Level of Service Definitions

| Level of Service | Uninterrupted flow facility definition (*HCM 2010) | Interrupted flow facility definition (**AGTTM3) |
|---|---|---|
| A | A condition of free-flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent. | Describes primarily free-flow operation. Vehicles are completely unimpeded in their ability to manoeuvre within the traffic stream. Control delay at the boundary intersections is minimal. The travel speed exceeds 85% of the base free-flow speed. |
| B | In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with level of service A. | Describes reasonably unimpeded operation. The ability to manoeuvre within the traffic stream is only slightly restricted and control delay at the boundary intersections is not significant. The travel speed is between 67% and 85% of the base free-flow speed. |
| C | Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level. | Describes stable operation. The ability to manoeuvre and change lanes at mid segment locations may be more restricted than at LOS B. Longer queues at the boundary intersections may contribute to lower travel speeds. The travel speed is between 50% and 67% of the base free-flow speed. |
| D | Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems. | Indicates a less stable condition in which small increases in flow may cause substantial increases in delay and decreases in travel speed. This operation may be due to adverse signal progression, high volume, or inappropriate signal timing at the boundary intersections. The travel speed is between 40% and 50% of the base free-flow speed. |
| E | Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown. | Characterised by unstable operation and significant delay. Such operations may be due to some combination of adverse progression, high volume, and inappropriate signal timing at the boundary intersections. The travel speed is between 30% and 40% of the base free-flow speed. |
| F | In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result. | Characterised by a flow at extremely low speed. Congestion is likely occurring at the boundary intersections, as indicated by high delay and extensive queueing. The travel speed is 30% or less of the base free-flow speed. LOS F is assigned to the subject direction of travel if the through movement at one or more boundary intersections has a volume-to-capacity ratio greater than 1.0. |

* HCM – Highway Capacity Manual 2010
**AGTTM3 – Austroads Guide to Traffic Management Part 3

# 2 Site Assessment

## 2.1 Site Description

The proposed development site (Figure 2) is located in an area zoned for local centres and infrastructure which forms part of the Byron Shire Council (BSC) Local Government Area (LGA). The subject site is approximatly 8,850m$^2$ in plan and is located on Lot 9 on DP818197 (local Centre), Lot 51 on DP844054 (infrastructure), and a Portion Lot 4729 on DP1228104 (infrastructure. The site currently contains:

- Lot 9 on DP818197 (3,165m$^2$):
  - Large shed covering the majority of the site.
  - Site access at the north to a carpark.
  - Battle axe access to the south of the lot.
  - Small landscaped area.
- Lot 51 on DP844054 (3,850m$^2$)and portion of Lot 4729 on DP1228104 (1,835m$^2$):
  - Complete grass cover with scattered trees.
  - Wetland in the south area of the site.
  - Lot 4729 on DP1228104 is currently part of a rail corridor.


Figure 1-Subject Site (Source: NearMaps, 2020)

It is proposed to construct a two-storey car park with sufficient capacity to service the number of car parks required by Byron Shire Council for a retail classified development. The ground floor and 1st floor of the 2-storey car park access shall be via the public road. The access to the site will be via Jonson Street. Jonson street is primarily accessed from the Jonson/Browning Street intersection.

Two Medium Rigid Vehicle (MRV) loading bays, doubling as a single Heavy Rigid Vehicle (HRV) loading bay, are proposed on the site via Johnson Street. directly north of the vehicle access point to the 2-storey carpark. The proposed carpark is sized accordingly to accommodate for workers, employees, and visitors of the subject site. It is proposed to extend the existing access via Jonson Street to the south by approximately 10.5m to cater for two-way traffic.

# 3 Existing Infrastructure

## 3.1 Parking Provisions

Byron Shire Council introduced a paid parking scheme in December 2015 that extends throughout the Byron Bay CBD, including the majority of the local streets (Figure 2). There is available free and paid parking along Jonson street directly north of the subject site. Free parking exists south of Jonson street, adjacent to Mitre 10, directly north of the subject site.

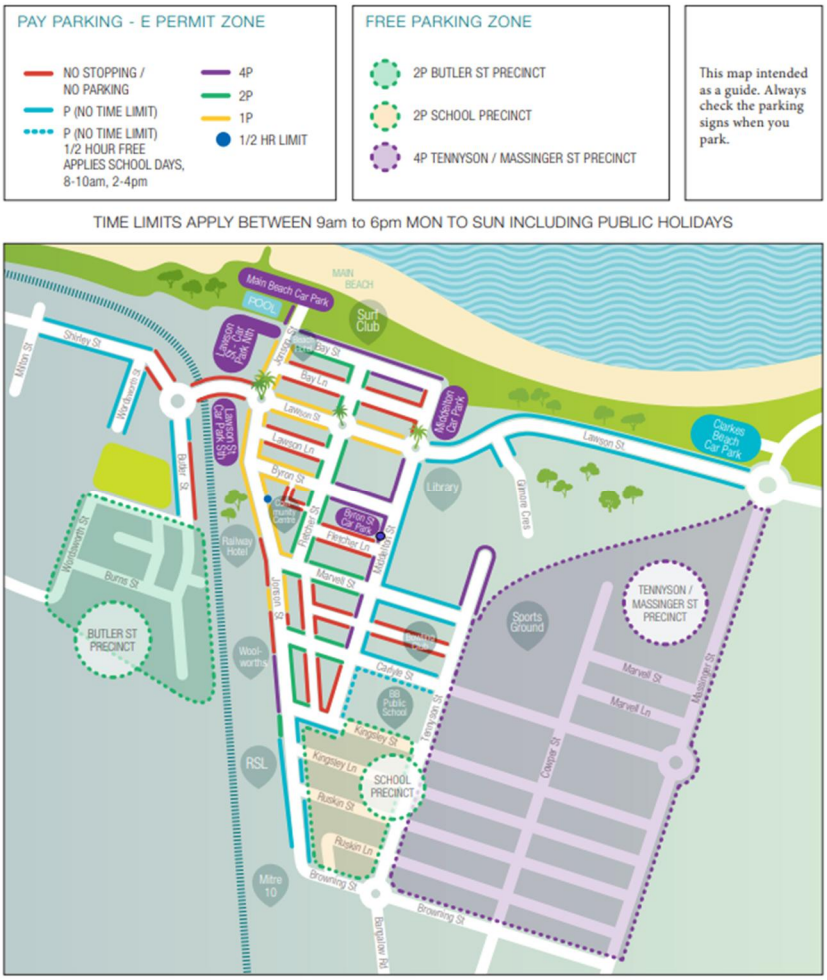



Figure 2 | BSC Paid Parking Scheme

## 3.2 Public Transport

Bus services are the only form of public transport (PT) facility available in close proximity to the site. Approximately several bus routes pass near the proposed development. Northern Rivers Bus lines group (Routes 610 and 635), Blanch's Bus Company (Routes 637, 640 and 641) and Greyhound (Routes Red and Green) are the main providers of bus services in the Byron Shire. The scheduled routes to and from Byron Bay operate 7 days a week. Byron Bay bus origin/destinations include but are not limited to, Bangalow, Ballina, Mullumbimby, Lismore, Gold Coast and Brisbane.

Although no official bus stops are displayed on the official routes along Jonson or Browning street, Blanch's Bus Company operates these routes on a 'hail and ride' policy. The closest bus stop is approximately 450m north of the subject site. Blanch's timetables show that bus routes are passing the subject site on weekdays and weekends. This gives future users the opportunities to utilise PT to the proposed development.

## 3.3 Road Network

The main roads surrounding the subject site are Jonson Street and Browning Street, both are RMS controlled roads. The total road carriageway is approximately 16m wide, this include two 5m wide traffic lanes and two 3-metre-wide kerbside parking shoulders. The intersection where Jonson Street and Browning Street meet is the primary route to access the subject site. It should be noted that this connection point is where the new bypass roundabout is currently under construction. Therefore, the existing intersection will be upgraded and resealed to accommodate for an increase in traffic demand and to divert significant traffic flows away from Byron Bay CBD.

Table D.1.5 of the Northern Rivers Local Government (NRLG) Development Design Specification- 'Geometric Road Design' specifies that the maximum traffic volume for distributor roads is 3000+ (vpd). This value has no explicit vehicle limit and does not give valuable representation of the maximum allowable vehicles on the road network directly north of the subject site.

The SIDRA modelling of Jonson Street and Browning Street intersection provides a simulated model representation of the performance of the road network. Modelling results are provided in Section 7 of this report. Additionally, site inspections during peak hour periods provide a good representation of the current operation of the road network.

## 3.4 Peak Hour Traffic Survey

### 3.4.1 Turning Movement Survey

Planit has previously performed an onsite AM peak turning movement survey between 8am and 8:30am on Thursday 4th of May 2017. This turning movement survey was conducted at the intersection at Ruskin Lane and Browning Street. The survey results are provided in the below:

Table 2| Turning Movement Survey

| Approach | Turning movement | Vehicles survey in 30 minutes | *Adopted AM peak hour volume |
|---|---|---|---|
| Browning Street (Eastbound) | Left | 2 | 4 |
| | Straight | 172 | 344 |
| | Right | 0 | 0 |
| Browning Street (Westbound) | Left | 0 | 0 |
| | Straight | 269 | 538 |
| | Right | 0 | 0 |

*Refer to section 3.4.3 of this report for the adopted volumes for 2020

The total volume for the AM peak hour would be 886 vehicles per hour on Browning Street. Due to the close proximity of the surveyed location and the subject site, these results are considered representative for the purpose of this Traffic Impact Study.

### 3.4.2 Traffic Survey

Currently, the road network adjacent to the site is subject to significant roadworks (Byron Bay Bypass construction. Therefore, Planit believes any traffic counts conducted at present time would not be representative of 'normal, operations. Accordingly, Historic traffic survey data was accessed by Planit. Accordingly, the traffic volumes in accordance with Table 3 have been assumed.

Table 3| Jonson and Browning Street Peak Hour Volumes

| Approach | AM Peak Hour Volume | PM Peak Hour Volume |
|---|---|---|
| Browning Street (Westbound) | 624 | 517 |
| Browning Street (Eastbound) | 411 | 556 |
| Jonson Street | 453 | 588 |

### 3.4.3 Adopted Peak Hour Traffic Volumes

Adopted data based has been presented in Table 4. The results obtained from the turning movements survey and traffic data is multiplied by a seasonality factor of 1.05 (+5%) to give a growth estimate of the average peak hour volumes across the entire year. The values obtained from multiplying the results by the seasonality factor will utilise 2017 as the base data traffic volumes. The 2020 and 2030 design year will be modelled in SIDRA to give a simulated visual representation of the intersection will operate in

existing and future conditions. Based on experience with other developments in the Byron shire region, an annual compound growth rate of 2.5% is adopted for 2020 and 2030 design year. The volumes used for modelling inputs can be seen in table 4.

Table 4 | Turning Movements

| Approach | Turning Movements | 2017 AM Peak | 2017 PM Peak | 2020 AM Peak | 2020 PM Peak | 2030 AM Peak | 2030 PM Peak |
|---|---|---|---|---|---|---|---|
| Browning Street (Eastbound) | Left | 4 | 0 | 4 | 0 | 6 | 0 |
| | Straight | 412 | 583 | 444 | 628 | 568 | 804 |
| Browning Street (Westbound) | Right | 0 | 0 | 0 | 0 | 0 | 0 |
| | Straight | 655 | 490 | 705 | 528 | 903 | 675 |

## 3.5 Daily Traffic Survey

The AADT is a more accurate parameter discussed more commonly than ADT in traffic engineering. The AADT gives a better representation of the average traffic on a road network because it accounts for the high and low volume times of the year. Based on this information, the adopted data was converted to AADT using a seasonality factor to account for the variations in daily traffic throughout the year. A factor of 1.05 (Derived from Austroads) will be used to determine the 2017 AADT. An annual Compound traffic growth factor of 2.5% will be adopted to calculate growth traffic volumes for the design year of 2030. Table 5 shows the AADT calculations.

Table 5| AADT Calculations

| | Jonson Street | Browning Street |
|---|---|---|
| 7-day ADT | 11890 | 11609 |
| Seasonal adjustment factor | 1.05 | 1.05 |
| 2017 AADT | 12484.5 | 12189.45 |
| Annual Compound traffic Growth factor (2.5%) | 0.025 | 0.025 |
| 2020 AADT | 13444 | 13127 |
| 2030 AADT | 17210 | 16803 |
| % HV | 6.1% | 4.9% |

Table 6 shows the adopted traffic speeds.

Table 6|Speed Data

| | Jonson Street | Browning Street |
|---|---|---|
| Mean (Km/h) | 40.3 | 39.4 |
| 85% percentile (Km/h) | 46.1 | 44.3 |
| 95% percentile (Km/h) | 49.7 | 47.5 |
| Median (Km/h) | 40.3 | 39.6 |

## 3.6 Peak Period Traffic Characteristics

Two traffic site inspections have been carried out on (7/09/2020), in the surrounding vicinity of the subject site, observations of which are presented in this section of the assessment.

### 3.6.1 8:00 to 9:00 AM Observations

- Tennyson/Browning Street Roundabout:
  - Minor congestion and queues are observed in all circulating and turning movements for the intersection;
  - Tennyson/Browning street roundabout is the primary access point for road users travelling from the south to get into Byron CBD; and
  - Cars travelling north on Tennyson Street can enter the 'Bay Grocer' grocery without any significant queuing.
- Jonson Street/Browning Street Intersection:
  - Trucks are observed to be able to safely accelerate coming out of the Mitre-10 parking area and entering Jonson Street northbound in a safe manner;
  - Cars and Trucks can enter the 'Mitre-10' area through Jonson Street (through lane), no significant queuing was observed;

  - The 'Mitre-10' Liberty petrol station provides sufficient turning movements for vehicles to safely re-enter the main road; and
  - It was observed that two road users carried out illegal U-turn manoeuvres to alter their direction of travelling while transiting northbound on Browning street. This will no longer be an issue once the new roundabout is constructed.
- Ruskin Lane/Browning Street Intersection:
  - Only one road user is observed coming out of Ruskin Lane onto Browning Street. The user had to wait for approximately 15 seconds before being able to turn right.
  - On-Street Parking:
  - Cars can park on both sides of Jonson Street and Browning Street. The carpark strips were both at approximately 40% capacity.
- Public Transport:
  - Blanch's school Bus stopped by at 08:01 students gathered nearby 'Spell and the Gypsy' on the northern side of the Browning Street/Tennyson Street roundabout.
- Pedestrians:
  - Pedestrians can generally walk safely and efficiently within the vicinity of the subject site. They share the footpaths with cyclists; and
  - Pedestrians walking from Bangalow Road to Tennyson Street face difficulties crossing the roundabout due to vehicles having the right of way onto the roundabout.
- Cyclists:
  - Cyclist can generally ride safely and efficiently within the vicinity of the subject site;
  - It was observed that cyclists travelling in the surround area tend to ride on the traffic lane and neglect the designated cyclist path; and
  - Cyclist travelling on the footpaths from Bangalow Road to Tennyson Street face difficulties during roundabout crossing, just like pedestrians.

### 3.6.2 15:10 to 16:10 PM Peak Observations

- Tennyson/Browning Street Roundabout:
  - It was observed that there was more congestion and queuing observed in all circulating and turning movements for the intersection because of peak hour school traffic; and
  - Cars travelling north on Tennyson Street can enter the 'Bay Grocer' grocery with minor queuing.
- Jonson Street/Browning Street Intersection:
  - Trucks and cars entering from Jonson Street can safely queue on existing turning lane; and
  - Cars and medium articulated vehicles can use the intersection in all directions. Stable flow and no significant queuing was observed.
- Ruskin Lane/Browning Street Intersection:
  - No vehicles were observed using the intersection.
- On-Street Parking:
  - Cars are parked on both sides of Browning and Jonson street; and
  - Both car parks were at 80% capacity
- Public Transport:
  - Blanch's School Bus stopped by at 16:03 to drop off students on the northern side of Browning street; and
  - Blanch's School Bus stopped by at 16:10 to drop off students on the southern side of Browning street.
- Pedestrians:
  - Similar observations to AM
- Cyclists:
  - Similar observations to AM

# 4 Car Parking

## 4.1 Carparking Number

To ensure sufficient onsite car, bicycle, and motorcycle parking spaces, it is proposed to include a new 2-storey carpark to service the development. Car parking requirements are outlined in with BSC'S DCP 2014 Chapter B4 'Traffic Planning, Vehicle Parking, Circulation and Access' and the 2002 RTA 'Guide to Traffic generating Developments'.

### 4.1.1 Overall Car Parking

Overall car parking as part of the DCP requirements calculations are detailed in table 7. A minimum of 240 car spaces are required for the proposed development. However, Planit believes that to adequately service the site, a reduction in these spaces is warranted for the following reasons:

- Proximity to the town centre, residential areas and available infrastructure allows for adequate walkability and cyclability;
- Because of the mixed-use nature of the development (retail, restaurant and office space), different peak times for different components are likely to occur, hence flattening parking requirements;
- It is considered likely that a significant number of patrons will be tourists who will be able to walk from short-stay accommodation in town. Based on previous studies by Planit, it is believed that a significant number of tourists within the town centre are do not bring a vehicle; and
- The proponent is proposing upgrades to Jonson Street which may improve on-street parking.

Therefore, it is proposed to reduce the number of required spaces to 200.

Table 7 | Overall Car Parking Calculation Table

| Relevant DCP Land use Definition | Calculation Rate | Total Footprint ($m^2$) | Number of Parking Spaces (DCP) | Number of Parking Spaces (Proposed) |
|---|---|---|---|---|
| Retail/Shopping centres | 6.1 per 100$m^2$ | 3411 | 208 | 175 |
| Commercial/Offices | 1 space per 20$m^2$ GFA | 627 | 32 | 25 |
| Total Number of Carparks Required | | | 240 | 200 |

It should be noted that the proposed carparking layout proposed 284 parking spaces. Planit understands that the proponent is requesting to use surplus spaces as parking credits for future development directly adjacent to the subject site (Lot 1 DP 1267388). Considering that this lot is directly bordering the carpark, Planit believes that this is appropriate from a serviceability point of view.

### 4.1.2 Accessible Car Parking

Accessible car parking requirements are specified in AS2890.6 and Volume 1 of the 2015 National Construction Code and Building Code of Australia. These codes provide rates for various building classes. The overall accessible car parking is presented in the Table 8.

Table 8 | Accessible Parking Requirements

| Item | Class | Calculation Rate | Number of parking spaces | Number of Accessible spaces |
|---|---|---|---|---|
| Retail/Shopping centres | 6 | 1 space for every 50 car parking spaces or part thereof | 174 | 3.5 |
| Commercial/Offices | 5 | 1 space for every 100 carparking spaces or part thereof | 25 | 0.25 |
| Total | | | | 3.75 = 4 |

It should be noted that proposed car parking allocated to future development has not been included in accessible car parking calculations. From a serviceability point of view, it is considered more appropriate if these are provided on-site in the future.

### 4.1.3 Bicycle Parking

Bicycle spaces are calculated in accordance with the requirements of Chapter B4 of the 2014 Byron Shire DCP. It is calculated that a minimum of 23 bicycle spaces are to be provided onsite. A calculation summary is provided in Table 9 below.

Table 9|Bicycle Space Calculations

| Item | Relevant DCP land use definition | Calculation Rate | Total Footprint ($m^2$) | Number of Bicycle spaces |
|---|---|---|---|---|
| Retail/Shopping centres/ Commercial & Offices | Business premises | 2 per 100$m^2$ (or part thereof) up a floor area of 200$m^2$ and 1 per 200$m^2$ Thereafter | 4038 | 23.19 |
| Total | | | | 23 |

Dimensions for bicycle spaces shall be in accordance with section 4.2 of this report.

### 4.1.4 Motorbike Parking

As stated in the BSC DCP, large commercial developments with a GFA exceeding 1000$m^2$ shall make provision for a minimum of two percent of car parking spaces will be converted to motorbike spaces (at a rate of 4 motor cycle spaces for every space converted).

The proposed development exceeds the GFA 1000$m^2$ threshold, therefore the above requirement applies. We recommend that four of the 200 spaces be converted to a total of 16 motor-cycle spaces. Dimensions for motorcycle spaces shall be in accordance with section 4.2 of this document.

### 4.1.5 Loading Bays

Loading bay calculations are carried out in accordance with Chapter B4 of the 2014 Byron Shire DCP and the GTTG, based on development types. The calculations are provided in table 10.

Table 10|Loading Bay Calculations

| Relevant DCP land use definition | GFA ($m^2$) | Number of loading bays required by vehicle class |
|---|---|---|
| Retail premises, tourist and visitor accommodation | 4038 | 2 x SRV (Small Rigid Vehicle)<br>2x MRV (Medium Rigid Vehicle)<br>1x HRV (Medium Rigid Vehicle) |

Based on table B4.2 of Chapter B4 of the 2014 DCP, a total of 2 SRV loading bays, two (2) MRV loading bays and 1 HRV loading bay would be required. However, to accommodate for spatial constraints and to be able to utilise the existing loading dock, it is proposed to utilise the following configuration:

- Single loading dock near the carpark entry that can accommodate a MRV, HRV and, if managed adequately, an AV;
- Provide a queuing space suitable to either accommodate a single HRV or two MRVs.
- This configuration will allow for:
  - Two MRV's or SRV's waiting in a safe spot, away from the general public whilst an MRV or HRV is loading/ unloading; or
  - 1 HRV waiting in a safe spot , away from the general public whilst an MRV or HRV is loading/ unloading.

It should be noted that the main tenant of the development, Harris Farm does have extensive experience with operating spatially constraint sites in the Sydney metro area and has indicated that this arrangement is fit-for-purpose. It is recommended that a commercial vehicle management plan is prepared and implemented prior to occupation of the site.

## 4.2 Geometric Requirements

Geometric requirements for the parking spaces and loading bays are determined in accordance with AS2890.1 and AS2890.6. An overview of the geometric requirement is provided in table 12. The proposed design complies with the parking requirements and geometric design requirements outlined in this chapter of the report. The design has been modified to ensure that the require carparking, motorcycle, accessible and bicycle spaces are provided. Safety measure including pedestrian zones and pedestrian crossings have been provided to enhance safe pedestrian movement within the subject site.

Table 11| Geometric requirements

| Item | Minimum Required | Relevant user classes | Dimensions |
|---|---|---|---|
| Regular parking spaces | 200 | 1A,2,3 | 5.4 x 2.6m spaces with 5.8m aisle width. |
| Accessible parking spaces | 5 | 4 | 5.4 x 2.5m spaces with 2.4m shared between 2 spaces |
| Bicycle spaces | 23 | - | - |
| Motorbike spaces | 16 | - | 2.5 x 1.2m |
| Staff parking spaces | 0 | - | - |
| SRV loading bay | N/A | - | 3.5 X 6.4m bay with 3.5m vertical clearance |
| MRV loading bays | 2 | - | 3.5 x 8.8m bay with 4.5m vertical clearance |

# 5 Trip Generation

## 5.1 Trip Generation Rates

This section of the report focuses on the traffic generated by the proposed development. Trip generation rates have been obtained from multiple sources including the RMS's 'Guide to Traffic Generating Development' (GTTGD) and ITE's 'Trip Generation Manual'. Planit has adopted a merit-based assessment for trip generation to ensure that an accurate representation of the proposed site is shown. Based on Planit's experience with development within the Byron Shire area, the rates that best represent the proposed development will be adopted for this assessment. Table 13 shows a summary of relevant rates provided in the GTTGD and the ITE Trip Generation Manual. The rates provided in this table have been analysed to establish the most appropriate trip generation rates for the proposed development. The rates are summarised in the tables 13-16 below.

Table 12 | Trip Generation, data sources

| Item | Trip generation Parameter | Source | Daily trip generation rate | Peak hour trip generation rate |
|---|---|---|---|---|
| Shopping centre | m² GFA | RTA Guide to generating traffic developments | Daily generation rate 121 per 100m² GFA (0-10,000m² GFA) | 12.5 per 100m² GFA |
| Commercial Office | m² GFA | RTA Guide to generating traffic developments | 10 per 100m² GFA | 2 per 100m² GFA |
| Shopping centre | m² GFA | ITE Trip Generation manual | 42.7 per 100m² GFA | 0.96 PER 100m² GFA (AM)<br>3.71 per 100 m² GFA (PM) |

The proposed refurbished portal frame warehouse development has a significant GFA footprint and will constitute a large percentage of trip generation to the development. The GTTGD and ITE Trip Generation Manual both provides daily trip and peak hour rate for shopping centres. Both trip generation guides and manuals have been sourced to provide a better understanding of the trip generation at the development.

Clause 3.6.1 of the GTTGD suggests that a 25% discount rate can be applied to the shopping centre rates that are less than 10,000m² GFA. This reduces the daily trip generation to 91 trips per 100m² GFA, and the peak hour trip generation to 9.3 trips per 100m² GFA. The ITE Trip Generation Manual predicts significantly lower trip generation for the proposed shopping centre. For modelling purposes, the discounted GTTGD rates will be utilised as they are conservative trip generation rates for the estimated development use.

Additionally, the Byron Bay Town Centre Master Plan supports the promotion of a pedestrian and cycle friendly CBD to reduce the amount of traffic within the CBD. This is also consistent with the 2019 Pedestrian Access and Mobility Plan (PAMP) which aims to improve pedestrian and cycle access throughout the CBD and encourages visitors to arrive via alternative modes of transport rather than private vehicles.

The adopted peak hour trip generation rates are summarised in Table 14.

Table 13 | Trip Generation (peak hour rates)

| Item | Trip generation Parameter | Source | AM Peak Hour Trip Generation Rate | Total Footprint | AM peak hour trip generation | PM peak hour trip generation |
|---|---|---|---|---|---|---|
| Shopping centre | m² GFA | RTA Guide to generating traffic developments | 9.3 per 100m² GFA | 3134 | 291 | 291 |
| Commercial/ Offices | m² GFA | RTA Guide to generating traffic developments | 2 per 100m² GFA | 904 | 18 | 18 |
| Total | | | | 4038 | 309 | 309 |

The existing site conditions comprises of a Singhs (tyre shop), Repco, Liberty, and Mitre-10. The existing peak hour trip generation conditions are estimated based of RTA Guide to generating traffic

developments. The existing condition trip generation rates for daily and peak hour are presented in Table 15.

Table 14 | Peak Hour Trip Generation, adopted rates for existing conditions

| Item | Trip generation Parameter | Source | Total Footprint | Daily Trip Generation Rate | AM peak hour trip generation | PM peak hour trip generation |
|---|---|---|---|---|---|---|
| Car Tyre Retail Outlets | m² GFA | RTA Guide to generating traffic developments | 250 | 25 | 2.5 | 2.5 |
| RTA Building Supplies | m² GFA | RTA Guide to generating traffic developments | 500 | 165 | 21 | 25 |
| RTA Service Station | m² GFA | RTA Guide to generating traffic developments | 40 | 114 | 18 | 18 |
| Automotive parts | m² GFA | RTA Guide to generating traffic developments | 350 | 217 | 16 | 23 |
| Total | | | 1140 | 320 | 57.5 | 68.5 |

## 5.2 Daily Trip Calculations

Based off the above table, the existing daily trip generate rate is approximately 58 AM peak hour trips, 69 PM peak hour trips and 320 daily trips per day. The daily trip generation for the proposed development are provided in table 16.

Table 15 | Daily Trip Generation, adopted rates

| Item | Trip generation Parameter | Source | Daily Trip Generation Rate | Total Footprint | Trip Generation |
|---|---|---|---|---|---|
| Shopping centre | m² GFA | RTA Guide to generating traffic developments | 91 per 100m² GFA | 3134 | 2852 |
| Commercial/Offices | m² GFA | RTA Guide to generating traffic developments | 10 per 100m² GFA | 904 | 90.4 |
| Total | | | | 4038 | 2942 |

Based on the parameter above provide by RTA Guide to generating traffic developments with a net daily trip generation of 2942 vehicle trips per day.

Trip calculation results presented in this section of the report formed the input for traffic modelling. The modelling results are presented in Section 8 of this report.

# 6 Development Access Assessment

## 6.1 Jonson Street Access

The propose development proposes a primary access point through the main road on Jonson Street. The access point is located in the north-eastern quadrant of Lot 51 (DP844054). Refer to Figure 3 below for the location of the access point.

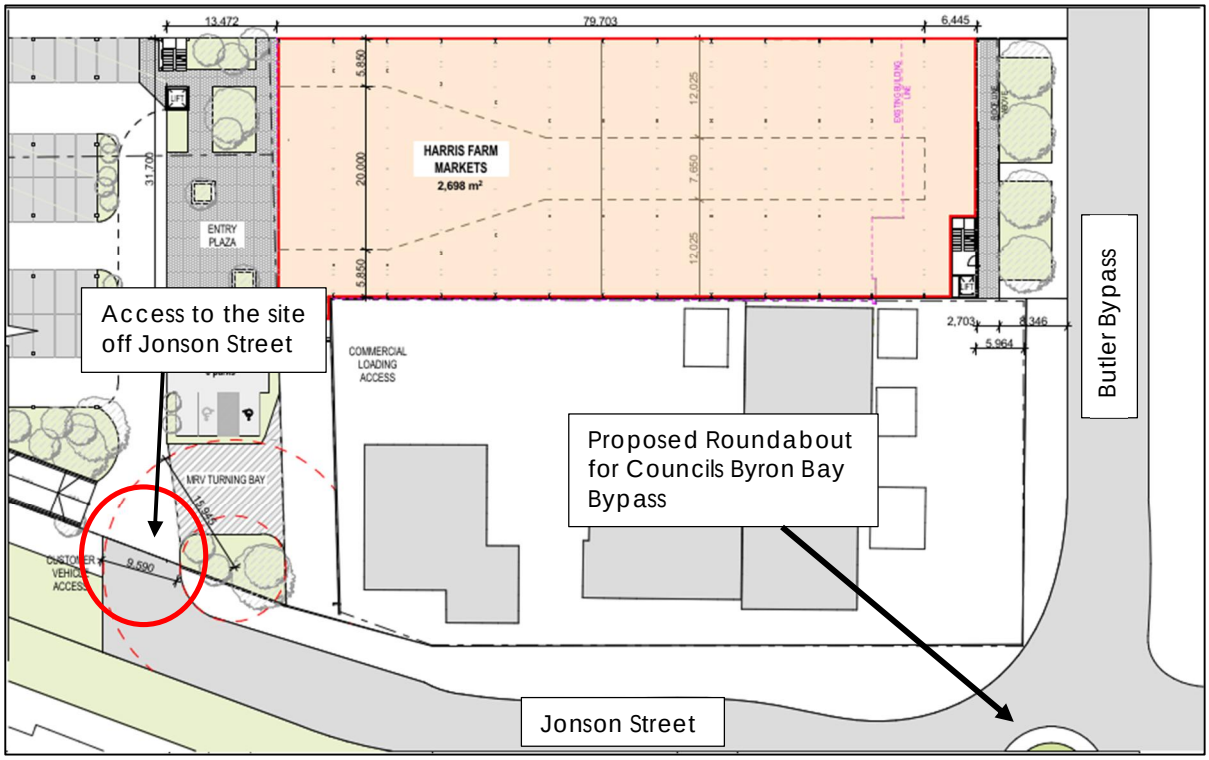



Figure 3 | Site access to the subject site

# 7 Internal Manoeuvring

Internal manoeuvring has been assessed for the design vehicles for the site, using Autodesk Vehicle Tracking software. The following design vehicles have been adopted:

- Standard MRV as per AS2890.2;
- Standard HRV as per AS2890.2;

The results of swept path analysis has been presented in Figures 4 and 5.


Figure 4| 2 x MRV turning movements into Loading Bay

Figure 4 demonstrates that an MRV can safely access the site via the main entrance and enter the queuing area, line up in the loading back and reverse towards the loading dock. The figure also demonstrates that this can occur safely whilst a second MRV is positioned within the queuing area.

Figure 5 demonstrates that an HRV can safely access the site via the main entrance and enter the queuing area, line up in the loading back and reverse towards the loading dock. Sufficient space would be available for queuing when the loading bay is in use.


Figure 5 | MRV turning movements entering and exiting subject site

# 8 Impact on Surrounding Road Network

## 8.1 Impact on Road Capacity

The sections of Jonson street and Browning street adjacent to the subject site is currently used to enter and exit the Byron Bay CBD from and to the Suffolk park direction. The design of the proposed development also takes into account the proposed Byron Bay Bypass design and all road changes have been allowed for in this report.

The Byron Bay Bypass will begin at the corner of Jonson Street and Browning Street and connect into the end of Butler street and continue to the existing road adjacent to the police station. The proposed overall layout is presented in Figure 6. The bypass includes a new roundabout at the intersection of Johnson Street and Browning street, changing the dynamics of the existing traffic movement around the subject site. Construction of the bypass has commenced in July 2019 and is planned for completion in late 2020.

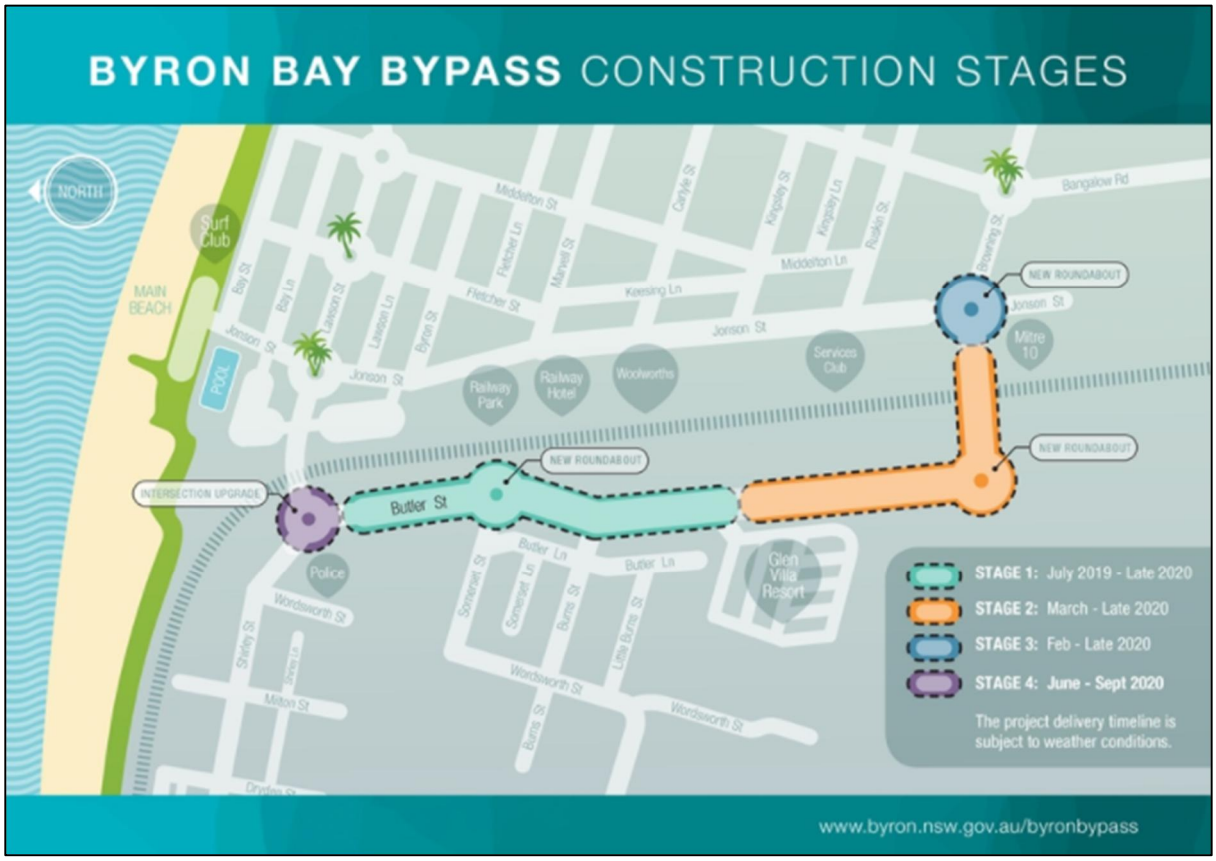



Figure 6 | Byron Bay Bypass Overall Layout Plan (Source: BSC)

The Byron Bay Bypass will aim to improve the traffic flow along Jonson Street by diverting through traffic around the Byron Bay CBD. It is anticipated that the traffic volumes along Jonson Street will decrease, and the traffic volumes along Browning Street will remain the same after commissioning of the bypass. Although the configuration of Browning Street will remain the same, the dynamic of the road will change as the flow of traffic will no longer be constant due to the provision of a roundabout at the Jonson Street and Browning Street intersection. Additionally, the vehicle speed coming off the roundabout travelling eastbound on Browning Street is expected to be reduced compared to the existing scenario, therefore making access/egress to/from the development site safer.

The average peak hour traffic volumes for Jonson Street and Browning Street are presented in table 17. These values are inclusive of the 1.05 seasonality factor. It is evident that the peak hour vehicle trips on the surrounding network in table 17 are within the 900vehicles/h limit (Table 5.1 of the *Guide to Traffic Management Part 3: Traffic studies and Analysis)*. Based on the calculations presented in table 14 (Section 5.1 of this report), the proposed development will have a peak AM and PM rate of 309 vehicles an hour. It is assumed that the distribution of trips will be 50% into and 50% out of the development.

Table 16|Peak Hour Vehicle Trips on Surrounding Road Network

| Scenario | Time | Jonson Street (Southbound) | Browning Street (Eastbound) |
|---|---|---|---|
| 2020 pre-development | AM Peak (vehicles/h) | 488 | 444 |
| | PM Peak (vehicles/h) | 633 | 628 |
| 2030 pre-development | AM Peak (vehicles/h) | 624 | 596 |
| | PM Peak (vehicles/h) | 811 | 804 |
| 2030 post-development | AM Peak (vehicles/h) | 765 | 737 |
| | PM Peak (vehicles/h) | 952 | 945 |
| Percentage increase (between 2030 and 2030 pre and post development) | AM Peak (vehicles/h) | 22.6% | 23.6% |
| | PM Peak (vehicles/h) | 17.3% | 17.5% |

## 8.2 SIDRA Modelling

### 8.2.1 Modelling Scenarios

The relevant modelling scenarios are based on the following questions and assumptions:

- How does the intersection perform with existing conditions and in the 2030 design year, adopting an assumed 2.5% annual compound traffic growth rate?
- How does the intersection perform in 2030 with post development traffic added? and
- Are there any additional intersection upgrades required?

Two distinctive intersection modelling scenarios have been setup to address the above questions. The pre-development modelling scenario was based on the existing conditions at Jonson Street and Browning Street. For the post-development scenarios, the new roundabout proposed at Jonson Street and Browning street has been modelled. The modelled scenarios are as follows:

- Pre-development 2020 AM Peak ; and
- Post-development 2030 PM Peak

### 8.2.2 General Modelling Information

SIDRA Intersection 8.0 PLUS was used to carry out intersection modelling. Although general site-specific modelling input is described in the corresponding sections, detailed SIDRA modelling data can be provided upon request.

For traffic on Jonson Street, Browning Street and the Butler bypass, an approach speed limit of 50km/h is assumed.

The following generic key performance indicators were adopted when deciding whether a modelling scenario is a pass or fail;

- Worst Level of Service on an intersection or roundabout: and
- Worst Level of Service on a through road.

The pre-development turning movements have been assumed based on observations by Planit. The movements have been used as the inputs for the turning movements along Jonson and Browning Street. The following assumptions were made for determining the traffic volumes;

- 2.5% per annum compound traffic growth on background traffic;
- Equal distribution of trips into and out of the proposed development (e.g. 50% in and 50% out);
- 50% of traffic to use the bypass and 50% to continue to use Jonson Street;
- Turning movements will be conservatively distributed through the new bypass roundabout; and
- The most critical peak hour volumes between the AM and PM are modelled in SIDRA.

Table 17| SIDRA Modelling Inputs

| Approach | Turning Movement | 2020 PM Peak Hour Volume (Pre-development) | 2030 PM Peak Hour Volume (Post-development) |
|---|---|---|---|
| Jonson Street (Southbound) | Left | 616 | 350 |
| | Straight | 17 | 141 |
| | Right | 0 | 0 |
| Jonson Street (Northbound) | Left | 12 | 59 |
| | Straight | 12 | 59 |
| | Right | 12 | 59 |
| Butler Bypass (westbound) | Left | 0 | 0 |
| | Straight | 0 | 350 |
| | Right | 0 | 141 |
| Browning Street (Eastbound) | Left | 17 | 141 |
| | Straight | 0 | 366 |
| | Right | 611 | 366 |

### 8.2.3 Modelling Results

Modelling results for level of service are provided figures 7 and 8. The SIDRA modelling demonstrates that the new intersection is operating at a level of service A for every movement. The modelling results show sufficient performance of both intersections for pre- and post-development scenarios. It is unlikely that there is any queuing of traffic leaving the subject site which in turn ensures that traffic flow from development can travel into and out of the proposed development unimpeded.

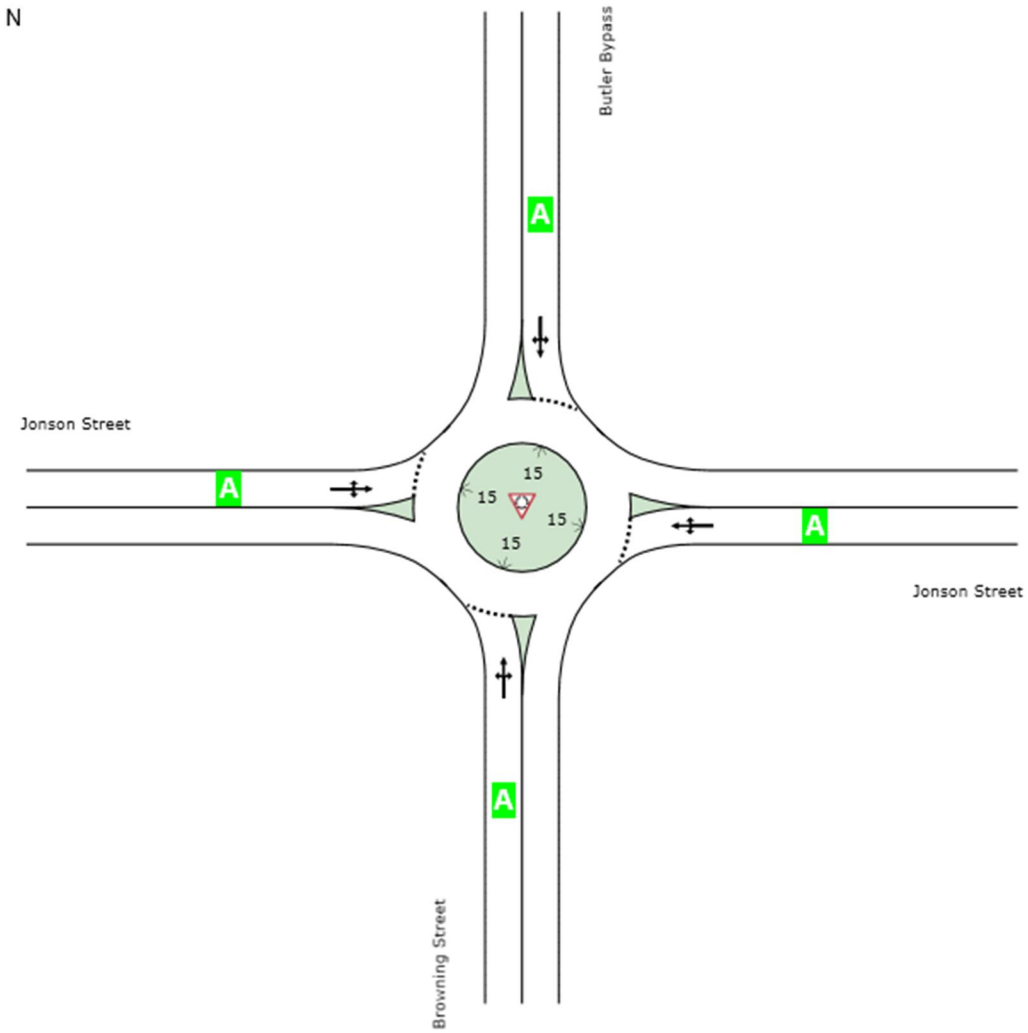



Figure 7| SIDRA output Level of Service for Pre-Development Scenario

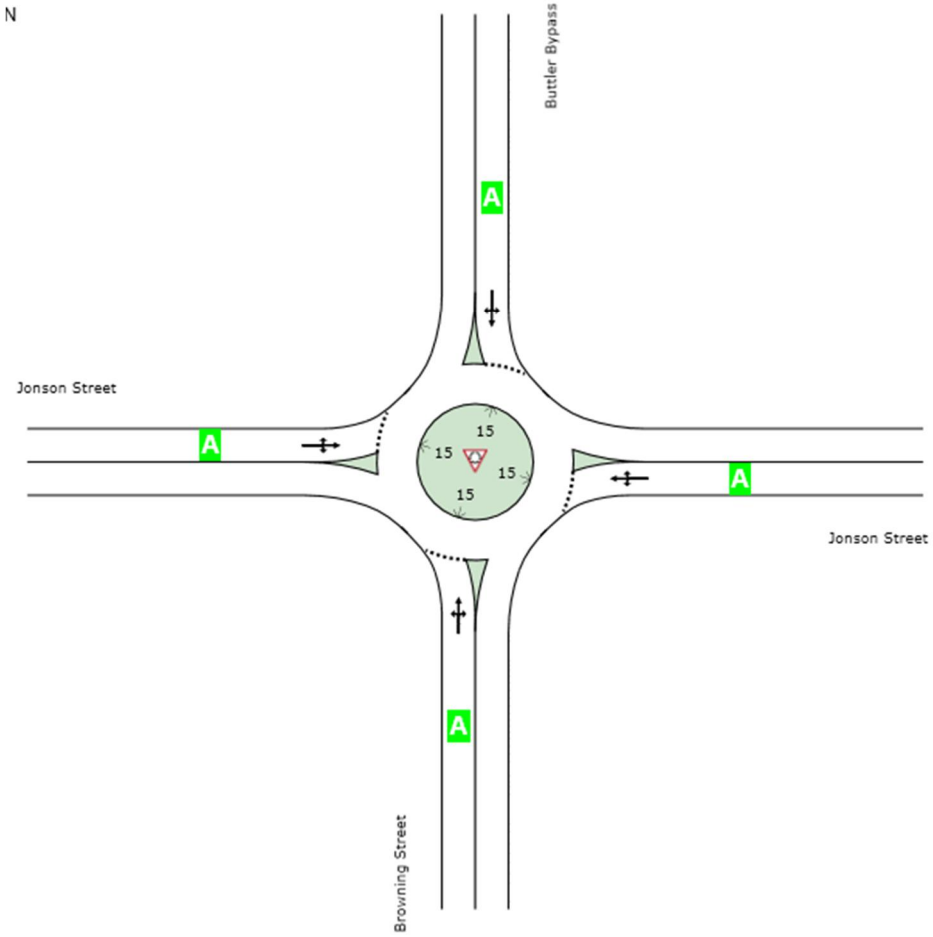



Figure 8 | SIDRA output Level of Service for Post-development scenario

The modelling results for the pre and pos development scenarios show:

- Level of service A for the most critical peak hour volumes for pre and post development scenarios; and
- The increased in peak trips has not resulted in a negative impact with regards the level of service.

# 9 Safety Considerations

## 9.1 Site Access

There is currently one proposed access point to 156-158 Jonson Street via the Jonson street frontage. It is proposed that all vehicle entry and exits to the subject site will be via Jonson Street. The site access will also allow for commercial vehicles servicing the site. The access point complies with the minimum width requirements outline in Table 3.1 of AS2890.2. It is believed that required sight lines on Jonson street and the proposed site access point on Jonson street are achievable.

## 9.2 Road Safety

A current pedestrian safety issue was identified along Jonson Street and Browning Street intersection where vehicles have right of way. It was noticed that pedestrians face difficulties whilst crossing the street from Browning street to 'Mitre 10'. The proposed development form, in combination with the bypass works currently under construction intent to improve the vision and facilities for pedestrian crossings. It was determined that Pedestrians walking to and from the proposed development through the new bypass intersection will have access at either end of Butler Street or Browning Street. Both pedestrian access points will have safe pedestrian refuge spacing. The provisions of signs and safety measurements will be put in place to ensure pedestrian safety.

The trip generation calculations show that the proposed development would not result in a significant change in road conditions, and that the capacity of the surrounding road network is not exceeded.

# 10 Cycling Provisions

There currently is a cycle way that exists throughout the Byron Bay CBD that promotes the use of bicycles in the area. In accordance with the the Byron Bay Town Centre Bypass design documentation, there will be a 2m wide shoulder/bicycle lane in each direction along the bypass. Butler Street currently has a designated cycle way and it is anticipated that the bypass will tie into cycle way. Refer Figure 9 for the existing path network in Byron Bay.

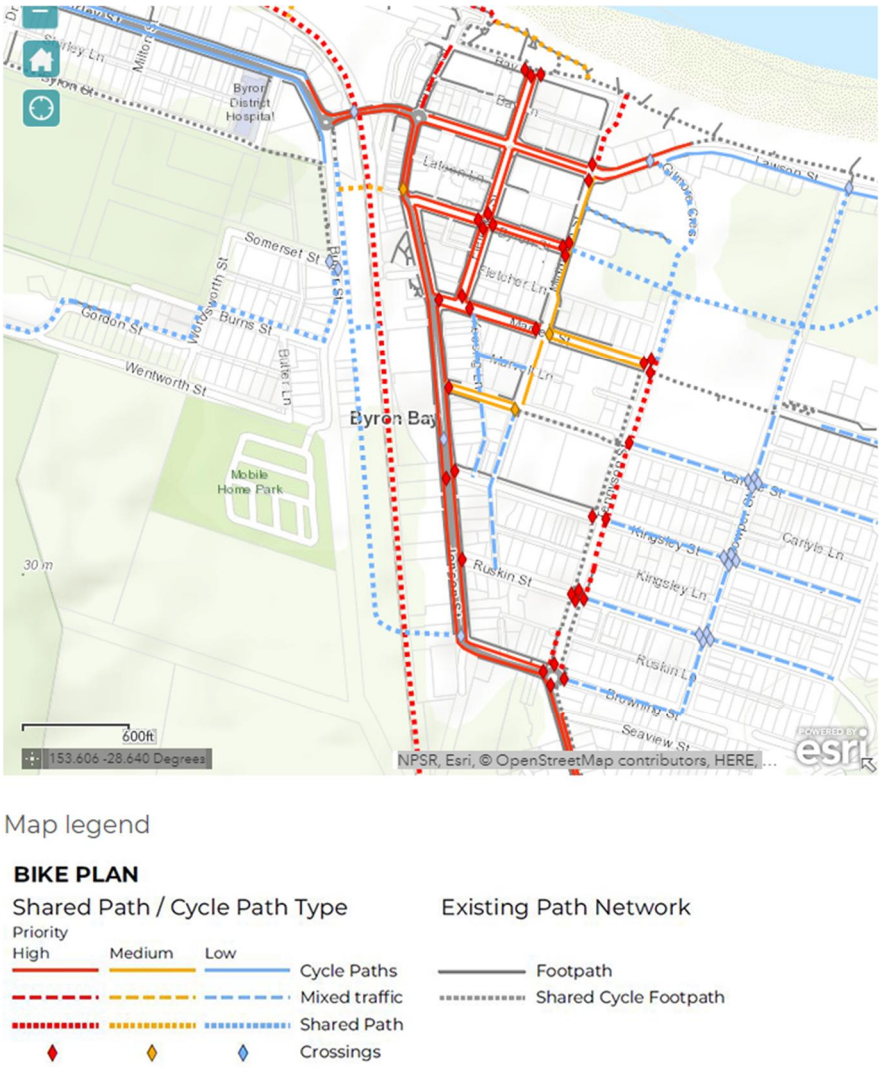



Figure 9 | Existing Byron Bay Path Network (source: BSC)

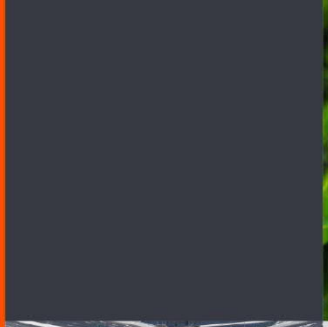
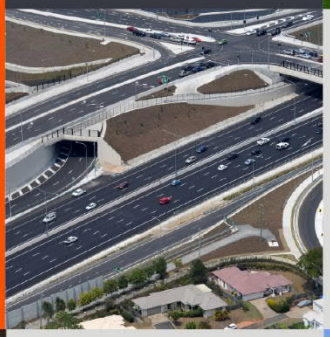
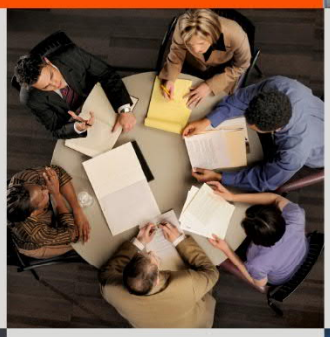
The Byron Shire Bike Plan and the 2019 Draft PAMP promotes the transitioning of the Byron Shire into a cycle friendly road space. It is proposed a minimum of 23 bicycle parks are provided at the development to promote sustainable means of transport to and from the site. The bicycle storage will be provided on the ground level of the 2-storey carpark. Therefore, the development adequately addresses the requirements of the Byron Shire Bike Plan and Action Plan and the 2019 Draft PAMP.

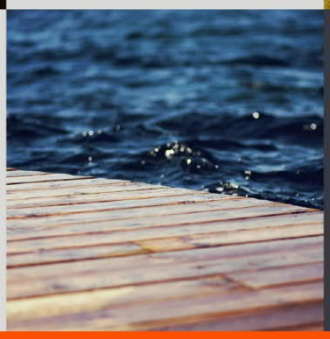
# 11 Conclusions and Recommendations

Based on the findings in this report, it was determined that;

- The proposed development will increase traffic volumes on the surrounding road network by up to 23%, however this does not result in exceedance of roadway capacity. SIDRA modelling shows suiable intersection performance with a level of service 'A' for each movement for the new intersection;
- The proposed development can be serviced by two MRV in the proposed loading bay and zones;
- The development adequately incorporates the recommendations of the Byron Shire Bike Strategy and Action Plan and 2019 Draft PAMP as well as Byron Shire Councils Masterplan principles;
- The proposed development as outlined in this report is unlikely to create safety hazards to road users and pedestrians.

Based on this assessment, an appropriate traffic and parking strategy can be achieved for the proposed development in compliance with Byron Shire Councils 2014 DCP.

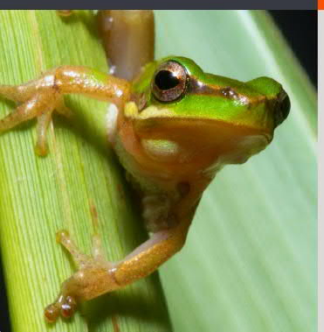


# Stormwater Management Plan

156-158 Jonson Street, Byron Bay, NSW, 2481
Lot 9 on DP818197
Lot 51 on DP844054
Lot 4729 on DP1228104

156 Jonson St Pty Ltd
By Planit Consulting Pty Ltd

September 2020



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Project Details

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| Project Name | 156-158 Jonson Street |
| Client | 156 Jonson St Pty Ltd C/- HGA |
| Client Project Manager | Maxime Beaur |
| Authors | Jake Bentley, Chaej Wrencher |
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Disclaimer

# Contents

# Figures



# Tables

# 1 Executive Summary

This Stormwater Management Plan (SWMP) has been prepared in support of the development located at 156-158 Jonson Street Byron Bay, NSW, 2481. Planit was engaged by 156 Jonson Street Pty Ltd to assess and report on the stormwater constraints and opportunities associated with this development.

The proposed development site is located in an area zoned for local centres and infrastructure which forms part of the Byron Shire Council (BSC) Local Government Area (LGA). The subject site is approximatly 8,850m$^2$ in plan and is located on Lot 9 on DP818197 (zoning – local Centre), Lot 51 on DP844054 (zoning – Infrastructure), and a Portion Lot 4729 on DP1228104 (zoning – Infrastructure).

The site is mapped as having presence of Acid Sulfate Soils (Class 2 and 3) below the surface (Figure 3). The proposed development will required excavation of soil, accordingly, an ASS investigation should be completed prior to construction to determine, if required, soil treatment specifications.

The buildings will be flood proofed in accordance with section C2.3.4 of BSCs DCP – Chapter C2 – Areas Affected by Flood Proofing.

The hydraulic assessment demonstrated a minimum detention storage of 59.4m$^3$ is required to mitigate peak flows from the post-development scenario equal those of equivalent pre-development for storm events. Therefore it is proposed to provide a 60m$^3$ detention tank.

The quality assessment demonstrated that the following stormwater infrastructure is appropriate to meet BSC's quality objectives:

- 1 x 60m$^3$ detention tank.
- 1 x 55l/s jellyfish filter (model JF-2250-10-2) or approved equivalent.
- 2 x Ocean Guard pit inserts or approved equivalent.
- 1 x treatment chamber for uncover area.

Provide appropriate sediment and erosion control measures are to be implemented during the construction phase to management the quantity and quality of stormwater generated during works. These provisions shall be in accordance with the 'Blue Book'.

# 2 Introduction

## 2.1 Project Background

This Stormwater Management Plan (SWMP) has been prepared in support of the development located at 156-158 Jonson Street Byron Bay, NSW, 2481 which falls within the Byron Shire Council (BSC) Local Government Area. Planit was engaged by 156 Jonson Street Pty Ltd to assess and report on the stormwater constraints and opportunities associated with this development.

The proposed development involves the construction of a mixed use development and carpark. Refer to Table 1 for additional subdivision detail with the subject site presented in Figure 1.

Table 1 – Site Details Summary

| Component | Details |
|---|---|
| Applicant | 156 Jonson St Pty Ltd |
| Street Address | 156-158 Jonson St |
| Local Government Area | Byron Shire Council |
| Climatic Region | Subtropical |
| Zoning | B2 – Local Centre<br>SP2 – Infrastructure |
| Proposed development type | Mixed use |
| Site Area | 8,850m$^2$ |
| Map Reference | Lot 9 on DP818197<br>Lot 51 on DP844054<br>Portion Lot 4729 on DP1228104 |

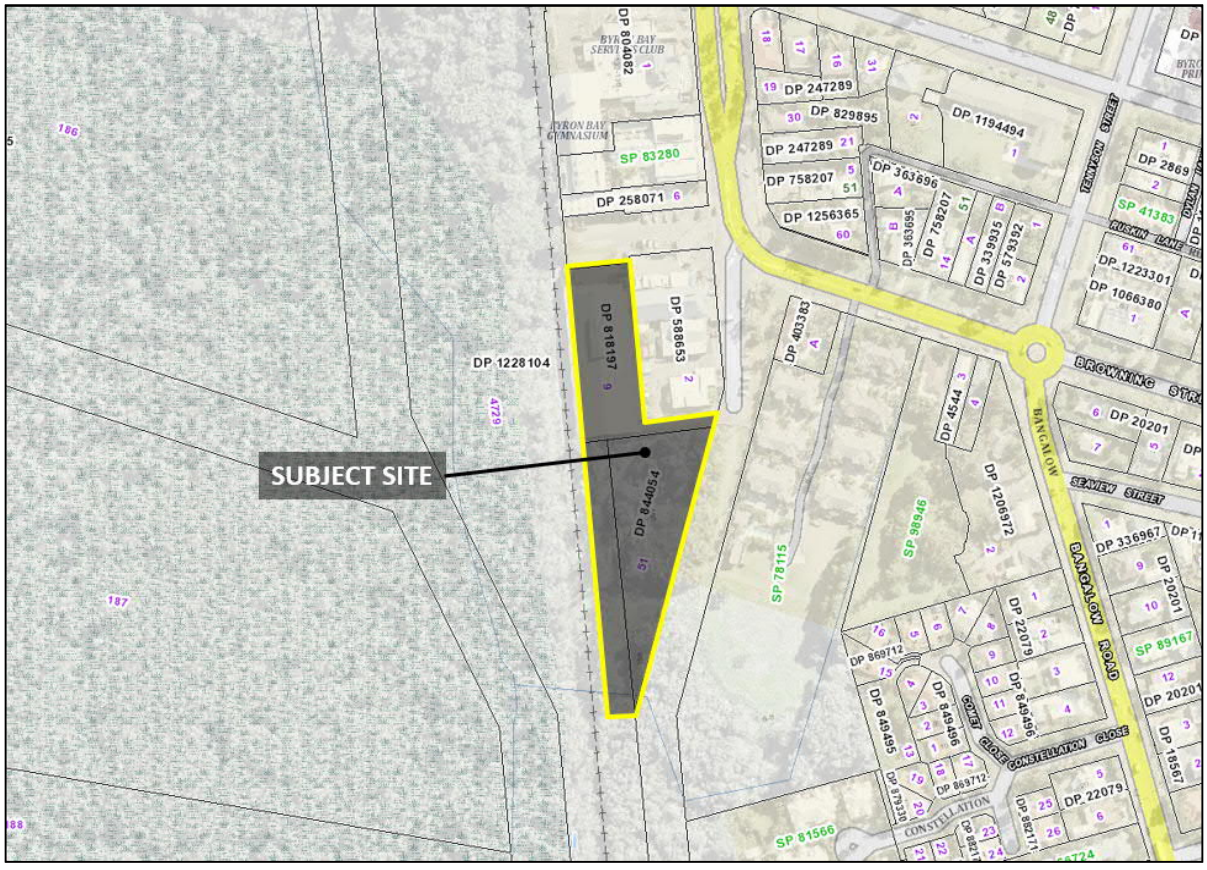


Figure 1- Subject Site (Sixmaps)

## 2.2 Project Scope

This assessment includes the following scope:

- Analysis of the subject site including:
  - Locality.
  - Existing Stormwater services.
  - Topography.
  - Legislation.
  - Flood and soil constraints.
- Stormwater management including:
  - Catchment analyses of the pre and post development site.
  - Hydrological and Hydraulic modelling to estimate peak flow rates in the existing scenario and proposed scenario (DRAINS modelling).
  - Provide recommendations for stormwater conveyance and the proposed detention system.
  - Hydrological and Hydraulic modelling to estimate the required stormwater treatment provisions for the proposed scenario (MUSIC modelling).
  - Provide recommendations for the proposed treatment train.
- Providing conclusions/recommendations with regard to stormwater management of the site.

# 3 Site Analysis

## 3.1 Site Description

The proposed development site (Figure 2) is located in an area zoned for local centres and infrastructure which forms part of the Byron Shire Council (BSC) Local Government Area (LGA). The subject site is approximatly 8,850m$^2$ in plan and is located on Lot 9 on DP818197 (local Centre), Lot 51 on DP844054 (infrastructure), and a Portion Lot 4729 on DP1228104 (infrastructure. The site currently contains:

- Lot 9 on DP818197 (3,165m$^2$):
  - Large shed covering the majority of the site.
  - Site access at the north to a carpark.
  - Battle axe access to the south of the lot.
  - Small landscaped area.
- Lot 51 on DP844054 (3,850m$^2$)and portion of Lot 4729 on DP1228104 (1,835m$^2$):
  - Complete grass cover with scattered trees.
  - Wetland in the south area of the site.
  - Lot 4729 on DP1228104 is currently part of a rail corridor.


Figure 2- Subject Site

To confirm the locations of existing services, a 'Dial Before You Dig' (DBYD) search has been requested within the vicinity of the development area, the results of which are included in Appendix B.

Additionally, the site survey is presented in Appendix Afor details of the site topography, refer to Section 5.1 of this document.

## 3.2 Existing Stormwater Features

Survey Information, dial before you dig records, and desktop/onsite investigations revealed the following stormwater features onsite:

- The north area of Lot 9 on DP818197 contains an existing carpark with two stormwater inlet pits.
- The battle axe access to Lot 9 on DP818197 contains an underground DN375 stormwater crossing
- A swale that runs paralell to the east boundary of Lot 51 on DP844054.
- Coastal Wetlands within a portion of the subject site and extending to the south. It should be noted that constrction activities will remain outside this wetland.

For the site survey, refer to Appendix A, and for details of the exsiting stormwater conveyacne refer to Section 4.1 of this document.

## 3.3 Engineering Constraints

Standards and Specifications

All civil works shall be in accordance with the BSC Engineering Specifications including the Subdivision Specifications and Standard Drawings as well as all codes and standards referenced in these documents.

Acid Sulfate Soils

The site is mapped as having presence of Acid Sulfate Soils (Class 2 and 3) below the surface (Figure 3). In addition, preliminary advice obtained from Regional Geotech Solutions suggest that it is likely that ASS will be encountered during excavations for carpark footings. Accordingly, an ASS investigation should be completed prior to construction to determine, if required, soil treatment specifications. Refer to Figure 3 for an extract of the Byron LEP ASS map within the vicinity of the subject site.

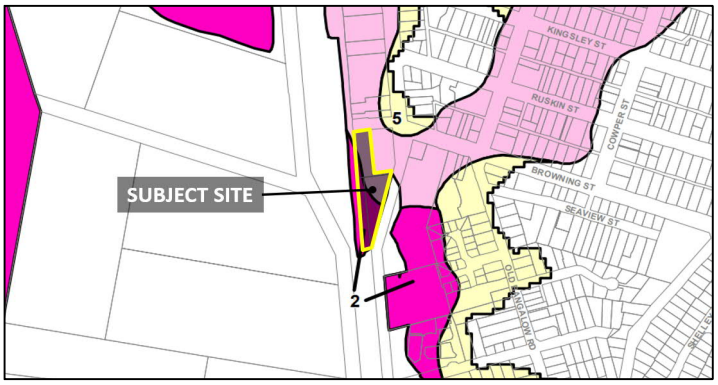


Figure 3- Subject Site Presence of Acid Sulphate Soils in the Byron Shire Council

Flooding

Upon review of the site, it was noted that a portion of the site falls within land subject to flooding. However, BSCs DCP – Chapter C2 – Areas Affected by Flood notes that for CBD infill developments, floor levels can be retained given that buildings comply with section C2.3.4 – Flood Proofing. Accordingly, the ground floor level shall be as per the existing levels and implement Flood Proofing in accordance with section C2.3.4 (Figure 4 below).

**C2.3.4 Flood Proofing**

1. Flood Compatible Material

Materials located below the relevant level defined by the **flood planning matrix** must be capable of resisting damage, deterioration, corrosion or decay taking into account the likely time the material would be in contact with flood water and the likely time it would take for the material to subsequently dry out.

2. Services

Services and related equipment, other than electricity meters, must not be located below the relevant flood planning level defined by the **flood planning matrix** unless they have been designed specifically to cope with flood water inundation. The location of electricity meters is regulated by the electricity supply authority.

Unless the electricity supply authority determines otherwise, electrical switches must be placed above the relevant level defined by the **flood planning matrix**. Electrical conduits and cables installed below the relevant level defined by the **flood planning matrix** must be waterproofed or placed in waterproof enclosures.

3. Enclosures

Any enclosure located below the relevant level defined by the **flood planning matrix** must have openings to allow for automatic entry and exit of floodwater for all floods up to the relevant level defined by the **flood planning matrix**.

Figure 4- Byron Bay Flood Proffing Requirements (BSCs DCP – Chapter C2 – Areas Affected by Flood)

# 4 Stormwater Management

## 4.1 Stormwater Conveyance

### 4.1.1 Existing Catchments

The site is relatively flat with a slight ridgeline running in a north-south direction centrally within Lot 51. Runoff from the site is discharged to the east and west. Runoff flowing east is discharged to a swale and drains to the south and runoff flowing west is discharged towards the railway where the flow is captured between two embankments and lows to the south.

To understand the existing catchments present onsite refer to Figure 5 below. Additionally, refer to Table 2 for a catchment breakdown.

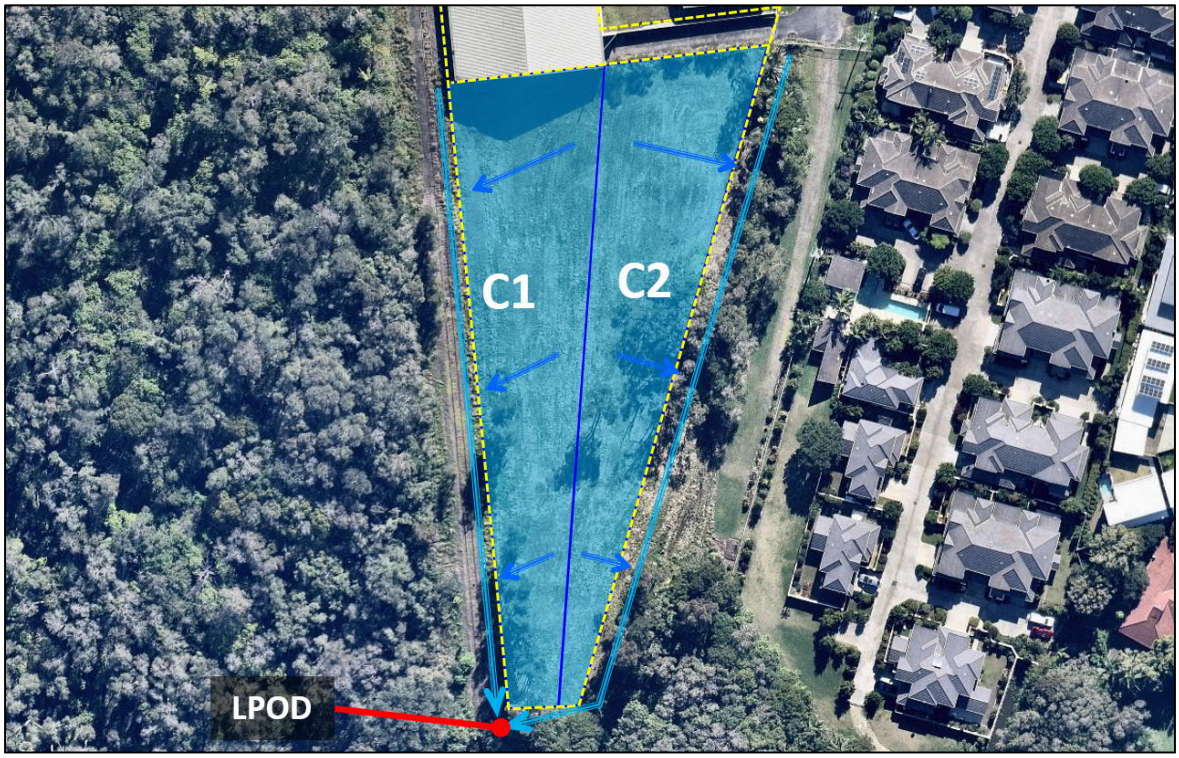


Figure 5- Exisitng Catchments

Table 2 - Catchment Breakdown (Existing)

| Catchment | Total (m²) | Impervious area (%) |
|---|---|---|
| C1 | 3,063 | 0% |
| C2 | 3,050 | 0% |
| Total | 6,113 | 0% |

It should be noted that for the purpose of this assessment, Lot 9 on DP818197 has been excluded from the catchment plan and breakdown as the lot will remain largely the same in the pre and post development scenarios. Some additional landscape areas will be provided which will decrease the impervious area of the site, hence, reducing peak runoff and increases the quality of stormwater discharged from the site.

### 4.1.2 Lawful Point of Discharge (LPOD)

Based on the catchment breakdown, the Lawful point of discharge shall be considered as the stream discharging to the west adjacent to the south corner of the subject site. This location of the LPOD is shown in both Figure 5 above (existing catchments figure) and Figure 6 below (proposed catchment figure). This is the same location for both the pre and post development and shall be the assessment point for stormwater quantity and quality.

### 4.1.3 Proposed Catchments

It is proposed that stormwater from the post development site discharge in the following manner:

- Top level Carpark
  - Collected in a trench grate network and discharged to a detention tank. Detention tank is to include a treatment flow pipe to discharge the $Q_{3month}$ event to a treatment system (Ocean Protect's Jellyfish Filter or approved equivalent) prior to discharge offsite. Events greater than the Q3month will bypass treatment while still been detained to the pre development peak flows for equivalent storm events within the proposed detention tank for up to and including the 1% AEP event.
- Ground Level Carpark (exposed area)
  - Collected in pits/pipes/grated drains and discharged to the swale running south adjacent to the east boundary of the subject site. Stormwater pits shall be fitted with litter baskets for stormwater to pass through prior to been discharged offsite.
- Ground Carpark (under cover)
  - Stormwater may enter the undercover area of the carpark, however, this would only include stormwater from open stairwells, small portions of open gardens etc. Therefore, as the quantity of stormwater expected to enter the basement is minimal, it is proposed to provide a separate pit and pipe system for the undercover area to capture any small portions of stormwater that may enter the covered area and any other water sources that may be present (i.e. potable water from a tap in the carpark). This pit and pipe system shall discharge to a sump and pump system receiving treatment prior to been pumped offsite. An additional note should be made that, in the circumstance that the pump system fails, stormwater shall be allowed to flow freely out of the undercover area.

To understand the proposed catchments, refer to Figure 6 below, Table 3 for a catchment breakdown, and Appendix C for Planit's concept layout plan.

It should be noted that this catchment breakdown represents exposed areas only:

- Top floor areas (C2-C4).
- Exposed ground floor area (C5-C9) (C5-C7 are ramp catchments with runoff draining to the ground floor area).
- Remaining existing catchment (C1).

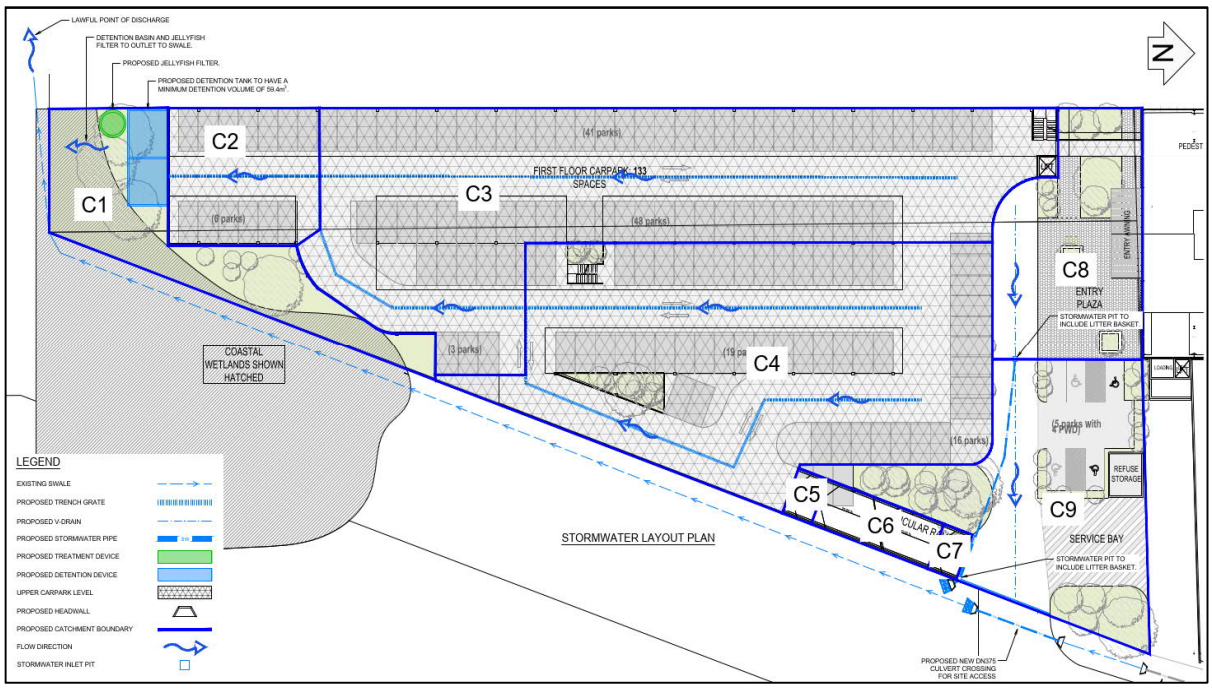


Figure 6- Proposed Catchments

Table 3 - Catchment Breakdown (Post Development)

| Catchment | Total (m²) | Impervious area (%) | Concentration Time (min.) |
|---|---|---|---|
| C1 | 510 | 0% | 5 |
| C2 | 350 | 100% | 5 |
| C3 | 1,975 | 100% | 5 |
| C4 | 1,780 | 100% | 5 |
| C5 | 25 | 100% | 5 |
| C6 | 100 | 100% | 5 |
| C7 | 25 | 100% | 5 |
| C8 | 560 | 80% | 5 |
| C9 | 840 | 70% | 5 |
| Total | 6,165 | 0% | 5 |

## 4.2 Stormwater Quantity

### 4.2.1 Model Hydrology and Parameters

For the stormwater quantity assessment, DRAINS software has been utilised using ARR 2016 rainfall data. The design rainfall data has been collected from the ARR Data Hub for the following longitude and latitude:

- Latitude: -28.650
- Longitude: 153.613

Table 4 below shows the rainfall intensities used in the hydraulic model.

Table 4 – Rainfall Intensities (ARR Data Hub)

| | | Exceedances per Year (EY) | | | | | Annual Exceedance Probability (AEP) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Duration | Duration (min) | 12EY | 6EY | 4EY | 3EY | 2EY | 63.20% | 50% | 0.5EY | 20% | 0.2EY | 10% | 5% | 2% | 1% | 1 in 200 | 1 in 500 | 1 in 1000 | 1 in 2000 |
| 1 min | 1 | 1.11 | 1.27 | 1.54 | 1.74 | 2.03 | 2.58 | 2.89 | 3.2 | 3.82 | 3.9 | 4.45 | 5.05 | 5.82 | 6.41 | 6.9 | 7.71 | 8.31 | 8.92 |
| 2 min | 2 | 1.98 | 2.25 | 2.69 | 3.02 | 3.5 | 4.35 | 4.86 | 5.4 | 6.51 | 6.64 | 7.65 | 8.8 | 10.4 | 11.8 | 12.8 | 14.3 | 15.5 | 16.6 |
| 3 min | 3 | 2.77 | 3.15 | 3.79 | 4.26 | 4.92 | 6.11 | 6.83 | 7.58 | 9.13 | 9.31 | 10.7 | 12.3 | 14.5 | 16.2 | 17.6 | 19.7 | 21.3 | 22.8 |
| 4 min | 4 | 3.47 | 3.96 | 4.79 | 5.38 | 6.23 | 7.73 | 8.64 | 9.59 | 11.5 | 11.8 | 13.5 | 15.4 | 18.1 | 20.1 | 21.7 | 24.3 | 26.2 | 28.1 |
| 5 min | 5 | 4.1 | 4.68 | 5.68 | 6.4 | 7.42 | 9.2 | 10.3 | 11.4 | 13.7 | 14 | 16 | 18.2 | 21.2 | 23.5 | 25.3 | 28.3 | 30.6 | 32.8 |
| 10 min | 10 | 6.44 | 7.41 | 9.09 | 10.3 | 12 | 14.9 | 16.6 | 18.5 | 22 | 22.4 | 25.5 | 28.9 | 33.1 | 36.3 | 39 | 43.6 | 47 | 50.4 |
| 15 min | 15 | 8.02 | 9.25 | 11.4 | 12.9 | 15.1 | 18.8 | 21 | 23.4 | 27.8 | 28.3 | 32.2 | 36.4 | 41.6 | 45.5 | 48.9 | 54.6 | 58.9 | 63.2 |
| 20 min | 20 | 9.19 | 10.6 | 13.1 | 14.9 | 17.5 | 21.8 | 24.4 | 27.1 | 32.2 | 32.8 | 37.3 | 42.2 | 48.4 | 52.9 | 56.9 | 63.6 | 68.6 | 73.6 |
| 25 min | 25 | 10.1 | 11.7 | 14.5 | 16.5 | 19.3 | 24.2 | 27.1 | 30.1 | 35.8 | 36.5 | 41.5 | 47 | 54 | 59.3 | 63.8 | 71.3 | 76.9 | 82.5 |
| 30 min | 30 | 10.9 | 12.6 | 15.7 | 17.8 | 20.9 | 26.3 | 29.4 | 32.6 | 38.9 | 39.7 | 45.2 | 51.2 | 59 | 64.9 | 69.9 | 78.2 | 84.3 | 90.4 |
| 45 min | 45 | 12.6 | 14.7 | 18.2 | 20.8 | 24.5 | 31 | 34.7 | 38.5 | 46.2 | 47.1 | 53.9 | 61.4 | 71.4 | 79 | 85.3 | 95.3 | 103 | 110 |
| 1 hour | 60 | 13.8 | 16.1 | 20.1 | 23 | 27.2 | 34.6 | 38.8 | 43.1 | 51.9 | 52.9 | 60.8 | 69.6 | 81.5 | 90.7 | 97.9 | 109 | 118 | 127 |
| 1.5 hour | 90 | 15.7 | 18.3 | 23 | 26.4 | 31.4 | 40.2 | 45.2 | 50.2 | 61 | 62.2 | 72 | 83 | 98.1 | 110 | 119 | 133 | 143 | 154 |
| 2 hour | 120 | 17.1 | 20 | 25.2 | 29 | 34.6 | 44.7 | 50.4 | 55.9 | 68.5 | 69.9 | 81.3 | 94.2 | 112 | 126 | 136 | 152 | 164 | 176 |
| 3 hour | 180 | 19.3 | 22.7 | 28.8 | 33.3 | 39.9 | 52.1 | 58.9 | 65.3 | 81 | 82.6 | 96.8 | 113 | 135 | 153 | 165 | 184 | 199 | 213 |

For this assessment DRAINS ILSAX model has been utilised assigning model parameters as per Figure 7 below.

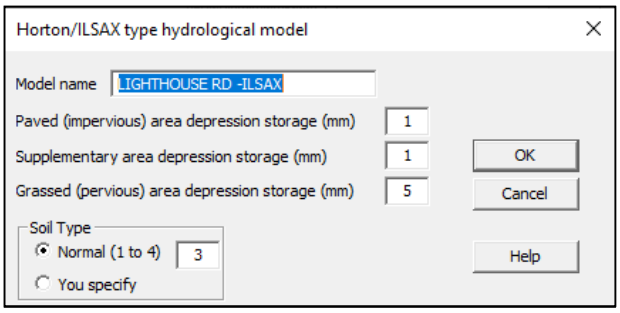


Figure 7- Hydraulic Model Inputs

### 4.2.2 Hydraulic Assessment

The aim of this assessment is to estimate the peak flows generated from the pre and post development site to determine detention storage requirements and size conveyance infrastructure appropriately. For the comparative assessment, DRAINS models were setup as per Figure 8 below using catchment parameters as per Table 3 above.


Figure 8- DRAINS Layout

### 4.2.3 Hydraulic Assessment Results

The results from the hydraulic assessment are presented in Table 4 below from the 1EY Event to the 1% AEP event for the pre and post development scenario. The post development scenario included a detention basin with a total detention volume of 60m³.

Table 5 – DRAINS Peak Flow Summary

| Scenario | 1 EY (m³/s) | 0.5 EY (m³/s) | 20% AEP (m³/s) | 10% AEP (m³/s) | 5% AEP (m³/s) | 2% AEP (m³/s) | 1% AEP (m³/s) |
|---|---|---|---|---|---|---|---|
| Pre Development | 0.082 | 0.124 | 0.159 | 0.201 | 0.237 | 0.273 | 0.309 |
| Post Development | 0.079 | 0.111 | 0.153 | 0.187 | 0.221 | 0.251 | 0.269 |
| Total Impact | -0.003 | -0.013 | -0.006 | -0.014 | -0.016 | -0.022 | -0.040 |

Based on the results of the hydraulic assessment, a minimum detention storage of 59.4m³ (maximum volume reached within the proposed detention tank in the 1% AEP event) is required to mitigate peak flows from the post development scenario to that of the pre development for equivalent storm events. Therefore, it is proposed to provide a 60m³ detention tank.

It should be noted that to achieve the required flow mitigation for more frequent events (1EY – 10% AEP event), a High Early Discharge (HED) system has been included in the model. Parameters of the detention tank and HED system are subject to detailed design.

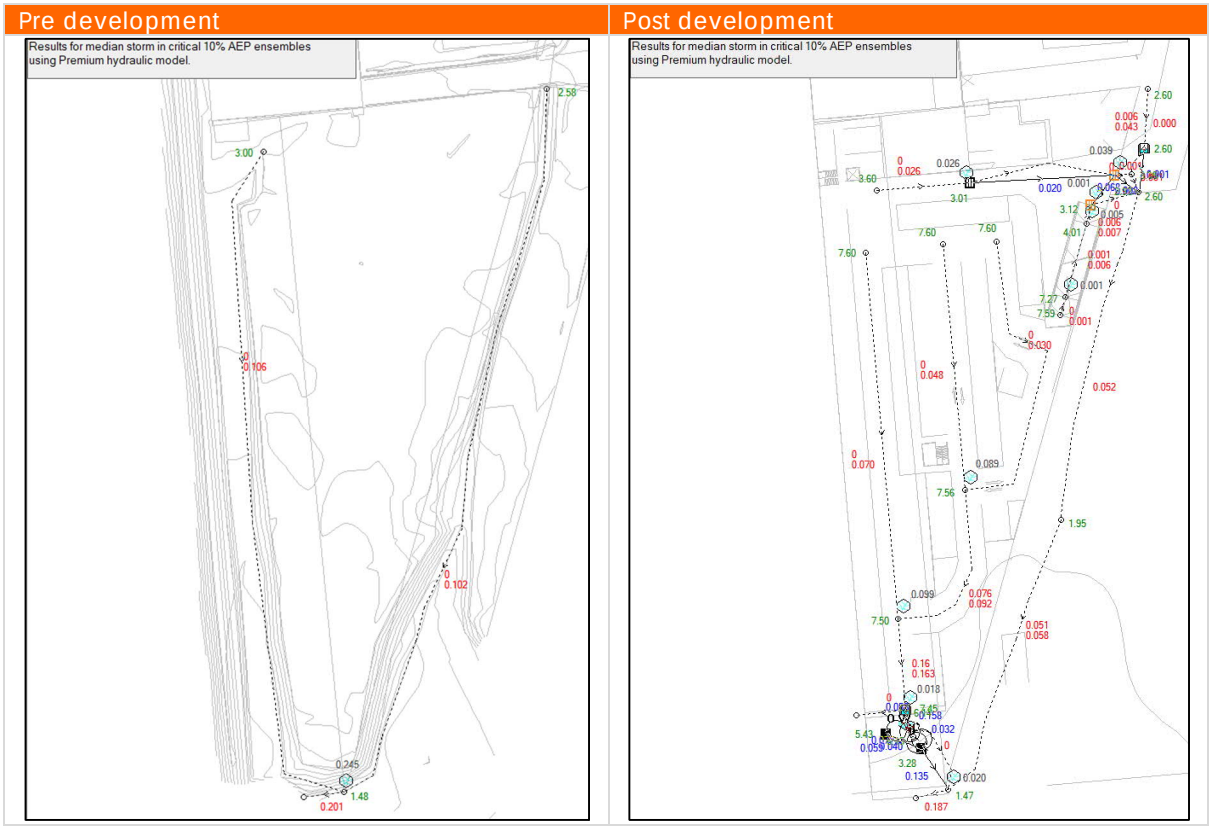


Figure 9- DRAINS Model Results (10% AEP Event (Minor Event))

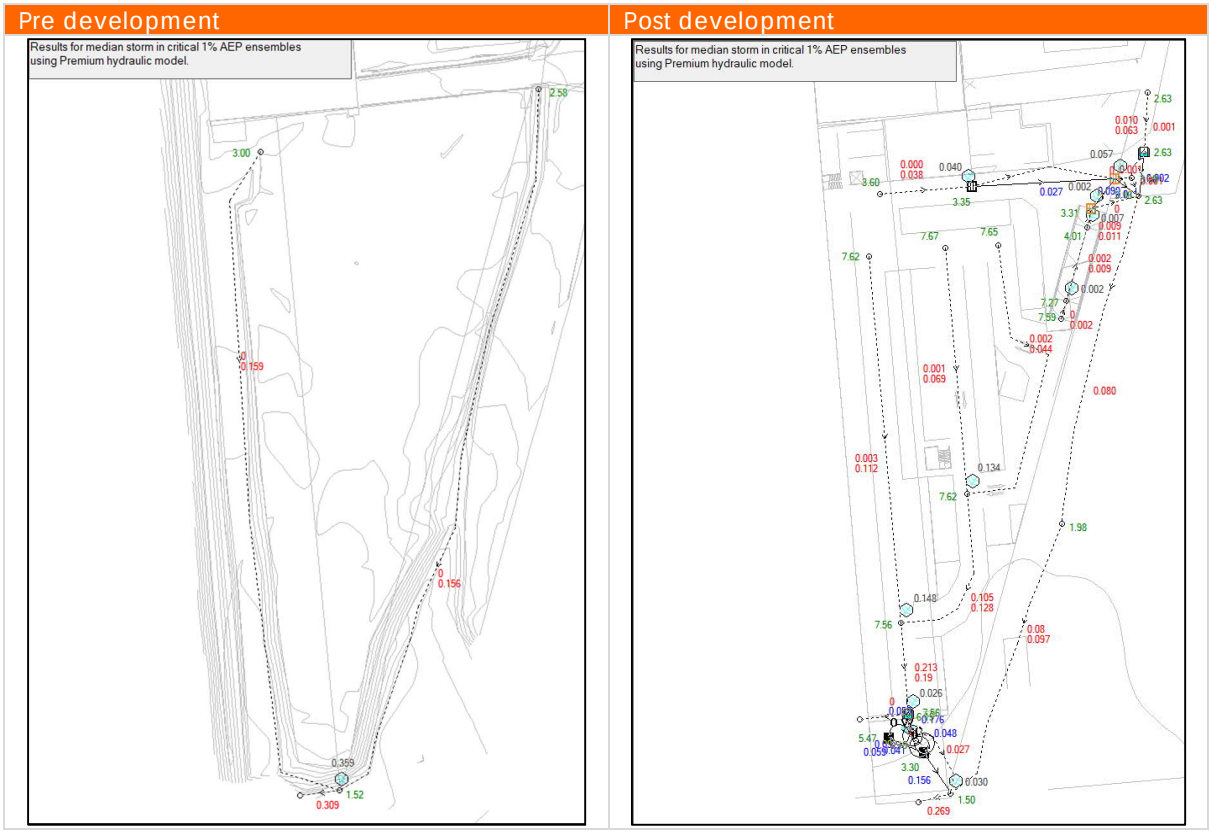


Figure 10- DRAINS Model Results (1% AEP Event (Major Event))

DRAINS model files can be submitted on request.

## 4.3 Stormwater Quality

### 4.3.1 Stormwater Quality Objectives

As the development will impact the quality of stormwater runoff, treatment measures shall be provided to improve the quality of stormwater runoff prior to discharge off site in accordance with BSC's DCP.

The degree of treatment for stormwater runoff prior to discharge offsite is noted by BSC's DCP Chapter B3. Figure 11 below presents an extract from the document showing the required stormwater pollutant retention prior to discharge offsite.

**Table B3.2 – Pollutants and Retention Criteria**

| Pollutant / Issue | Retention Criteria |
|---|---|
| Litter | 70% of average annual load greater than 5mm. |
| Coarse Sediment | 80% of average annual load for particles 0.5mm or less. |
| Fine Particles | 50% of average annual load for particles 0.1mm or less. |
| Total Phosphorous | 45% of average annual load. |
| Total Nitrogen | 45% of average annual load. |
| Hydrocarbons, motor fuels, oils & grease | 90% of average annual load. |

Figure 11- Site Pollutant Retention Requirements (BSC's DCP Chapter B3)

### 4.3.2 Stormwater Quality Model

To demonstrate compliance with stormwater quality Objectives, MUSIC software has been utilised. The model has generally been set up in accordance with WaterByDesigns 'MUSIC Modelling Guidelines (2018). Refer below for the assigned model parameters.

Rainfall Data

The 'Alstonville 6 Minute' rainfall data template from year 2000-2010 has been utilised for the MUSIC Model.

Rainfall Runoff Parameters

Rainfall runoff parameters have been assigned as per Figure 12 below.

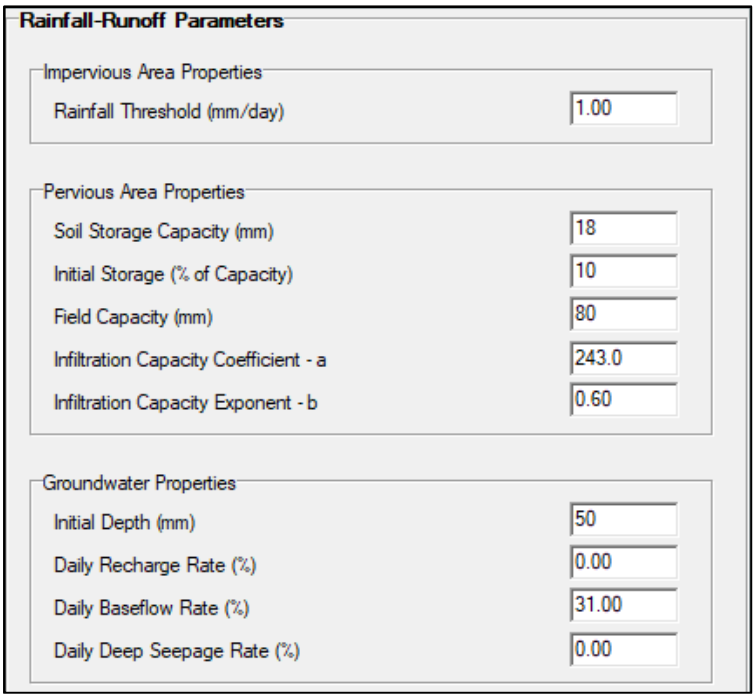


Figure 12- Assigned Rainfall Runoff Parameters

Catchment Input
MUSIC catchments have been assigned as per Table 3 in Section 4.1.3 of this document breaking up surfaces as the following:

- Top level of carpark roof area assigned as a Roof catchment node.
- Top level of carpark driveway area assigned as a Sealedroad catchment node.
- Ground level driveway area assigned as a Sealedroad catchment node.
- Ground level plaza entry area assigned as a Mixed catchment node.
- Ground level vegetated area assigned as a revegetated land node.

Pollutant Loading
Pollutant loading values have been assigned in accordance with WaterByDesigns Music Modelling Guidelines (2018).

Treatment System Parameters
For treatment of stormwater it is proposed to install a detention tank, one of Oceans Protect's Jellyfish filters and to fit Oceans Protect's Ocean Guard litter baskets into stormwater pits (x2). The detention tank and jellyfish filter will treat the top level of carpark with the ground level been treated via the litter baskets. To ensure appropriate treatment parameters have been used for modelling purposes, the proposed jellyfish filter and litter basket MUSIC nodes have been obtained from Oceans Protect and the detention tank parameters are as per the DRAINS assessment determined storage.

### 4.3.3 Stormwater Quality Results

Figure 13 below presents the MUSIC layout inclusive of the assessment results.

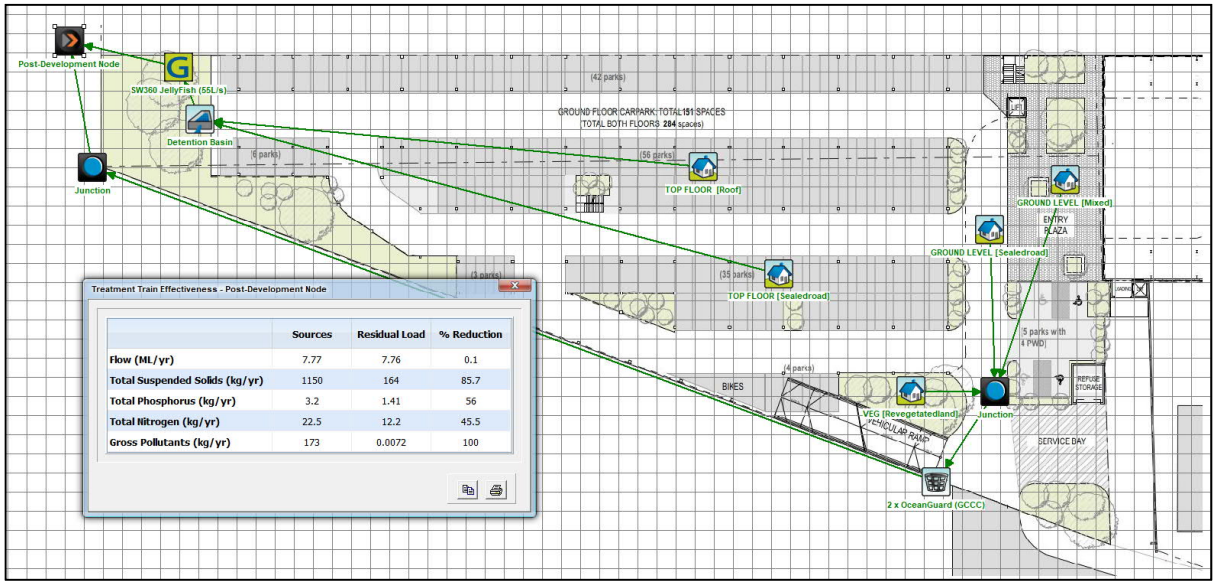


Figure 13- MUSIC Results

The assessment demonstrated that the following stormwater infrastructure is appropriate to meet BSC's quality objectives:

- 1 x 60m$^3$ detention tank.
- 1 x Ocean Protect's 55l/s jellyfish filter (model JF-2250-10-2) or approved equivalent.
- 2 x Ocean Protect's Ocean Guard litter baskets or approved equivalent.

It should be noted that in addition to the infrastructure above, a sump and pump system including a treatment chamber shall be included for the covered area. The main function of this chamber will be to remove any oil that may accumulate on the ground floor area. This has been excluded from the MUSIC model and shall be incorporated into the detailed design phase.

Refer to Appendix C for a preliminary site layout incorporating the proposed stormwater treatment devices.

## 4.4 Sediment and Erosion Control

The aim of the following controls is to achieve a no worsening impact of stormwater quality and achieve no reduction in the environmental values of the downstream receiving waters caused by construction activities on the subject site during the construction of the development.

Stormwater quality during construction activities shall be achieved through the implementation of Erosion and Sediment Controls in accordance with the requirements of the Landcom 'Soils and Construction Volume 1 – Managing Urban Stormwater: Soils and Construction' (i.e. Blue Book). The measures are to be implemented before the commencement of any subdivision works and should be inspected regularly, and after heavy storm events to ensure they are achieving their desired purpose. The measures to be used on site include:

- Hessian fence is to be installed around the proposed property boundaries.
- Minimise the number of site access points and provide stabilised site access.
- Stabilised site access to be provided at access to shake down all vehicles entering and leaving the site, minimising the transport of sediment off-site. All vehicles must use the designated site access to enter or leave the site.
- Installation of downstream sediment barriers prior to commencement of any works.
- Sediment fences are to be installed downstream of works and exposed soils to ensure contaminated run-off is filtered and sediment captured before it can make its way into the downstream receiving environment.
- Turf Strips where required.
- Cut-off drains are to be formed at the top of batter slopes (Cut-off drains will allow the discharge of water to be conveyed and directed to the most desirable points of discharge to ensure suitable sediment treatment is achieved).
- External catchment is to be conveyed around the area of works and discharged at appropriate location.
- Stabilise and protect earthwork areas immediately once earthwork profiles are achieved.
- Stockpile materials in protected locations away from overland flow paths and protected by sediment fence boundaries.
- Stockpile locations will be located in an elevated, level area nominally 5m away from any water body or channel. Upslope protection measures (i.e. sandbags or equal) are to be used to divert run-off in the event of rain, and sediment fences are to be installed downstream of any erodible stockpile. At the end of each day or in the event of rain or high winds, stockpiles are to be covered and secured. Appropriate locations of stockpiles are to be determined by the site manager at the time of construction.
- Sediment fence to be used on low side of any areas of soil disturbance (e.g. road formation, house pad, soil stockpiles, etc).
- Rock filter dams and gypsum filled bags, flock blocks or equivalent placed on low side of check dam spillway, are to be provided in key locations to treat stormwater run-off from the works area.
- Site is to be watered during the construction phase to minimise the generation of dust onsite.
- When wind speeds reach 35km/h, all dust generating construction activities must cease onsite.

The following inspection program shall be established by the Site Contractor and monthly Check Sheet reports shall be submitted to the Supervising Engineer:

- Daily inspection of the site Stabilised Access point and amendments as necessary.
- Formal weekly inspection of erosion and sediment controls.
- Inspections after 10mm rainfall events in 24 hours.
- Testing runoff after significant rainfall events to ensure a max. discharge of 50mg/L suspended solids.

In addition to the inspection details, the following information will be recorded:

- List frequency and method of removal of material from stabilised access point.
- Volume of material removed from in/around sediment controls.
- Location of site where materials are disposed.
- Any repairs/additions as appropriate.

# 5 Conclusion/Recommendations

This Stormwater Management Plan (SWMP) has been prepared in support of the development located at 156-158 Jonson St Byron Bay, NSW and falls within the BSC Local Government Area. Planit was engaged by 156 Jonson St Pty Ltd to assess and report on the stormwater management associated with this development.

Planit has designed this project in accordance with BSC standards (including Northern River Local Government Development design/construction manuals and standard drawings), Queensland Urban Drainage Manual (QUDM), WaterByDesigns MUSIC Modelling Guidelines (2018), and the 'Blue Book'. Accordingly, Planit recommends the following:

- Provide a 60m3 detention tank with a HED system for peak flow mitigation.
- Provide Ocean Protect's Jellyfish filter and 2 x Ocean Guards (or approved equivalent) for treatment.
- Take appropriate sediment and erosion control measures in accordance with the 'Blue Book'.

Based on the assessment undertaken, it is believed that the proposed development can readily be serviced in a sustainable way.

# Appendix A

Site Survey and Layout Plans

LEGEND

- MAJOR CONTOUR 1.0m
- MINOR CONTOUR 0.2m
- LOT BOUNDARIES
- CONCRETE
- RETAINING WALL
- DECK
- BUILDING FOOTPRINT
- EDGE OF FORMATION
- KERB BACK
- KERB INVERT
- KERB LIP
- FENCE
- TOP OF BANK
- BANK TOE
- DRAIN INVERT LINE
- UNDERGROUND TELSTRA
- OVERHEAD POWER
- WM - WATER METER
- EL - ELECTRICAL PILLAR BOX
- SEWER MANHOLE FH - FIRE HYDRANT
- STOP VALVE PP - ELECTRICAL POLE
- DENOTES A TREE. (X,Y,Z)
- SURFACE LEVEL

AREA CURRENTLY UNDER CONSTRUCTION

JONSON - BROWNING STREET

MGA DP1256365

MONITORING WELL

FUEL BOWSER

SITE CONTAINER

SITE CONTAINER

CONTAINER EXTENSION

WATER TANK

PATIO

'WICKED WEASEL' BYRON BAY

LOT 2 DP588653

'MITRE 10' BYRON BAY HARDWARE STORE

AREA CURRENTLY UNDER CONSTRUCTION

LOT 4729 DP1228104

LOT 9 DP818197

RAILWAY

OLD LINE

W/C BUILDING

TR 400 4 6 MANGO

'REPCO' BYRON BAY AUTO PARTS STORE

CONCRETE PAD

MONITORING WELL

'GOODYEAR AUTOCARE' BYRON BAY TIRE SHOP

DBYD

DBYD

LID LEVEL 3.62 IL: 1.21 ø300 VC

PP

STAY-O

DISCLAIMER

BOUNDARIES HAVE BEEN INVESTIGATED (NOT MARKED) IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYING & SPATIAL INFORMATION ACT, 2017 AND ARE BASED ON THE LATEST SURVEY RECORDS AVAILABLE FROM LAND REGISTRY AT THE TIME OF SURVEY. NO RESPONSIBILITY CAN BE TAKEN FOR SURVEYS AT A LATER DATE WHICH MAY VARY BOUNDARY DIMENSIONS. ANY EASEMENTS WHETHER REGISTERED OR IMPLIED HAVE NOT BEEN INVESTIGATED.

THE POSITIONAL ACCURACY OF ANY CRITICAL FEATURE REQUIRES CONFIRMATION PRIOR TO ITS USE IN DESIGN OR CONSTRUCTION.

UNDERGROUND SERVICES HAVE NOT BEEN INVESTIGATED. CONSULT WITH "DIAL BEFORE YOU DIG" PRIOR TO ANY EXCAVATION WORKS.


BYRON BAY SURVEYING

BYRON BAY SURVEYING PTY LTD
REGISTERED LAND SURVEYING

Suffolk Park NSW 2481 Tel: 0407 345 099
Alstonville NSW 2477 Tel: 0431 348 590
Info@ByronBaySurveying.com.au
www.ByronBaySurveying.com.au



| REV | DATE | DESCRIPTION |
|---|---|---|
| 1 | 30/07/2020 | ORIGINAL ISSUE |
| 2 | 04/08/2020 | BLD WALL AMENDED |

| | |
|---|---|
| PROJECT | BYR041 |
| SURVEYOR | LF & WN |
| SURVEY DATE | 20/07/2020 |
| FIELD BOOK ID | TSC3#1 |
| PLAN BY | LF |
| APPROVED BY | WN |

| | |
|---|---|
| MGA GDA2020 | HZ DATUM |
| DP1256365 | ORIGIN |
| AHD | VT DATUM |
| PM30252 | ORIGIN |
| 3.393 | LEVEL |
| 07/07/2020 | SCIMS |

0 1 2 5m

1:150 - A1

IMPORTANT NOTICE:
THIS PLAN MAY HAVE BEEN CHANGED DURING PRINTING OR REFORMATTING. THE SCALE SHOULD THEREFORE BE VERIFIED PRIOR TO USE. ANY DIMENSIONS SHOWN ON THIS PLAN OVERRULE SCALING.

## PLAN OF DETAIL SURVEY

LOT 51 IN DP844054
158 JONSON ST
BYRON BAY 2481

CLIENT: PLANIT CONSULTING
DWG No: BYR041.DWG
SH: 2 OF 4

LOT 9
DP818197

LOT 2
DP588653

LOT 4729
DP1228104

LOT 51
DP844054

SP78115

MGA
DP1256365

WIRE FENCE ATOP CONCRETE BLOCK WALL

PUMP

IL: 2.66
(ø350 RCP)

Ø350
RCP

IL: 2.58
(ø350 RCP)

WIRE

MESH

STAY

PP

CONCRETE
PAD

FENCE

LINE

RAILWAY

OLD

32.06 m

41.39 m

3.24 m

POST

& WIRE

PALING

TIMBER

TR

## LEGEND

- MAJOR CONTOUR 1.0m
- MINOR CONTOUR 0.2m
- LOT BOUNDARIES
- CONCRETE
- RETAINING WALL
- DECK
- BUILDING FOOTPRINT
- EDGE OF FORMATION
- KERB BACK
- KERB INVERT
- KERB LIP
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- BANK TOE
- DRAIN INVERT LINE
- UNDERGROUND TELSTRA
- OVERHEAD POWER
- WATER METER
- ELECTRICAL PILLAR BOX
- SEWER MANHOLE
- FIRE HYDRANT
- STOP VALVE
- ELECTRICAL POLE
- DENOTES A TREE. (X,Y,Z)
- SURFACE LEVEL

DISCLAIMER

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BYRON BAY SURVEYING

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REGISTERED LAND SURVEYING

Suffolk Park NSW 2481 Tel: 0407 345 099
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Info@ByronBaySurveying.com.au
www.ByronBaySurveying.com.au



| REV | DATE | DESCRIPTION |
|---|---|---|
| 1 | 30/07/2020 | ORIGINAL ISSUE |
| 2 | 04/08/2020 | BLD WALL AMENDED |

| | |
|---|---|
| PROJECT | BYR041 |
| SURVEYOR | LF & WN |
| SURVEY DATE | 20/07/2020 |
| FIELD BOOK ID | TSC3#1 |
| PLAN BY | LF |
| APPROVED BY | WN |

| | |
|---|---|
| MGA GDA2020 | HZ DATUM |
| DP1256365 | ORIGIN |
| AHD | VT DATUM |
| PM30252 | ORIGIN |
| 3.393 | LEVEL |
| 07/07/2020 | SCIMS |

0 1 2 5m
1:150 - A1

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# PLAN OF DETAIL SURVEY

LOT 51 IN DP844054
158 JONSON ST
BYRON BAY 2481

CLIENT: PLANIT CONSULTING
DWG No: BYR041.DWG
SH: 3 OF 4

# 156 JONSON STREET - BYRON BAY

# 10/9/20


01 LOCATION PLAN
1:1000

HARLEY GRAHAM ARCHITECTS
LVL 1/144 JOHNSON STREET BYRON BAY | PO BOX 1285 NSW 2481
F: 02 66809820 | T: 02 66809690 | E: office@harleygraham.com
ABN: 85158246003 NSW 7892



| Issue Date | Issue ID | Issue Name |
|---|---|---|
| DRAFT DA - 10/9/20 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| 156 JONSON ST (JOB NAME) | 156 Jonson St, Byron Bay (ADDRESS) | NORTH | SHEET TITLE: LOCATION PLAN | | | |
| HGA194 (JOB NO.) | SW (DRAWN) | HG (APPROVED) | (SCALE) | PAPER: A3 | DWG NO.: CP.01 | STATUS: NOT FOR CONSTRUCTION | REV |

# Appendix B

Dial Before You Dig

# Job No 19844123

Phone: 1100
**www.1100.com.au**

## Caller Details

| | | | | | |
|---|---|---|---|---|---|
| **Contact:** | Mr Brendan Thomson | **Caller Id:** | 1866918 | **Phone:** | 02 6670 1301 |
| **Company:** | Planit Engineering | **Mobile:** | Not Supplied | **Fax:** | Not Supplied |
| **Address:** | PO Box 1623<br>Kingscliff NSW 2487 | **Email:** | brendant@planitconsulting.com.au | | |

## Dig Site and Enquiry Details

**WARNING:** The map below only displays the location of the proposed dig site and does not display any asset owners' pipe or cables. The area highlighted has been used only to identify the participating asset owners, who will send information to you directly.


**User Reference:** J6799
**Working on Behalf of:** Byron Shire Council

| Enquiry Date: | Start Date: | End Date: |
|---|---|---|
| 08/07/2020 | 09/07/2020 | 10/07/2020 |

**Address:**
156 Jonson Street
Byron Bay NSW 2481

| Job Purpose: | Onsite Activity: |
|---|---|
| Excavation | Vertical Boring |
| **Location of Workplace:** | **Location in Road:** |
| Both | CarriageWay,Footpath,Nature Strip |

- Check the location of the dig site is correct. If not submit a new enquiry.
- If the scope of works change, or plan validity dates expire, resubmit your enquiry.
- Do NOT dig without plans. Safe excavation is your responsibility. If you do not understand the plans or how to proceed safely, please contact the relevant asset owners.

**Notes/Description of Works:**

## Your Responsibilities and Duty of Care

- The lodgement of an enquiry does not authorise the project to commence. You must obtain all necessary information from any and all likely impacted asset owners prior to excavation.
- If plans are not received within 2 working days, contact the asset owners directly & quote their Sequence No.
- ALWAYS perform an onsite inspection for the presence of assets. Should you require an onsite location, contact the asset owners directly. Please remember, plans do not detail the exact location of assets.
- Pothole to establish the exact location of all underground assets using a hand shovel, before using heavy machinery.
- Ensure you adhere to any State legislative requirements regarding Duty of Care and safe digging requirements.
- If you damage an underground asset you MUST advise the asset owner immediately.
- By using this service, you agree to Privacy Policy and the terms and disclaimers set out at **www.1100.com.au**
- **For more information on safe excavation practices, visit www.1100.com.au**

## Asset Owner Details

The assets owners listed below have been requested to contact you with information about their asset locations within 2 working days.
Additional time should be allowed for information issued by post. It is **your responsibility** to identify the presence of any underground assets in and around your proposed dig site. Please be aware, that not all asset owners are registered with the Dial Before You Dig service, so it is **your responsibility** to identify and contact any asset owners not listed here directly.
** Asset owners highlighted by asterisks ** require that you visit their offices to collect plans.
# Asset owners highlighted with a hash require that you call them to discuss your enquiry or to obtain plans.

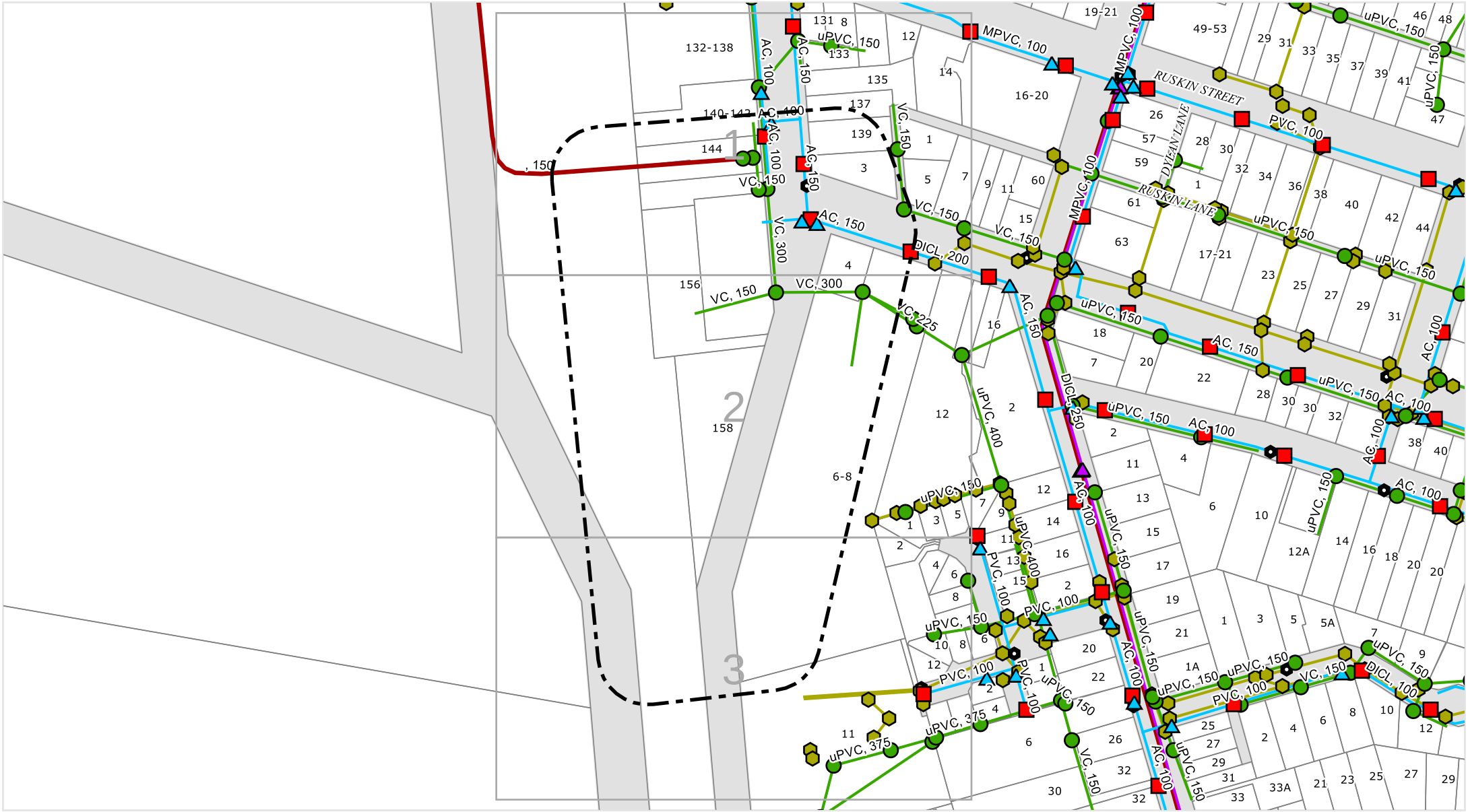
| Seq. No. | Authority Name | Phone | Status |
|---|---|---|---|
| 99470202 | Byron Shire Council | 0266267000 | NOTIFIED |
| 99470203 | Essential Energy | 132391 | NOTIFIED |
| 99470205 | NBN Co, NswAct | 1800626329 | NOTIFIED |
| 99470204 | Telstra NSW, North | 1800653935 | NOTIFIED |

END OF UTILITIES LIST

**Sequence No:** 99470202
**Job No:** 19844123
**Location:** 156 Jonson Street, Byron Bay, NSW 2481

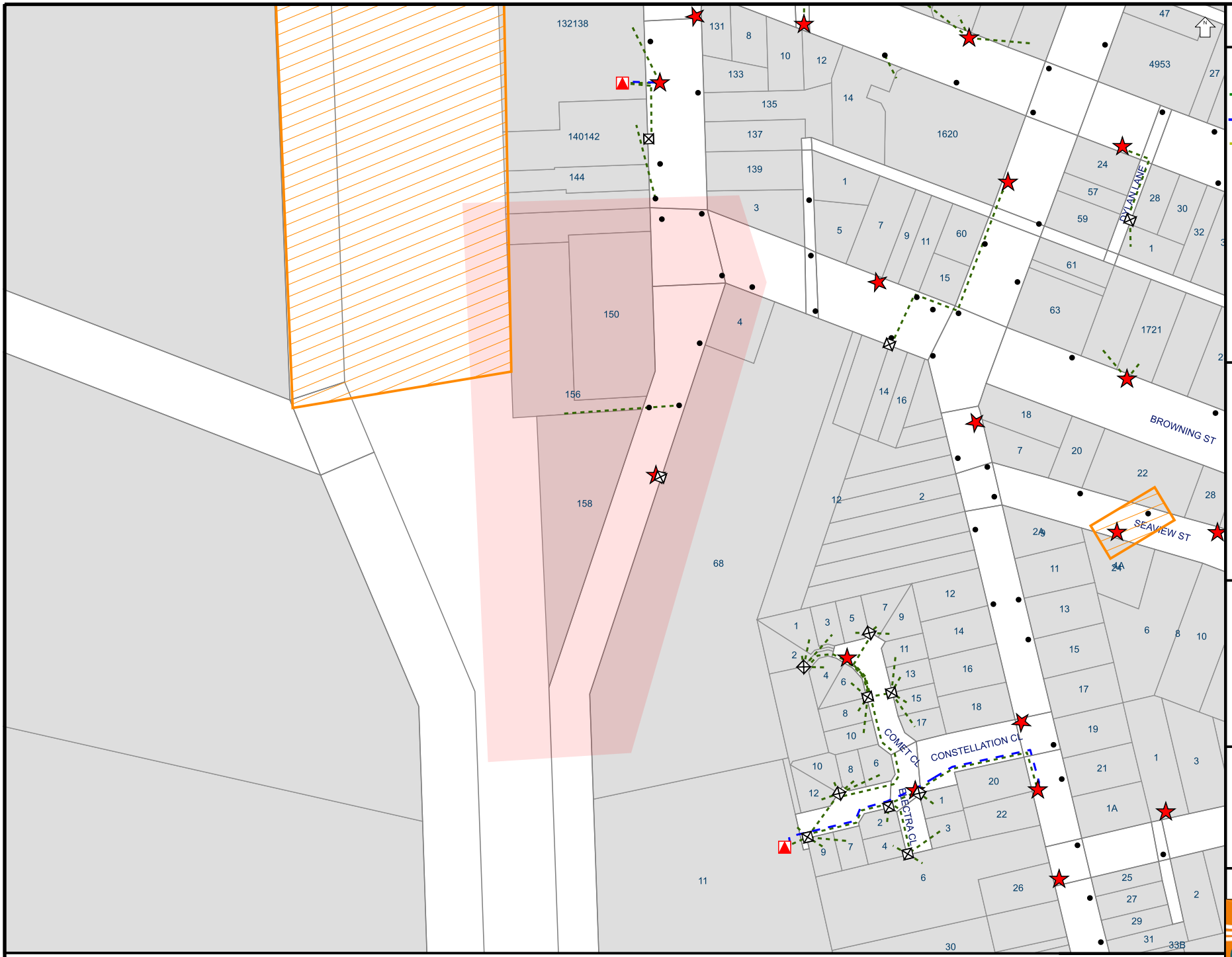
Scale: 1:3075 (A4)

DIAL BEFORE YOU DIG www.1100.com.au
The Essential First Step.




N

Water Main Drinking
Water Main Abandoned
Water Meter Pipe
Water Valves
Water Hydrants
Water Main Recycled
Water Valves Recycled
Wastewater Gravity Main
Wastewater Manhole
Wastewater Rising Main
Wastewater Valve
Wastewater Vacuum Main
Wastewater Vacuum Valves
Wastewater Vacuum Pods
Wastewater Pressure Main
Wastewater Pressure Valve
Stormwater Main
Stormwater Pit
Stormwater Culvert
SCIMS Survey Control Point
Incomplete Data
Property Boundary
Road Reserve
Rivers
No Digging Permitted




Overhead wires not shown
LOOK UP & LIVE!

## LEGEND

- LV Underground Cable
- HV Underground Cable
- Underground Pipe
- Underground Earth or Wires
- Ground Substation
- Pole
- Cubicle
- Pit
- Area of Interest

**Critical Assets**

Contact Essential Energy on 13 23 91

- Zone Substation
- Underground Cable
- Underground Fibre

**Proposed Works**

- Area of proposed works

Proposed assets are shown as orange symbols

THE INFORMATION ON THIS MAP MAY NOT BE ACCURATE. If details are incorrect, please notify Essential Energy on 13 23 91 (or fax 1800 354 636)

ISSUE DATE: 08/07/2020

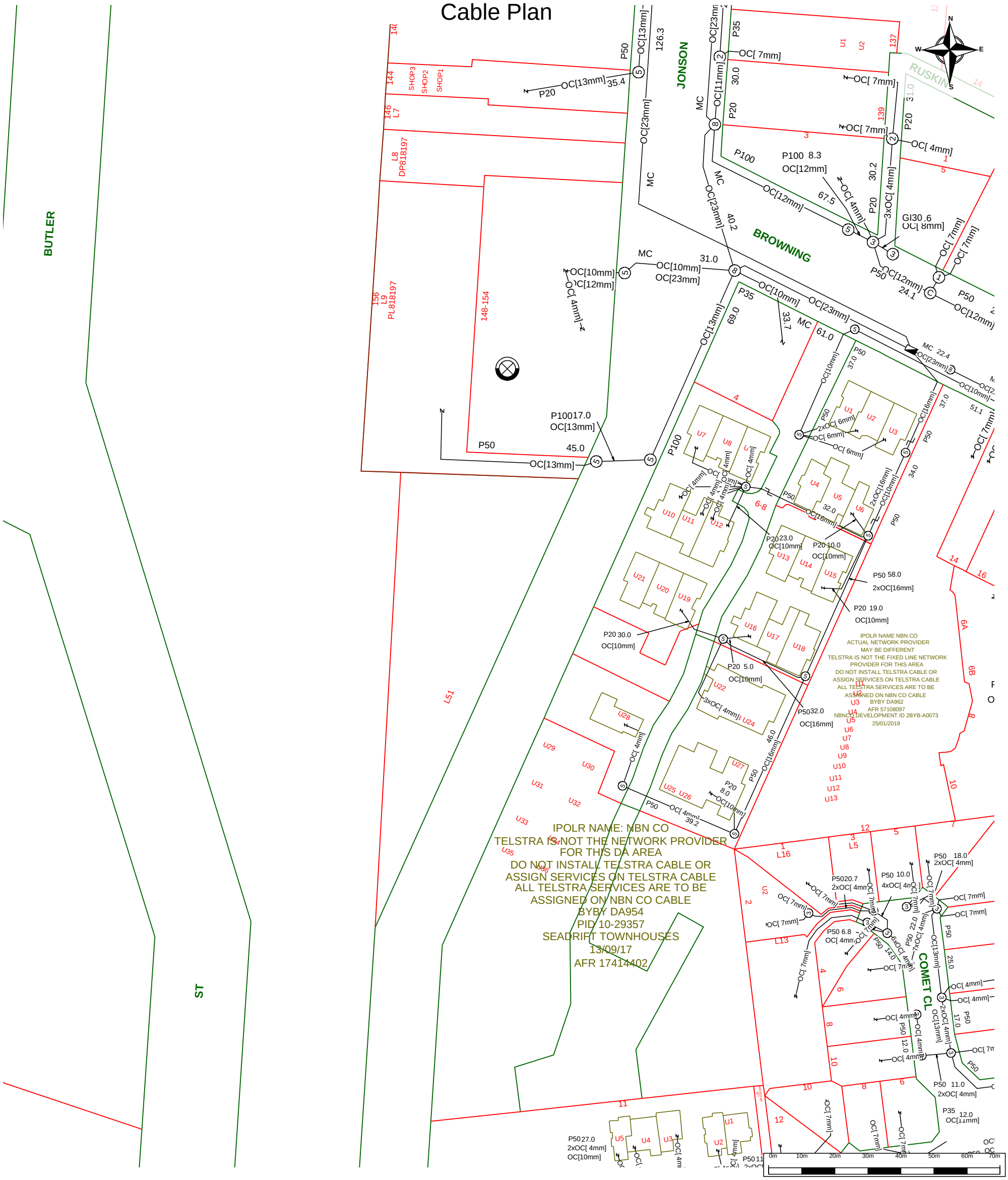
You must resubmit your request if you have not started work within 4 weeks of the 'Issue Date' above

A4 | SCALE: 1:2612

Job Number: 19844123 Sequence number: 99470203 Job location: 156 Jonson Street, Byron Bay Map Centre: 153° 36' 46.5", -28° 39' 5.1"

essential energy

# Cable Plan




For all Telstra DBYD plan enquiries -
email - Telstra.Plans@team.telstra.com
For urgent onsite contact only - ph 1800 653 935 (bus hrs)

TELSTRA CORPORATION LIMITED A.C.N. 051 775 556

Generated On 08/07/2020 10:00:20

Sequence Number: 99470204

CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.

The above plan must be viewed in conjunction with the Mains Cable Plan on the following page

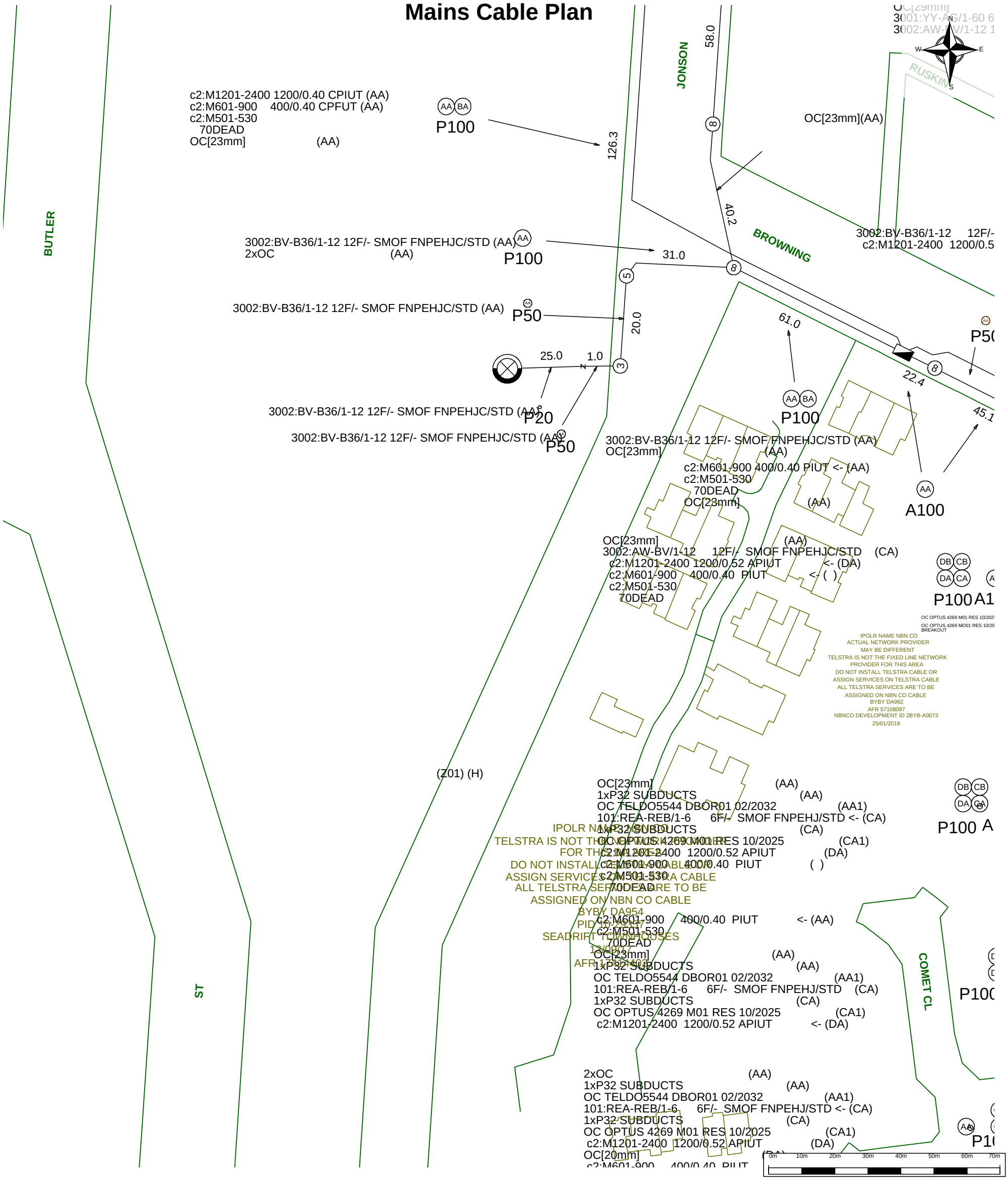
WARNING - Due to the nature of Telstra underground plant and the age of some cables and records, it is impossible to ascertain the precise location of all Telstra plant from Telstra's plans. The accuracy and/or completeness of the information supplied can not be guaranteed as property boundaries, depths and other natural landscape features may change over time, and accordingly the plans are indicative only. Telstra does not warrant or hold out that its plans are accurate and accepts no responsibility for any inaccuracy shown on the plans.

It is your responsibility to locate Telstra's underground plant by careful hand pot-holing prior to any excavation in the vicinity and to exercise due care during that excavation.

Please read and understand the information supplied in the duty of care statement attached with the Telstra plans. TELSTRA WILL SEEK COMPENSATION FOR LOSS CAUSED BY DAMAGE TO ITS PLANT.

Telstra plans and information supplied are valid for 60 days from the date of issue. If this timeframe has elapsed, please reapply for plans.

# Mains Cable Plan




Telstra

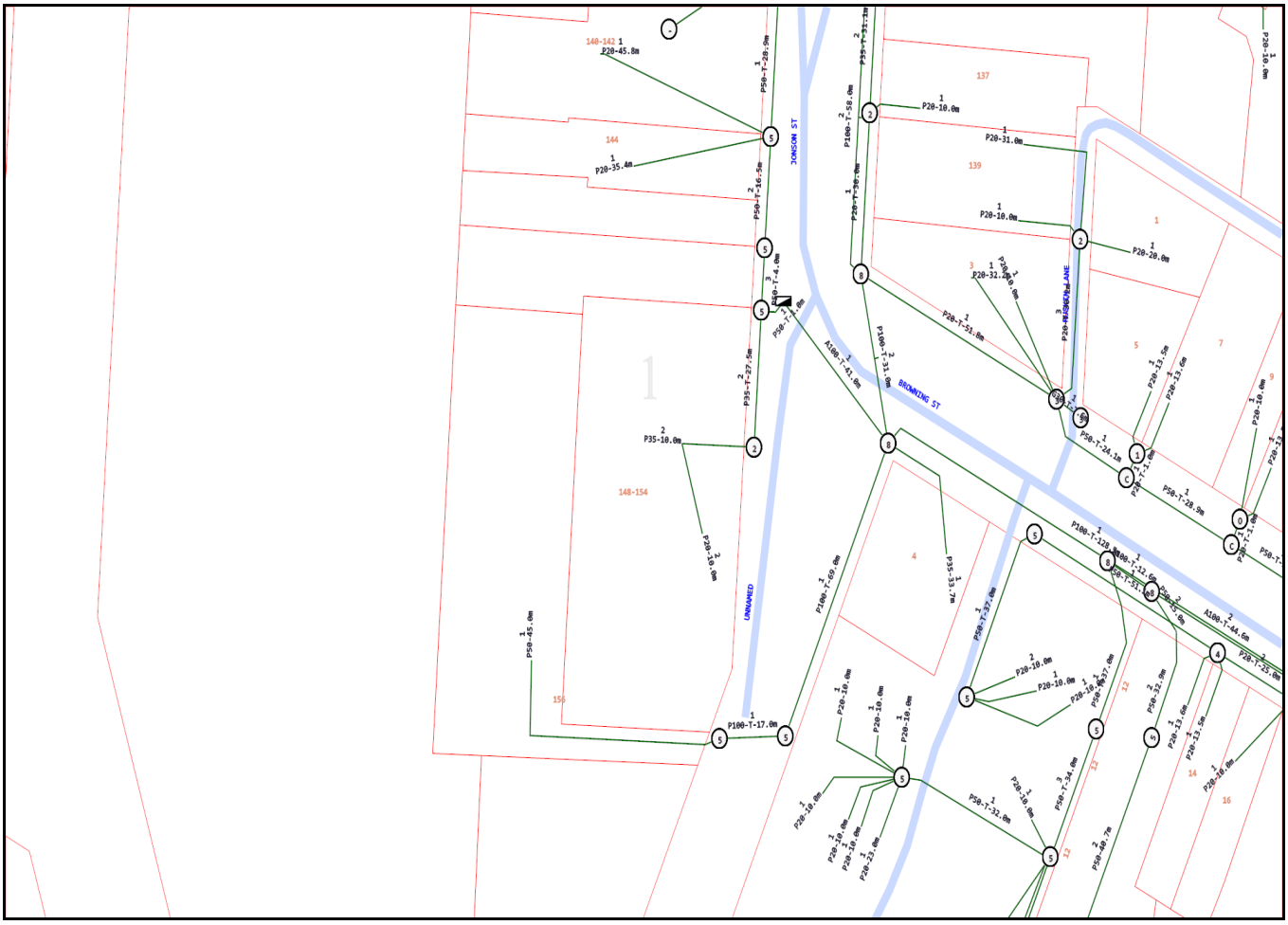
For all Telstra DBYD plan enquiries -
email - Telstra.Plans@team.telstra.com
For urgent onsite contact only - ph 1800 653 935 (bus hrs)

TELSTRA CORPORATION LIMITED A.C.N. 051 775 556

Generated On 08/07/2020 10:00:21

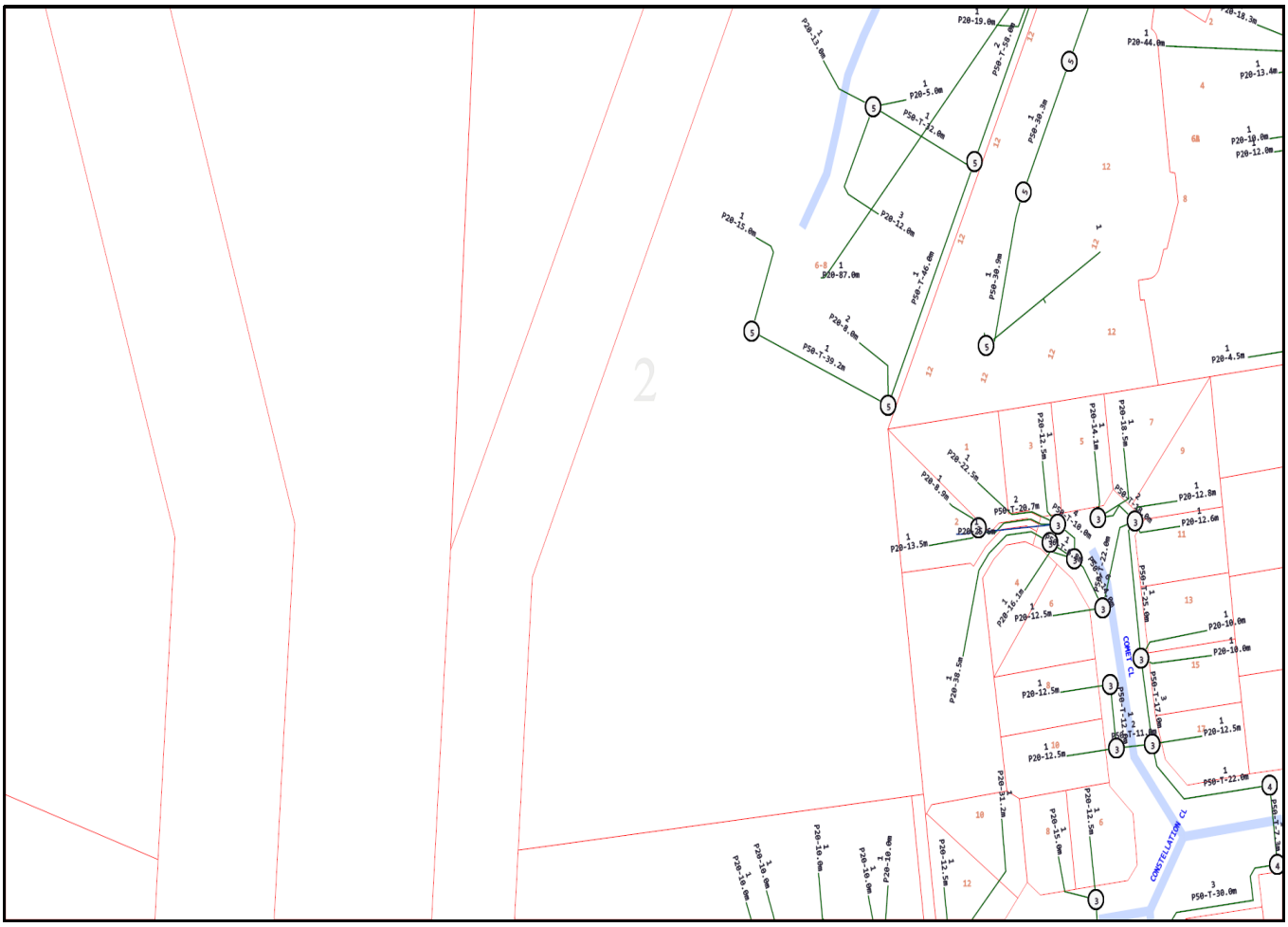
Sequence Number: 99470204

CAUTION: Fibre optic and/ or major network present in plot area. Please read the Duty of Care and contact Telstra Plan Services should you require any assistance.






Email info@nbn.com.au Web nbn.com.au

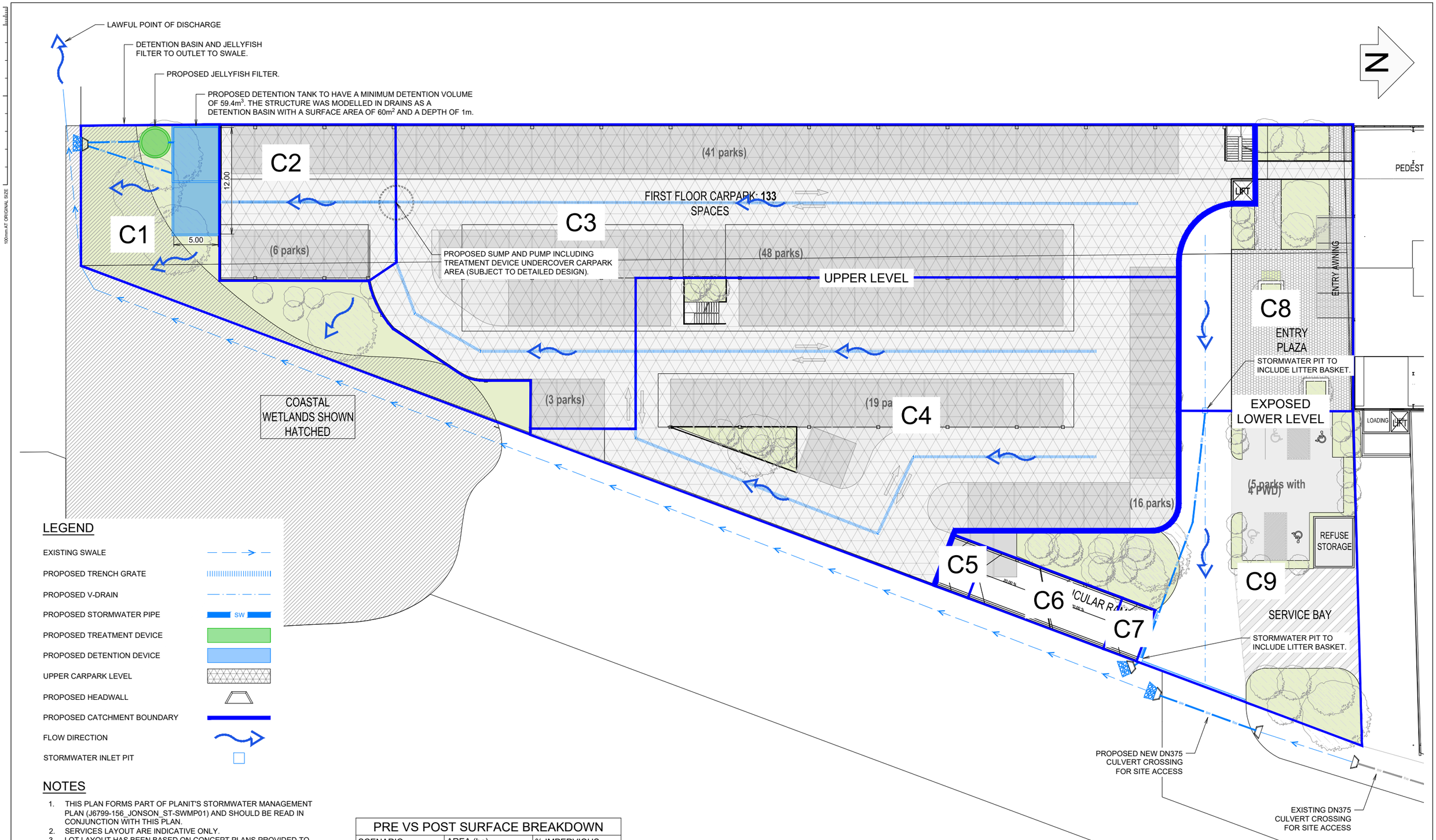



## Emergency Contacts

You must immediately report any damage to **nbn™** network that you are/become aware of. Notification may be by telephone - 1800 626 329.

# Appendix C

Stormwater Layout Plan




## LEGEND

- EXISTING SWALE
- PROPOSED TRENCH GRATE
- PROPOSED V-DRAIN
- PROPOSED STORMWATER PIPE (SW)
- PROPOSED TREATMENT DEVICE
- PROPOSED DETENTION DEVICE
- UPPER CARPARK LEVEL
- PROPOSED HEADWALL
- PROPOSED CATCHMENT BOUNDARY
- FLOW DIRECTION
- STORMWATER INLET PIT

## NOTES

1. THIS PLAN FORMS PART OF PLANIT'S STORMWATER MANAGEMENT PLAN (J6799-156_JONSON_ST-SWMP01) AND SHOULD BE READ IN CONJUNCTION WITH THIS PLAN.
2. SERVICES LAYOUT ARE INDICATIVE ONLY.
3. LOT LAYOUT HAS BEEN BASED ON CONCEPT PLANS PROVIDED TO PLANIT.
4. ALL MEASUREMENTS ARE IN METRES UNLESS OTHERWISE NOTED
5. STORMWATER MODELLING (MUSIC AND DRAINS) HAS BEEN COMPLETED FOR THE PROPOSED DESIGN TO DETERMINE THE APPRORPIATE SIZING OF STORMWATER CONVEYANCE, DETENTION, AND TREATMENT INFRASTRUCTURE.

| PRE VS POST SURFACE BREAKDOWN | | |
|---|---|---|
| SCENARIO | AREA (ha) | % IMPERVIOUS |
| PRE DEVELOPMENT | 0.617 | 0% |
| POST DEVELOPMENT | 0.617 | 86% |

## STORMWATER LAYOUT PLAN

1:200 @ A1

**PRELIMINARY ISSUE**
NOT FOR CONSTRUCTION

| REV | DESCRIPTION | DATE | DRAWN | DESIGN | CHECK | APPROVED |
|---|---|---|---|---|---|---|
| A | ISSUED FOR INFOMRATION | 18/09/20 | JB | JB | NVO | NVO |

SCALES: 0 2 4 8 12
Full Size 1:200 ; Half Size 1:400
Scale (m)
DO NOT SCALE FROM DRAWING



DRAWN BY: J. BENTLEY
DESIGN BY: J. BENTLEY
APPROVED BY:
DATE:
THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION UNLESS SIGNED AS APPROVED

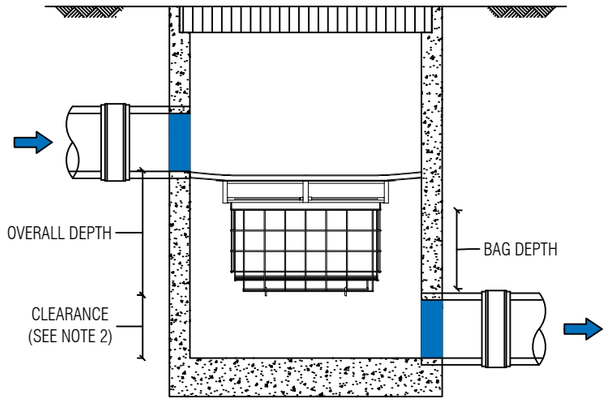
PLANIT CONSULTING
SUITE 9A, 80-84 BALLINA STREET
PO BOX 161
LENNOX HEAD NSW 2478
TELEPHONE: 02 6687 4666
ABN: 20 099 261 711
EMAIL: administration@planitconsulting.com.au

CLIENT: 156 JONSON ST PTY LTD
PROJECT: 156-158 JONSON ST
DRAWING TITLE: STORMWATER LAYOUT PLAN
LOCAL GOVERNMENT AUTHORITY: BYRON SHIRE COUNCIL
ORIGINAL SIZE: A1
PLANIT JOB No.: J6799
DRAWING No.: SW0001
REV: A

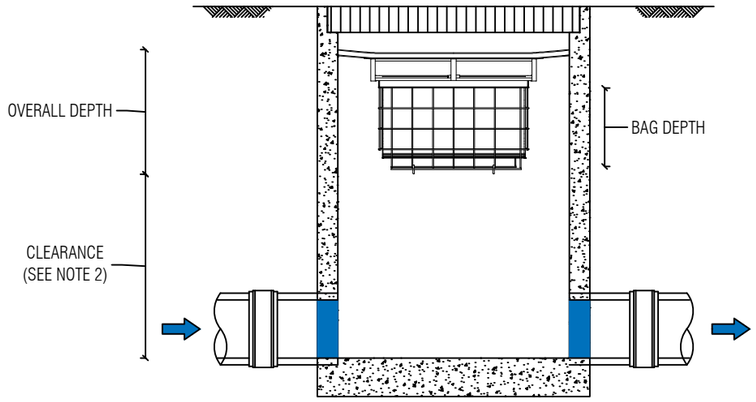
CAD FILE: I:\J6799 - 156 JONSON STREET, BYRON BAY\6 - ENGINEERING\6.3 DESIGN\6.3.2 DRAINS\BACKGROUND CAD\FOR STORMWATER REPORT SKETCHES_01.DWG PLOTTED BY: JAKE.BENTLEY PLOT DATE: 18/09/2020 10:59:00 AM

# Appendix D

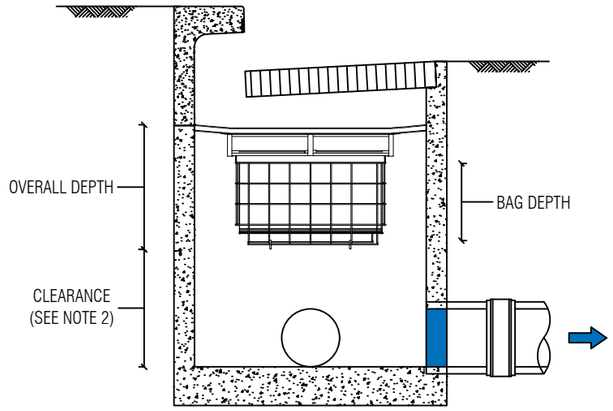
Proprietary Stormwater Infrastructure



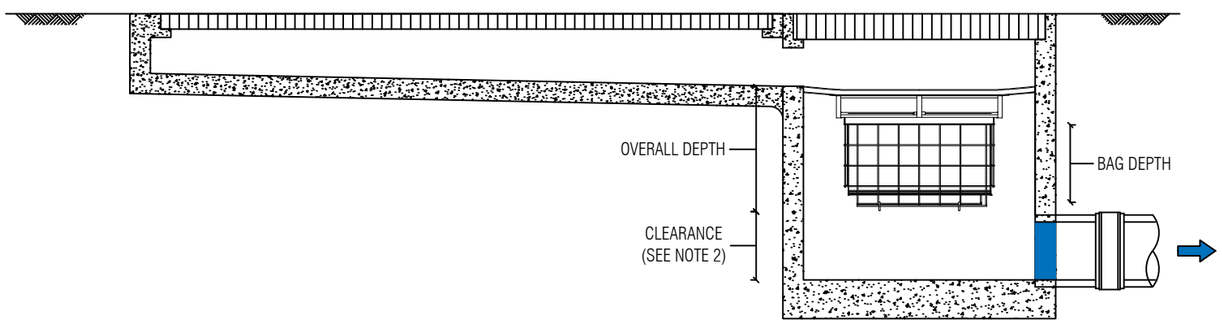

PIPE FLOW CONFIGURATION




SURFACE FLOW CONFIGURATION




SURFACE FLOW CONFIGURATION

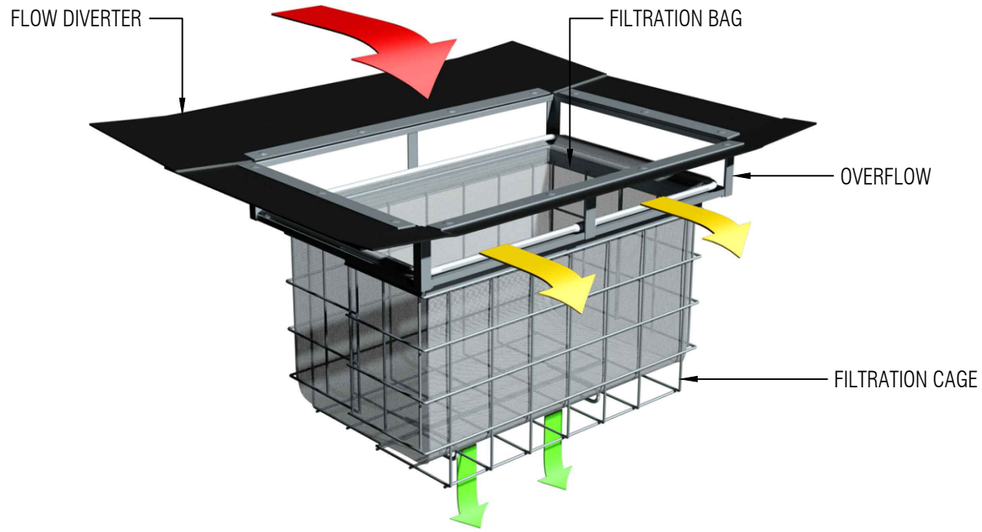



GRATED STRIP DRAIN CONFIGURATION

| PLAN ID | MAXIMUM PIT PLAN DIMENSIONS |
|---|---|
| S | 450mm x 450mm |
| M | 600mm x 600mm |
| L | 900mm x 900mm |
| XL | 1200mm x 1200mm |

| DEPTH ID | BAG DEPTH | OVERALL DEPTH |
|---|---|---|
| 1 | 170 | 270 |
| 2 | 300 | 450 |
| 3 | 600 | 700 |

| | | DEPTH ID | | |
|---|---|---|---|---|
| | | 1 | 2 | 3 |
| PLAN ID | S | ■ | | |
| | M | ■ | ■ | |
| | L | ■ | ■ | ■ |
| | XL | ■ | ■ | ■ |




GENERAL NOTES

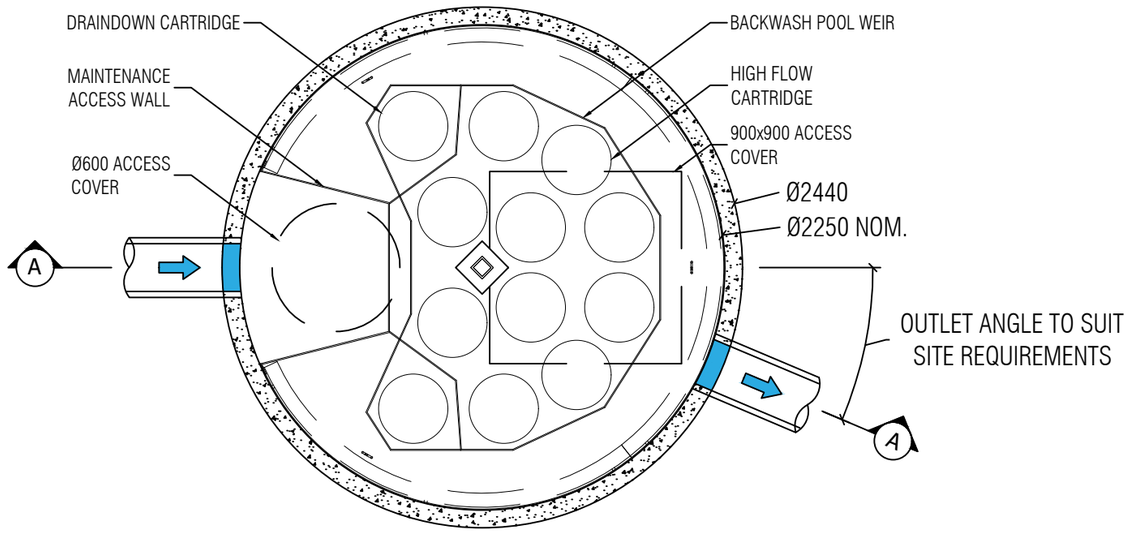
1. THE MINIMUM CLEARANCE DEPENDS ON THE CONFIGURATION (SEE NOTE 2) AND THE LOCAL COUNCIL REQUIREMENTS.
2. CLEARANCE FOR ANY PIT WITHOUT AN INLET PIPE (ONLY USED FOR SURFACE FLOW) CAN BE AS LOW AS 50mm. FOR OTHER PITS, THE RECOMMENDED CLEARANCE SHOULD BE GREATER OR EQUAL TO THE PIPE OBVERT SO AS NOT TO INHIBIT HYDRAULIC CAPACITY.
3. OCEAN PROTECT PROVIDES TWO FILTRATION BAG TYPES:- 200 MICRON BAGS FOR HIGHER WATER QUALITY FILTERING AND A COARSE BAG FOR TARGETING GROSS POLLUTANTS.
4. DRAWINGS NOT TO SCALE.

OCEAN PROTECT
PHONE: 1300 354 722
www.oceanprotect.com.au

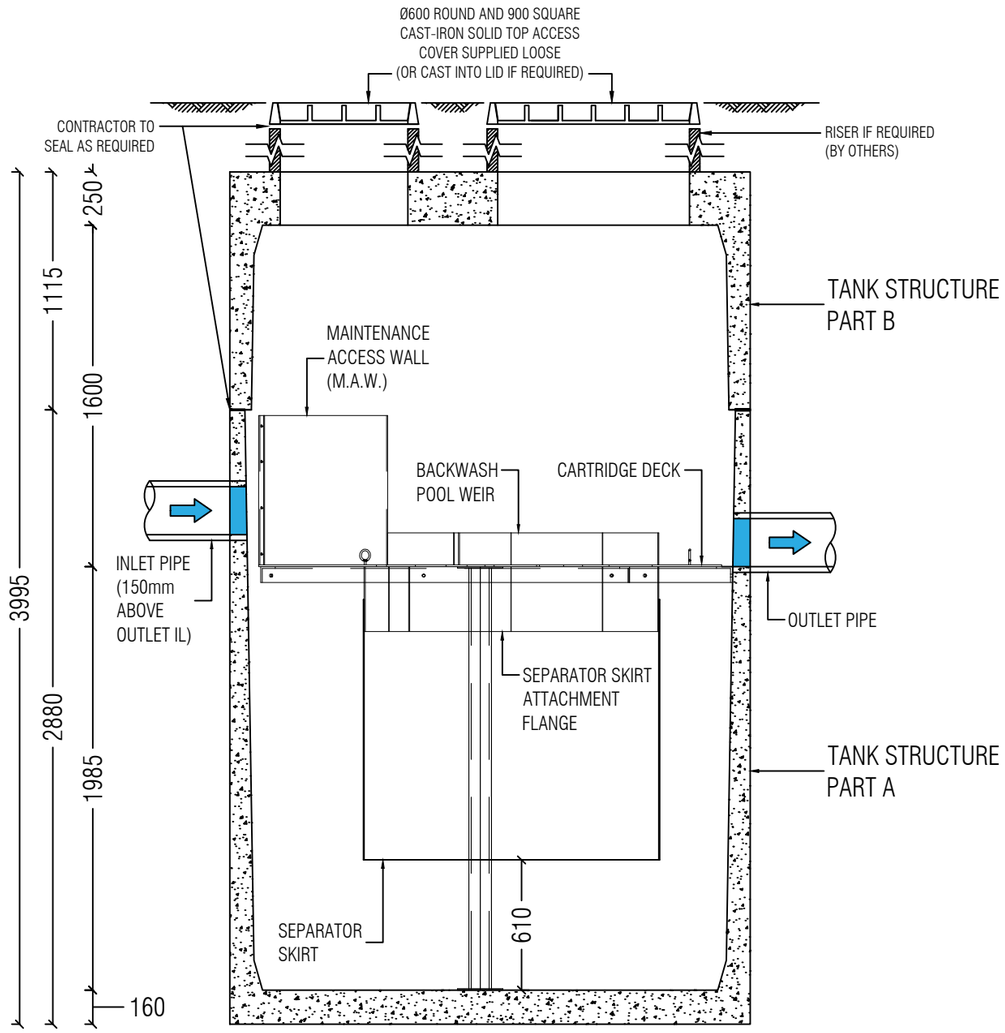
OCEAN PROTECT
# OCEANGUARD
## TYPCIAL ARRANGEMENTS
SPECIFICATION DRAWING

*LAST MODIFIED: 15-10-19*

NOT FOR CONSTRUCTION




**JELLYFISH PLAN**




**JELLYFISH SECTION**

# JELLYFISH DESIGN TABLE

**JELLYFISH TREATMENT FLOW IS A FUNCTION OF THE NUMBER OF CARTRIDGES AND THE DEVICE TOTAL HEAD DIFFERENTIAL. IF THE PIPE FLOW EXCEEDS THE TREATMENT FLOW THEN AN UPSTREAM BYPASS STRUCTURE IS REQUIRED.**

| | | |
|---|---|---|
| REQUIRED DEVICE TOTAL HEAD DIFFERENTIAL [mm] | 460 | 230 |
| CARTRIDGE FLOW RATE FOR HIGH-FLOW / DRAINDOWN [L/s] | 5 / 2.5 | 2.5 / 1.25 |
| CARTRIDGE LENGTH [mm] | 1375 | 1375 |
| OUTLET INVERT TO STRUCTURE INVERT [mm]) | 1985 | 1985 |

## SITE SPECIFIC DATA REQUIREMENTS

| | |
|---|---|
| STRUCTURE ID | [ ] |
| WATER QUALITY FLOW RATE (L/S) | [ ] |
| # OF CARTRIDGES REQUIRED (HF - DD) | [ - ] |
| CARTRIDGE SIZE | 1375 |

| PIPE DATA: | I.L. | MATERIAL | DIAMETER |
|---|---|---|---|
| INLET PIPE | [ ] | [ ] | [ ] |
| OUTLET PIPE | [ ] | [ ] | [ ] |

| | |
|---|---|
| UPPER TANK WEIGHT | 4,050kg |
| LOWER TANK WEIGHT | 6,350kg |

NOTE: TANK SUPPLIED IN TWO PARTS; PARTS A & B TO BE JOINED ON SITE

GENERAL NOTES

1. JELLYFISH WATER QUALITY STRUCTURE SHALL BE IN ACCORDANCE WITH ALL DESIGN DATA AND INFORMATION CONTAINED IN THIS DRAWING. CONTRACTOR TO CONFIRM STRUCTURE MEETS REQUIREMENTS OF THE PROJECT.
2. PRECAST STRUCTURE SUPPLIED WITH CORE HOLES TO SUIT OUTER DIAMETER OF NOMINATED PIPE SIZE / MATERIAL.
3. PRECAST STRUCTURE SHALL MEET W80 WHEEL LOAD RATING ASSUMING A MAXIMUM EARTH COVER OF 2.0m AND A GROUND WATER ELEVATION AT, OR BELOW, THE OUTLET PIPE INVERT ELEVATION. CERTIFYING ENGINEER TO CONFIRM ACTUAL GROUNDWATER ELEVATION.PRECAST STRUCTURE SHALL BE IN ACCORDANCE WITH AS3600.
4. IF THE PEAK FLOW RATE, AS DETERMINED BY THE CERTIFYING ENGINEER, EXCEEDS THE TREATMENT FLOW RATE OF THE SYSTEM, AN UPSTREAM BYPASS STRUCTURE IS REQUIRE.
5. ALL WATER QUALITY TREATMENT DEVICES REQUIRE PERIODIC MAINTENANCE. REFER TO OPERATION AND MAINTENANCE MANUAL FOR GUIDELINES AND ACCESS REQUIREMENTS.
6. SITE SPECIFIC PRODUCTION DRAWING WILL BE PROVIDED ON PLACEMENT OF ORDER.
7. DRAWING NOT TO SCALE.

INSTALLATION NOTES

A. ANY SUB-BASE, BACKFILL DEPTH, AND/OR ANTI-FLOTATION PROVISIONS ARE SITE SPECIFIC DESIGN CONSIDERATION AND SHALL BE SPECIFIED BY THE CERTIFYING ENGINEER.

B. CONTRACTOR TO PROVIDE ALL EQUIPMENT WITH SUFFICIENT LIFTING AND REACH CAPACITY TO LIFT AND SET THE STRUCTURE (LIFTING DETAIL PROVIDED SEPARATELY).

C. CONTRACTOR TO INSTALL AND LEVEL THE STRUCTURE, APPLY SEALANT TO ALL JOINTS AND TO PROVIDE, INSTALL AND GROUT INLET AND OUTLET PIPES.

D. CONTRACTOR TO TAKE APPROPRIATE MEASURES TO PROTECT CARTRIDGES FROM CONSTRUCTION-RELATED EROSION RUNOFF.

E. CARTRIDGE INSTALLATION, BY OCEANPROTECT, SHALL OCCUR ONLY AFTER SITE HAS BEEN STABILIZED AND THE JELLYFISH UNIT IS CLEAN AND FREE OF DEBRIS. CONTACT OCEAN PROTECT TO COORDINATE CARTRIDGE INSTALLATION WITH SITE COMPLETION.


OCEAN PROTECT

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OCEAN PROTECT

JELLYFISH 2250

STANDARD PRODUCT DRAWING

*LAST MODIFIED: 25-02-19*