MIDCOAST
council

Planning Proposal to amend Greater Taree Local Environmental Plan 2010

Glenthorne Employment Area

Prepared by:

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Version	Purpose of Document	Author	Date
1	For Gateway Determination	LP	5 December 2018
2	For Gateway Determination – as amended and reported to Council	RD	4 March 2019
3	Minor amendments in response to DP&E comments	RD	1 July 2019
4	For public exhibition	RD/AK	30 March 2021

1. Introduction

This planning proposal (herein referred to as the Glenthorne Employment Area planning proposal) has been prepared by MidCoast Council in accordance with Section 3.33 of the *Environmental Planning and Assessment Act 1979* and the relevant Department of Planning and Environment (Department) Guidelines, including *A Guide to Preparing Local Environmental Plans* (2016) and *A Guide to Preparing Planning Proposals* (2016). It outlines the intended effect of, and justification for, the proposed amendments to the *Greater Taree Local Environmental Plan 2010* (GT LEP 2010)

The proclamation of 12 May 2016 ratified the merger of the Local Government Areas of Gloucester Shire, Greater Taree and Great Lakes Councils into MidCoast Council. A four-way merger was later created by the addition of MidCoast Water. The Greater Taree LEP 2010 still stands as a separate environmental planning instrument. This planning proposal seeks to amend the GT LEP 2010 to increase economic development and employment opportunities in the Taree environs by facilitating development on certain land in Glenthorne with strong economic prospects and distinct locational advantages.

In developing the planning proposal, a number of pre-lodgement meetings were held between Council and the proponents. A meeting was also held between Council, the proponents and the NSW Roads and Maritime Services (RMS). The issues discussed at those meetings are summarised below:

- Strategic merit will need to be addressed, particularly in relation to the relevant Regional Economic Development Strategy (REDS).
- The desired use is for employment lands. IN1 and B6 are likely to be appropriate for achieving the desired outcomes.
- Whilst only part of the land is identified in Council’s draft Manning Valley Local Strategy (MVLS), it is appropriate to consider the entire portion of Lot 2 DP 827097.
- Access would be a key issue and a link from Manning River Drive southbound may be considered. Access off Manning River Drive eastbound may be suitable, subject to assessment and possible provision of a deceleration lane.
- A stage 1 traffic study will be required and will need to model the affected roundabouts and intersections and investigate the split between local and highway traffic. The RMS need to know what impact the proposal would be likely to have on the highway and in particular the Taree South interchange. No modelling is likely to be required for the Taree South interchange. Council and the RMS will provide available data.
- The development would be considered under the Industrial ET category rating and negotiations may be required for water and sewer easements through adjoining properties.
- Water mains would need to be upgraded to service the lots.
- Stormwater quality and quantity treatments should be integrated. A concept strategy would be required after Gateway Determination to demonstrate that Council’s targets can be achieved.
- No flood study is required to be lodged prior to Gateway Determination.
- The Stage 1 PP should include the following specialist studies:
  - Preliminary Ecological Assessment.
  - Traffic Impact Assessment.
  - Economic Assessment.
  - Aboriginal Archaeology.

- A Development Control Plan (DCP) for the land will be required to be prepared after the Gateway Determination.

2. Description of the Land and Surrounds

This planning proposal relates to four parcels of land (the land) in Glenthorne, south of Taree. The subject land includes:

- Lot 50 DP 863972 (51 Glenthorne Road) being 6.42ha and owned by Michael and Heather Barrett.
- Lot 2 DP 573214 (55 Glenthorne Road) being 4.05ha and owned by Edward Gersbach.
- Lot 2 DP 827097 (50 Eriksson Lane) being 12.94ha and owned by Michael and Heather Barrett.
- Lot 20 DP 836884, known as Eriksson Lane and owned by MidCoast Council.

The subject land is located approximately 1.7km south of Taree and adjoins the existing Manning River Drive Employment Precinct. It is intended that the subject land will be the last addition to the precinct in the foreseeable future (to the east) as it provides the last area of land suitable for employment zones in this area.

The land has site-specific locational advantages, being in close proximity to the Pacific Highway, with existing road infrastructure in place to allow efficient vehicle movements in and out of the land without significant alterations to the current road network. In addition, there are high volumes of local traffic passing the land each day, providing a unique opportunity to capitalise on local trade and consolidate Taree South as an employment precinct.

The location of the subject land is shown in Figure 1.

The subject land is currently zoned RU1 Primary Production, with all lots currently used for extensive agriculture. The subject land contains two minor streams in the south and a third order stream in the north (Stitts Creek), with scattered native and exotic vegetation. It has a gently undulating topography primarily draining to the north-east. A dwelling is located on each lot.

To the west the subject land adjoins the B6 Enterprise Corridor, B5 Business Development and IN1 General Industrial zones within the Manning River Drive Employment Precinct. To the north and east the subject land adjoins RU1 Primary Production land used for extensive agriculture and rural lifestyle properties. To the south the subject land adjoins the RU5 Village zone of Purfleet on the opposite side of Manning River Drive. The Manning River Drive / Pacific Highway interchange is located approximately 350m east of the subject land. At its closest point the Manning River is located approximately 1.1km to the north.

Existing formal public access to the subject land is available from both Eriksson Lane and Glenthorne Road, with Eriksson Lane being only 660m in length and providing access to 50 and 55 Eriksson Lane, 235 Glenthorne Road and 79 Glenthorne Road. Glenthorne Road provides access to a number of rural properties and is approximately 2.8km long, providing access to properties down to the edge of the Manning River.

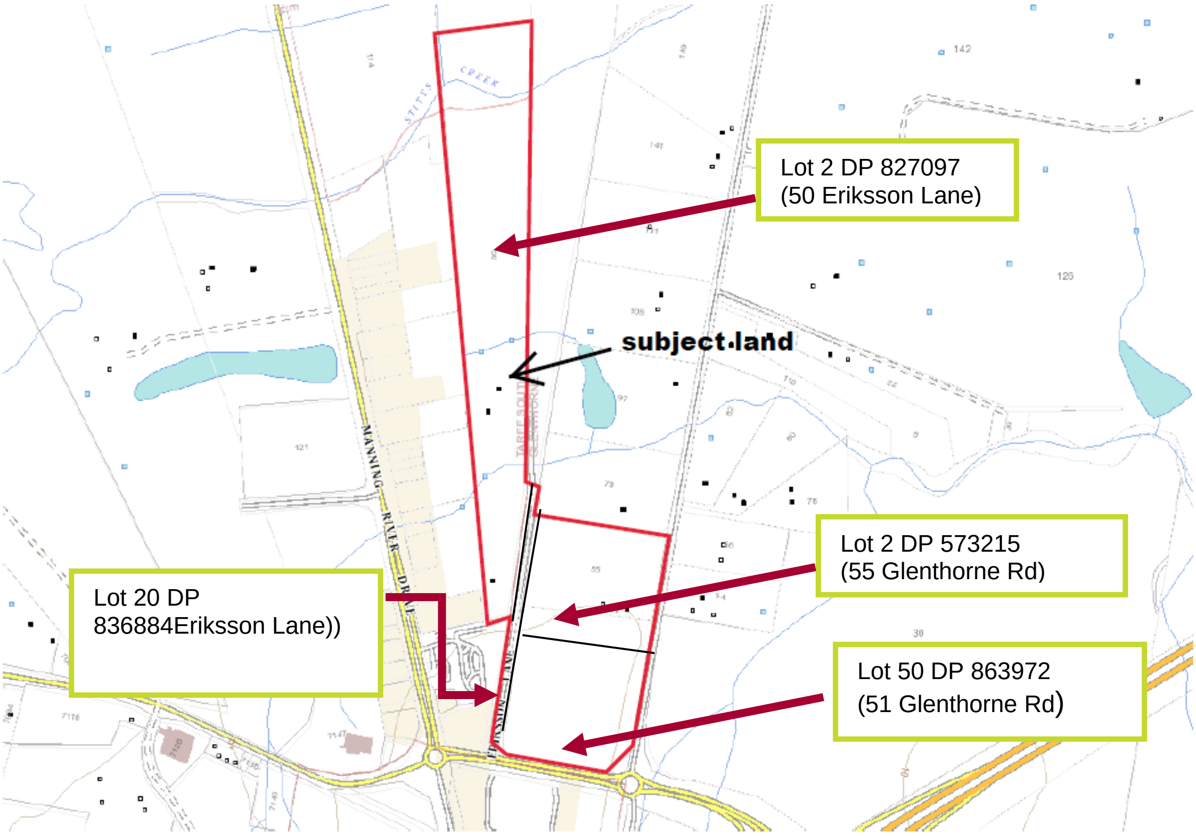

Figure 1: Location of Subject Land

3. Potential Development Outcomes

The delivery of the planning proposal will enable a coordinated extension to the Manning River Drive Employment Precinct. Future land subdivision and development upon newly created lots will be carried out in accordance with a site-specific development control plan (DCP). The DCP will provide principles for lot and road layout, principles for providing quality built form, ensure conservation of sensitive areas, ensure adherence to Water Sensitive Urban Design (WSUD) principles and indicative staging in accordance with the requirements of clause 6.3 of the GT LEP 2010.

4. Planning Proposal

Part 1 - Objectives or intended outcomes

(s.3.33(2)(a) A statement of the objectives or intended outcomes of the proposed instrument)

The objectives of the planning proposal are to change the statutory controls over Lot 50 DP 863972, Lot 2 DP 573214, Lot 20 DP 836884 and Lot 2 DP 827097 (the 'subject land') to facilitate industrial and business development and environmental conservation outcomes as follows:

- Lot 50 DP 863972 – B6 Enterprise Corridor and IN1 General Industrial.
- Lot 2 DP 573214 – IN1 General Industrial and E2 Environmental Conservation.
- Lot 2 DP 827097 - IN1 General Industrial, E2 Environmental Conservation and E3 Environmental Management.
- Lot 20 DP 836884 (Eriksson Lane) – E2 Environmental Conservation.

The intention is to amend GT LEP 2010 in accordance with the above so that a range of employment, industrial and service-related uses are permissible on the subject land. The intent is to facilitate an easterly orderly extension to the Manning River Drive Employment Precinct by taking advantage of the subject land's distinctive locational strengths to activate the creation of new employment opportunities.

Part 2 - Explanation of provisions

(s.3.33(2)(b) An explanation of the provisions that are to be included in the proposed instrument)

The objectives and intentions would be achieved by an amendment to GT LEP 2010. The amendment would bring the planning controls on the subject land into alignment with the rest of the Manning River Drive Employment Precinct. This would be achieved by amending the GT LEP 2010 maps as follows:

- The Land Zoning (LZN) Map – Sheet LZN_015A as it affects the subject land would be amended by changing the zone of the subject land from RU1 Primary Production to IN1 General Industrial, B6 Enterprise Corridor, E2 Environmental Conservation and E3 Environmental Management. Note that the RU1 zone currently applies to all of the subject land.
- The Floor Space Ratio (FSR) Map – Sheet FSR_015A as it affects the subject land would be amended by changing the maximum floor space ratio on that part of Lot 50 DP 863972 that is to be zoned B6 Enterprise Corridor to 1. Note that no FSR standard currently applies to the subject land.
- The Height of Buildings (HOB) Map – Sheet HOB_015A as it affects the subject land would be amended by changing the maximum building height on that part of Lot 50 DP 863972 that is to be zoned B6 Enterprise Corridor to 8.5m. Note that no HOB standard currently applies to the subject land.
- The Lot Size (LSZ) Map – Sheet LSZ_015A as it affects the subject land would be amended by removing the minimum lot size applying to Lot 50 DP 863972, removing the minimum lot size applying to the part of Lot 2 DP 573214 that is to be zoned IN1

General Industrial and removing the minimum lot size applying to the parts of Lot 2 DP 827097 that is to be zoned IN1 General Industrial. Note that a 40ha minimum lot size standard currently applies to the subject land.

A site-specific DCP has been prepared in accordance with Part 6 of GT LEP 2010 to guide the orderly development of the land and address site constraints, design, amenity and environmental protection and enhancement measures. The site-specific DCP will be an amendment to Part L of *Greater Taree Development Control Plan 2010*.

Part 3 - Justification

(s.3.33(2)(c) Justification for the objectives or intended outcomes and the process for their implementation)

Section A – Need for the Planning Proposal

3.A.1 Is the planning proposal a result of any strategic study or report?

Draft Manning Valley Local Strategy (June 2016):

The planning proposal is consistent with the draft Manning Valley Local Strategy (MVLS), prepared by MidCoast Council and dated 27 May 2016. Although the MVLS was not adopted by Council, the former Greater Taree City Council resolved to exhibit the Strategy and on 13 July 2016 the Strategy was reported to MidCoast Council for adoption. The matter was deferred as a result of the Council amalgamation. The MVLS however still provides a blue-print for growth across the Manning Valley and seeks to align Council's planning strategies to facilitate the coordinated delivery of key infrastructure, tourism, open space and community facilities.

The land was partly identified in the draft MVLS as shown in Figure 2.

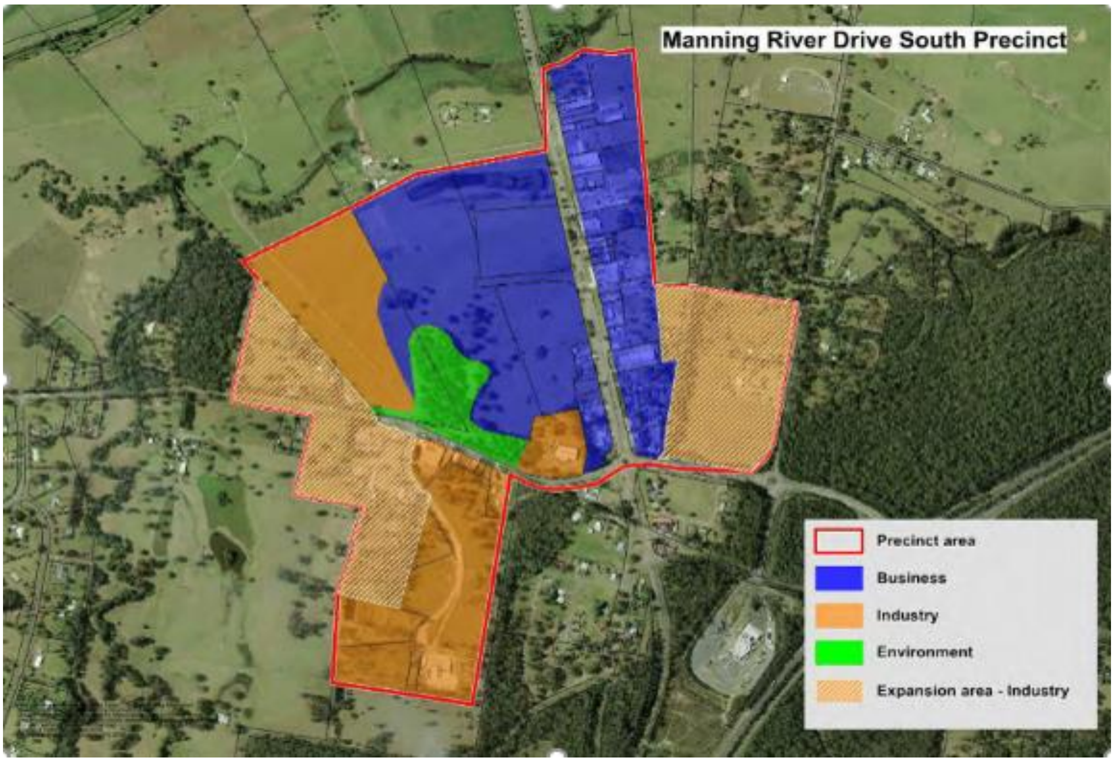

Figure 2: Extract from Draft Manning Valley Local Strategy showing the subject land identified as an expansion area for industry.

A key goal of the MVLS is to 'grow the local economy', by offering accessible and affordable options for new businesses. One of the high-level priorities in the MVLS is the provision of a commercial and industrial hub within the Manning River Drive precinct, which is recognised in the MVLS as a key economic precinct. It has been recognised as providing good access to the Pacific Highway with high volumes of passing traffic.

Goal 1 of the MVLS is to:

- Grow our local economy.

Direction 1.1 of the draft Strategy is to:

- Establish strong economic precincts.

> *"To plan for economic growth, we need to ensure employment lands are located and serviced appropriately to meet future business needs and trends. These include:*
>
> - *reliance on road freight for manufacturing. Today a key locational factor for manufacturing is good access to the Pacific Highway*".

The subject land has good access to the Pacific Highway and brings natural locational strengths to activate the creation of new employment opportunities, particularly in the provision of:

- truck and passenger vehicle related retail.
- transport related accommodation/hospitality (bringing flow-on effects to tourism).
- transport related servicing and manufacturing and
- technical services, logistics and manufacturing enterprises.

MidCoast Regional Economic Development Strategy 2018 - 2022:

The planning proposal is consistent with the Regional Economic Development Study (REDS) for the MidCoast region, prepared by the NSW Department of Premier and Cabinet (2018). The REDS for the MidCoast region provides a vision for future economic development through strategies, initiatives and actions that will be implemented to the year 2022. There are three core strategies that are being targeted for the MidCoast:

1. The first core strategy looks to strengthen the region as a 'location of choice'. In doing so improvements to core infrastructure, such as roads and businesses, will help drive growth and increase tourism into the area.

2. The second looks to create a supportive business environment through reducing/removing regulatory barriers that should allow for the growth of new and existing businesses.

3. The third will target marketing the MidCoast region to business owners, local residents and future retirees that will encourage growth in the labour force and hence economic development within the area.

The region's proximity to Sydney and Newcastle via the Pacific Highway, coupled with affordable land, makes it ideal for general industrial and freight/logistic businesses and industries. This potential will be accelerated following the completion of the Northern Gateway project which will make Taree a hub for freight and logistics that will significantly reduce freight costs in and out of the region. The proposal will ensure that Taree capitalises on all opportunities associated with the Pacific Highway, at both the southern and northern entries, to provide land for freight and logistics business and industry.

Looking forward the strategy plans to consolidate the region's key industries. This will include boosting productivity in agriculture through greater use of technology and innovation (which will be supported through the addition of the NBN), growing the local aquaculture industry, leveraging advantages for freight and logistics and building on its strength as an attractive location for people to reside and visit. The proposal has the potential to be a key contributor to achieving the strategy's objectives through the provision of land that is of a suitable zone and size and has locational advantages due to its proximity to a major transport corridor.

3.A.2 Is the Planning Proposal the best means of achieving the objectives or intended outcomes, or is there a better way?

The planning proposal provides the only way of achieving the intended outcome. The current zoning (RU1) permits rural uses on the land. The only means of achieving industrial and employment uses would be a planning proposal to rezone the subject land to IN1 General Industrial and B6 Enterprise Corridor. Sensitive areas on the land would be best protected from future development by applying E2 Environmental Conservation and E3 Environmental Management zones.

Section B – Relationship to Strategic Planning Framework

3.B.1 Is the planning proposal consistent with the objectives and actions contained within the applicable regional or sub-regional strategy?

Assessment Criteria:

a) Does the proposal have strategic merit? Is it:

- **Consistent with the relevant regional plan outside of the Greater Sydney region, the relevant district plan within the Greater Sydney region, or corridor / precinct plans applying to the site, including any draft regional, district or corridor / precinct plans released for public comment; or**

- **Consistent with a relevant local council strategy that has been endorsed by the Department; or**

- **Responding to a change in circumstances, such as the investment in new infrastructure or changing demographic trends that have not been recognised by existing planning controls.**

Hunter Regional Plan 2036

The planning proposal is consistent with the objectives and actions contained within the *Hunter Regional Plan 2036*. A summary of the planning proposal's consistency with the Plan is provided in Appendix A of this planning proposal.

b) Does the proposal have site-specific merit, having regard to the following:

- **The natural environment (including known significant environmental values, resources or hazards); and**

- **The existing uses, approved uses and likely future uses of land in the vicinity of the proposal; and**

- **The services and infrastructure that are or will be available to meet the demands arising from the proposal and any proposed financial arrangements for infrastructure provision**.

At January 2017 there was 750ha of employment zoned land within the MidCoast LGA, with 172ha (approximately 23%) known to be undeveloped. When compared to the rest of the Hunter region, the supply of undeveloped land is comparably low, with 51 per cent or 4,179 hectares undeveloped across the Hunter region. Almost 80 per cent of the undeveloped zoned employment land was located in the Greater Newcastle Metropolitan area.[1]

Whilst the data indicates that there is still a moderate supply of undeveloped employment zoned land in the LGA, the proposal has significant and distinctive site specific merit in comparison to other lands zoned for employment and has the potential to be a significant contributor to the growth of the local economy as it is strategically located as a basis of greater service provision for locals and visitors to the area and is therefore able to ‘tap into’ the economic opportunity that the land’s accessibility and exposure presents. In addition, the local road network and infrastructure require little modification or upgrade to enable development of the land, unlike other industrial land which requires significant cost input for the provision of road, water or sewer infrastructure.

The proposal will ensure mutual co-location benefits that support the wider region over a staged development provision. The proposal also seeks to incorporate provision for new economic and cultural development opportunities in partnership with the Purfleet-Taree Local Aboriginal Land Council given its close proximity to the village.

The Glenthorne Employment Area rezoning will consolidate the significance of the Manning River Drive Employment Precinct as an important southern entry to Taree. The proposal complements the Northern Gateway precinct, ensuring that Taree captures every opportunity to trade from highway traffic and local resident movements in order to maximise the available local economic benefits.

The proposal’s distinctive locational strengths will contribute to growing the local economy by offering accessible and affordable options for new businesses and has the potential to trigger much needed local investment and job creation. This objective is key to current Council and State Government initiatives to strengthen the regional economy and to build local resilience in the face of challenging demographic and economic trends.

In 2016, the value of industrial approvals in MidCoast was $2,660,000[2], which provides a relatively significant contribution to the local economy. There are strong site-specific economic grounds to support the proposed rezoning of land at Glenthorne which will contribute to redressing Taree’s current demographic trends, with a view to achieving a healthier balance between household formation and labour workforce.

In December 2017 Council provided a letter to the proponents indicating that the planning proposal has strategic merit. That letter is included at Appendix J.

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[1] *Data sourced from https://www.planning.nsw.gov.au/Research-and-Demography/Employment-Lands-Development-Monitor/Employment-Land-Precincts*

[2] *Data sourced from https://www.planning.nsw.gov.au/Research-and-Demography/Employment-Lands-Development-Monitor/Employment-Land-Precincts*

The land is capable of being fully serviced. A water and sewer servicing strategy will be completed after Gateway Determination to demonstrate serviceability of the development and outline required works.

3.B.2 Is the planning proposal consistent with the local council's Community Strategic Plan, or other local strategic plan?

MidCoast 2030: Shared Vision, Shared Responsibility

The planning proposal is consistent with Council's Community Strategic Plan *MidCoast 2030: Shared Vision, Shared Responsibility.* The following targets and actions are of relevance to the planning proposal:

Target	Action	Consistency
Our region is a popular place to visit, live, work and invest	Provide an environment to grow and strengthen local businesses and attract new business.	The proposal seeks to provide an extension to the Manning River Drive employment precinct. Its locational advantages and co-location with existing industrial and business uses will contribute to providing an environment to grow and strengthen local businesses and attract new businesses, particularly in the transport and logistics sector.
Our villages and business precincts are vibrant commercial, cultural and social hubs	Ensure strategies and processes recognise, maintain and support sustainable economic growth.	The proposal will contribute to sustainable economic growth by creating an opportunity for new industries to establish in a location with unique economic advantages.

3.B.3 Is the planning proposal consistent with applicable state environmental planning policies?

The planning proposal is consistent with applicable state environmental planning policies (SEPPs). A summary of the planning proposal's consistency with applicable SEPPs is provided in Appendix B of this planning proposal.

3.B.4 Is the planning proposal consistent with applicable Ministerial Directions (s.9.1 directions)?

The planning proposal is consistent with applicable S.9.1 Ministerial Directions. A summary of the planning proposal's consistency with relevant s.9.1 Ministerial Directions is provided in Appendix C of this planning proposal.

Section C – Environmental, Social and Economic Impact

3.C.1 Is there any likelihood that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal?

The subject land contains a number of vegetation communities, all of which have been highly modified by past activities. It is unlikely that critical habitat or threatened species, populations or ecological communities, or their habitats, will be adversely affected as a result of the proposal.

A Biodiversity Assessment Report (BDAR) was undertaken by JB Enviro (dated 16 June 2020 – Revision 4) to inform the planning proposal and is contained in full at Appendix D.

The findings of the BDAR are summarised as follows:

(a) Environment Protection Biodiversity Conservation Act 1999:

a. There are no relevant Threatened Ecological Communities (TECs) on the land.

b. land is not important to any migratory species.

c. Future development is unlikely to require referral to the Department of the Environment and Energy, unless a local population of Green and Golden Bell Frog (Litoria aurea) is recorded (very low to unlikely probability), a listed plant is detected (very low to unlikely probability), or possibly if loss of all known Koala habitat occurs.

(b) Biodiversity Conservation Act 2016:

a. Lot 2 DP 827097 contains portions of the generally larger local occurrence of two Endangered Ecological Communities (EECs): Freshwater Wetlands and Swamp Sclerophyll Forest on Coastal Floodplains (both possibly derived due to historical clearing), and adjoin the EEC – Subtropical Floodplain Forest on Coastal Floodplains east of Lot 2. The local occurrence of the Freshwater Wetlands EEC in the central drainage line on Lot 2 is limited to the land and study area.

b. Hollow-bearing trees are only present along the road reserve along Eriksson Lane, but most have few or poorly developed hollows. Hollows present are only suitable for small to medium fauna. Further survey is required to determine if any threatened hollow-obligate species (eg. Squirrel Glider, Brushtailed Phascogale) are present, if development is proposed within Eriksson Lane (currently not anticipated).

c. Future development is likely to trigger entry into the Biodiversity Offset Scheme (BOS) for development on any lot where native vegetation is cleared above the nominated threshold for the current or future minimum lot size. The western half of Lot 2 DP 573214 contains mostly native vegetation and hence is most likely to enter the BOS if clearingis proposed. Lot 50 DP 863972 and Lot 2 DP 827097 have limited native vegetation and development of these lots may possibly only need assessment under the Five Part Tests (subject to further investigation of groundcover composition on Lot 50 and evaluation of the criteria of the Paddock Tree module in the BAM). Regardless, a Stage 1Biodiversity Development Assessment Report (BDAR) using the BAM has been undertaken. This will assist in determining whether removal of vegetation can be considered and if so, the impact on the proposed zoning.

d. The Bodiversity Assessment Report proposes that the three drainage reserves transiting Lot 2 DP 827097 are zoned E3 Environmental Management. Appropriate mechanisms for the establishment, ownership, maintenance, and protection of the three drainage reserves are detailed in the Biodiversity Assessment Report in Appendix D.

e. The Stage 1 BDAR has provided insight to the biodiversity approval processes associated with the site. A Stage 2 BDAR will be completed at the development application stage (once rezoning has occcurred) for the lots subject of each development application.

(c) SEPP 44 – Koala Habitat Protection:

a. The land contains potential Koala habitat, mostly as very young regrowth on Lot 2 DP 573214 and in the road reserve of Eriksson Lane.

b. Evidence of Koalas was found in the form of a small number of confirmed scats under trees along the Eriksson Lane road reserve. Further survey as part of the BDAR has confirmed a low intensity of Koala usage, with no Koalas observed despite the site habitat being the only remaining unburnt habitat in the locality. The site has been determined to be Core Koala Habitat under the SEPP. However, the site is not identified as a key corridor, linkage value at the landscape or local scale for the Koala.Council has recommended that offsets should be preerentially secured from sited within a 2.5- kilometre radius of the subject land and there could be additional revegetation of a koala habitat. The land reserved for the Tallowood -Forest Red Gum Regrowth is to be zoned as E2 Environmental Conservation.

In summary the biodiversity issues within the site have been satisfactorily addressed. The results stemming from the BDAR have in part determined the location and boundaries of the E2 Environmental Conservation zone which are located within Lot 20 DP 836884 (Eriksson Lane) and on the western portion of Lot 2 DP 573215. Further considerations of biodiversity issues may be required for the finalisation of the Draft DCP for the site, for minor additional detail for statutory assessment under SEPP (Koala Habitat Protection) 2020 at the development application stage. It is noted that future development applications for subdivision would require separate and site-specific BDARs.

3.C.2 Are there any other likely environmental effects as a result of the planning proposal and how are they proposed to be managed?

Development of the subject land may have a potential impact on coastal management matters as well as the following:

- Bushfire
- Flooding and drainage
- Servicing
- Acoustics
- Air quality
- Traffic and access
- Acid sulfate soils
- Water quality and stormwater management
- Contamination
- Landscape and amenity
- Soils
- Archaeology and cultural heritage

Potential impacts and proposed management of those impacts are examined further below and where relevant planning controls have been provided within the Draft DCP for the site.

3.C.2.1 Coastal management issues

State Environmental Planning Policy (Coastal Management) 2018 (Coastal Management SEPP) applies to part of the site, being the northern part of Lot 2 DP 827097. The northern part of Lot 2 DP 827097 is within the Coastal Use Area, refered to in Figure 3, and much of this area has been identified for rezoning to E2 Environmental Conservation. The Coastal Use Area and further land within the lot but to the south is also within the Coastal Environment Area, referred to in Figure 4. The proposed draft DCP will consider whether any controls related to the SEPP will need to be included in future development assessment.

Figure 3: Extract from the SEPP (Coastal Management) 2018 maps showing the subject land and Coastal Use Area

Legend

🟦 Coastal Wetlands

▨ Proximity Area for Coastal Wetlands

🟧 Coastal Use Area Map

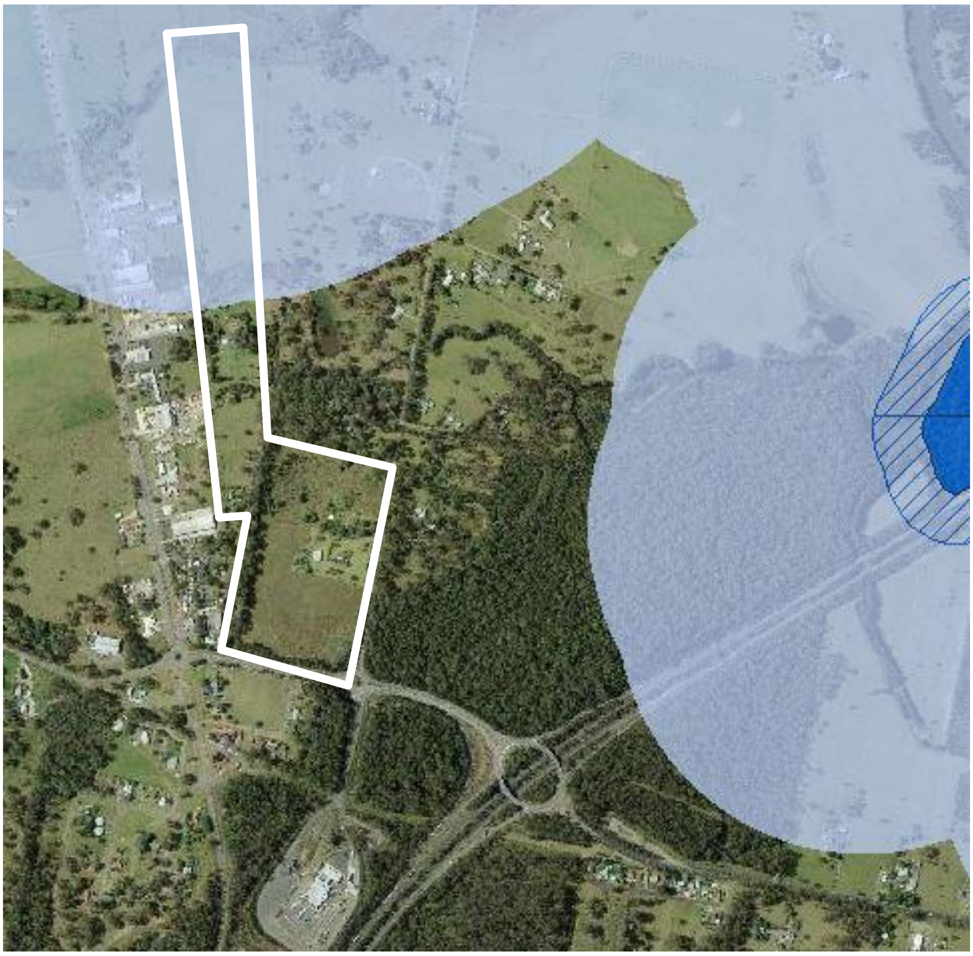

Figure 4: Extract from the SEPP (Coastal Management) 2018 maps showing the subject land and Coastal Environment Area

Legend

🟦 Coastal Wetlands

▨ Proximity Area for Coastal Wetlands

◻ Coastal Environment Area Map

3.C.2.2 Bushfire

Part of the subject land is mapped as bushfire prone, referred to in Figure 5, however the planning proposal does not include residential land, does not enable inappropriate development in bush fire prone areas and does not introduce controls that will prohibit bushfire hazard reduction within APZs. Compliance with the aims and objectives of *Planning for Bushfire Protection (PBP) 2006* can be achieved by development on the subject land and will be addressed in detail at the development application stage. Consultation with the Commissioner of the NSW Rural Fire Service is underway under section 56 of the EP&A Act.

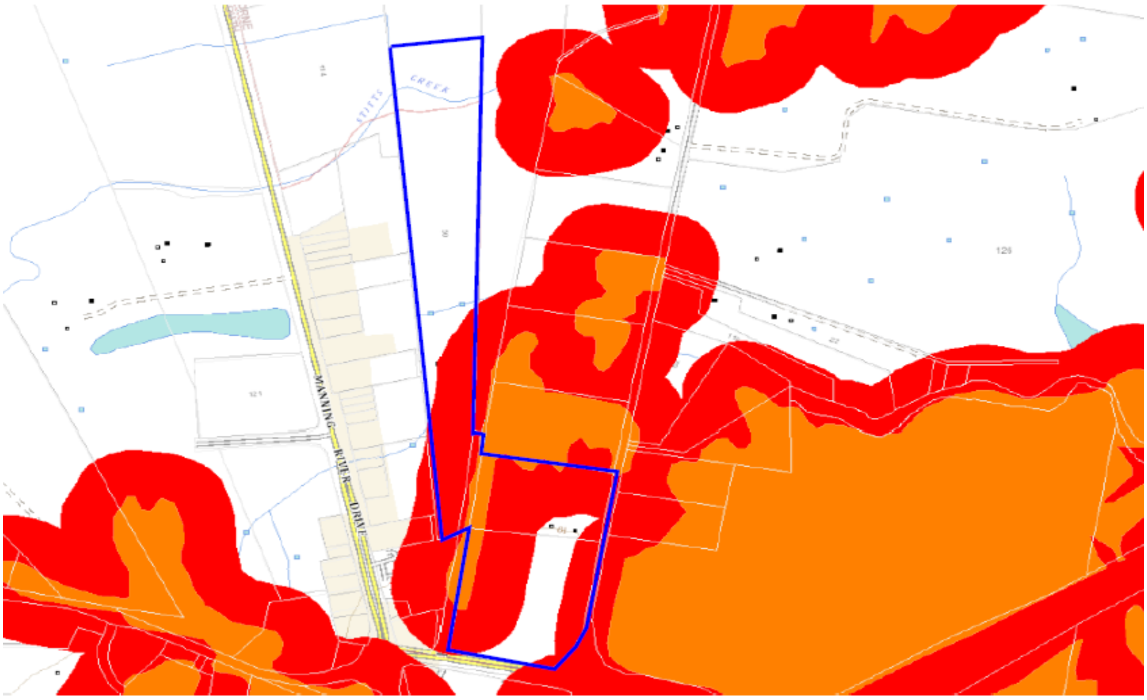

Figure 5: Extract from MidCoast Council Bushfire Prone Land Mapping, October 2018

3.C.2.3 Acid Sulfate Soils (ASS)

The southern half of the subject land contains Class 5 ASS, and the majority of the northern half contains Class 4 ASS, referred to in Figure 6. Small portions of Class 3 and Classes 2a and 2b occur in the far north of the land, within the area that will be zoned for environmental conservation (E2). Clause 7.1 of GTLEP 2010 contains the standard ASS risk management provisions to appropriately control future development of the land. As development would only occur on Class 4 and Class 5 ASS, this will be addressed in detail at the development application stage and no further consideration of ASS is required for the planning proposal.

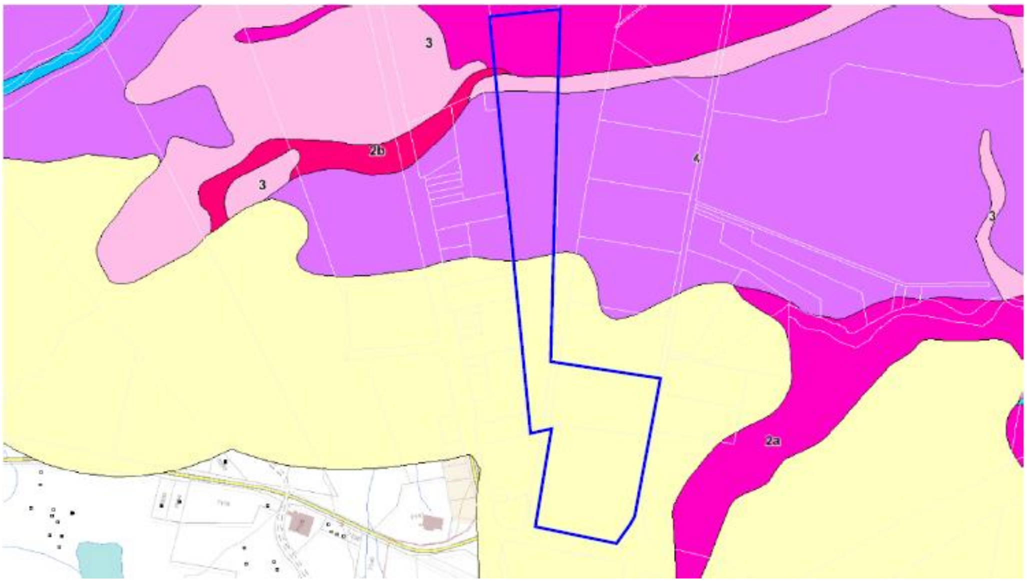

Figure 6: Extract from MidCoast Council Acid Sulfate Soils Mapping, October 2018

3.C.2.4 Flooding and Drainage

A portion of the central and northern parts of the subject land are located within Council's mapped FPL3 flood prone land area, referred to in Figure 7. The Manning River Flood Study (adopted by Council in November 2016) applies to the land and the Manning River Floodplain Risk Management Plan, currently under preparation by Council, will apply to the land when it is completed.

Figure 7: Extract from MidCoast Council Flood Prone Land Mapping, October 2018

Clause 7.2 of GT LEP 2010 contains the standard flood planning and flood risk management provisions to appropriately control future development of the land. Part E of DCP 2010 contains the flood assessment requirements in accordance with the *NSW Floodplain Development Manual 2005*.

Notably, the land is not proposed to be zoned for residential purposes, and the areas noted as flood prone will potentially be located within the E2 Environmental Conservation zone, particularly where Stitts Creek traverses the property, therefore risk to life and property from the proposal is minimal.

Flood free access to the northern part of Lot 2 DP 827097 will be possible via future industrial subdivision of this lot. The Draft DCP for the site contains a requirement that future subdivision in this vicinity will need to cater for an access handle to the northern part of Lot 2 DP 827097.

3.C.2.5 Stormwater Management

Stormwater represents a significant proportion of the natural water cycle, and all development has the potential to impact on the behaviour of stormwater through the addition of impervious surfaces, diversions and drainage. Stormwater runoff also has the potential to impact on water quality as rain events result in stormwater that flows over impervious surfaces carrying untreated pollutants into waterways.

The subject land generally drains in a northerly direction towards Stitts Creek and the Manning River further north, though the undulating topography of the land means that this is slightly variable across the entire area and some variation to the levels may be required to achieve effective stormwater drainage. On-site stormwater detention would be included in the developed land on individual lots to ensure that post-development flow rates from the land are not greater than pre-development flow rates, including runoff from the internal roads. The design storm standard used for on-site detention will be 1 in 100 as per Council's *On-site Stormwater Detention Guidelines* (former Greater Taree City Council).

A Stormwater Strategy for the site has been undertaken by Lidbury Summers and Whiteman and is contained in Appendix E. The widths of the two proposed E3 Environmental Management zones have been determined to adequately contain 1% AEP peak stormwater flows. The Water Sensitive Design modelling shows post development loads of gross pollutants are capable of being reduced to 90%. The strategy focuses on the treatment of the road runoff within the proposed development.

It is noted in the strategy that all of the treatment for the individual lots will be addressed on lot at the time of the development application. The report documents that this approach has been endorsed by Council however it is Council's preference moving forward, for an integrated approach with the treatment of the future lots within the road reserve. This is due to:

- The difficulty in reaching water quality targets when going from a pre-condition of rural to an industrial development of very high imperviousness
- The issues in relying on individual owners to maintain treatment devices presents a level of risk to the treatments being maintained (particularly as these are industrial sites where site amenity may not be a priority)
- the additional staff resources for assessment at the DA stage and audit and compliance activities if the treatments are not maintained by future owners.

It is acknowledged that in feedback provided to the applicant in 2018 that "It would be considered acceptable and appropriate for the pre-treatment be included on lots within the development as it is acknowledged that each development may require different pre-treatment depending on the nature of the development proposed at the DA stage". It was also noted that "On lot treatment of dissolved pollutants places an unacceptable burden on future owners/operators of each lot and is not considered a cost effective approach to water treatment both in terms of capital costs, land take and ongoing maintenance compared to a centralised approach for this small catchment".

More information is required to understand why on lot treatment was recommended as part of this strategy as it is preferred that there are less treatment locations within the development. It is also noted that some are situated away from the roads, the preference would be for them to be closer to the roads for ease of access for maintenance.

Water quality provisions based on the above discussions can be imp0lemenetd through the associated DCP for this Planning Proposal and will most likely occur as an addendum to the DCP at the post-exhibition stage.

3.C.2.6 Services

The land is capable of being fully serviced. The design and construction of all water and sewer infrastructure required to service the development would be undertaken by the developer(s) in accordance with standards published by the Water Services Association of Australia, and MidCoast Council. The developer(s) would be responsible for the costs of design and construction of water and sewerage infrastructure required to service the development, as well as the development charges applicable at the time of development.

Council has identified that the area is capable of being serviced by Council's reticulated water and sewerage network. The allotments to the north of the site are capable of being serviced by private sewerage pump and macerator type systems which Council is prepared to accept.

Electricity and telecommunications are available to the site.

3.C.2.7 Contamination

The land is not mapped as potentially contaminated. The land has historically been used for agriculture (grazing) and no contaminating activities are known to have occurred on the land.

A Geotechnical and Preliminary Site Contamination Assessment has been prepared and is contained in Appendix F. Soil sampling analysis carried out as part of the Assessment did not yield concentrations of chemicals of concern and were below the health investigation criteria for a Commercial/Industrial D Site.

Previous and current activities on the site generally appear to have involved low intensity grazing and farming. Identified Areas of Environmental Concern (AEC) were predominantly around existing structures including houses, farm sheds, stored and discarded building materials and old drums, fill stockpiles, and potentially waste from illegal dumping and unidentified disturbed areas or fill stockpiles (in addition to the two stockpiles of fill identified on Lot 2 DP827097, and one stockpile of fill identified on Lot 50 respectively).

Some fragments of fibro-cement were present on the ground surface on the northern side of the shed on Lot 50 DP 863972. The fragments were suspected of being asbestos containing material.

The Geotechnical and Stage 1 Site Contamination Assessment recommends that an Asbestos Management Plan be prepared by a suitably qualified person in accordance with the NSW WorkCover Code of Practice (How to Manage and Control Asbestos in the Workplace) prior to works commencing onsite. It also recommends that stored and/or discarded building materials, old drums and fill stockpiles be removed and disposed of at a licenced landfill or recycling facility.

Based on the results obtained in the Geotechnical and Stage 1 Site Contamination Assessment the site is considered suitable for the proposed rezoning and industrial use provided the recommendations and advice of the Assessment are adopted, and site preparation works are conducted in accordance with appropriate site management protocols and legislative requirements.

3.C.2.8 Acoustics

The subject land is surrounded by rural land to the east and north and a business zone to the west. A small caravan park is operating adjacent the south west corner of the subject land on the opposite side of Eriksson Lane, which acts as a buffer of moderate width between the subject land and the caravan park. The development control plan to be prepared after Gateway Determination will ensure that an adequate buffer distance is included between any potential future development and the existing caravan park.

The village of Purfleet is located to the south of the subject land on the southern side of Manning River Drive which is four lanes in this location. As the village area is separated by Manning River Drive, which is approximately 46m wide in this location, it is unlikely that the development of the subject land would have significant negative noise impacts on the village of Purfleet.

3.C.2.9 Landscape and Amenity

Lot 50 DP 863972 is located at the southern entry to Taree and presents an opportunity to provide a key gateway entry site with high amenity including roadside landscaping. Manning River Drive in this location is approximately 46 metres wide and contains a mounded barrier. The barrier, constructed and landscaped as part of the Taree bypass and highway upgrade works, contains scattered native trees (immature – semi mature) and shrubs. This landscaping is currently poorly maintained.

A site- specific landscaping plan will be required for any new development fronting Manning River Drive. This requirement is specified in the Draft DCP for the site.

3.C.2.10 Air Quality

The development of the land for industrial and business purposes has the potential to have a minor negative impact on air quality as increased vehicular traffic will be accessing the land. As the land is located adjacent to an existing business zone to the west, there are unlikely to be sensitive receivers to the west. The exception to this is the caravan park adjacent to the south western corner of the land. A site-specific requirement for building setback for future development adjacent to Eriksson Lane opposite Lot 102 DP1118846 is contained within the Draft DCP for the site.

The properties to the east and north of the land are all rural, with dwellings dispersed over the properties at considerable distance from the subject land. Given the distances to sensitive receivers, it is unlikely that air pollution would have a significant impact on those dwellings.

3.C.2.11 Soils

The subject land consists of an A horizon of fine clay loam that overlays a B Horizon of fine clay loam sand (NSW Soil and Land Information System), with alluvial soils likely to be present in association with the waterways. Impacts on soils will be considered at development application stage when proposed development will be subject to erosion and sediment control.

3.C.2.12 Traffic and Access

The Traffic Impact Assessment (TIA) included at Appendix I considers the potential impacts of the planning proposal (excluding construction traffic) on the local road network and the Pacific Highway[3]. Suitable mitigation strategies have been recommended to ensure that the road network is not negatively impacted by the proposal.

The assessment was based on the following assumptions for the land, which are conceptual only and were confirmed by Council's traffic engineers to be suitable for the purpose of the assessment.

- Industrial land (IN1 – General Industrial): Approximately 38,800m^2 Gross Floor Area (GFA).

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[3] *The TIA does not include detailed review of any future development layouts, parking or potential construction traffic impacts of the proposed development, as this will form part of future applications for development of the land.*

- Business land (B6 – Enterprise Corridor) excluding the service station: Approximately 20,600m^2 GFA.
- Service Station: Approximately 855m^2 GFA (approximately 24,000m^2 land area).

The development forecasts used in the assessment are considered to be highly conservative with land development (including land use type and yield) realistically being driven by market demand, which is unknown. The traffic forecast includes a 2% per annum growth in existing traffic, added to the rezoning land traffic and the traffic estimated for the Manning River Drive Business Park DCP area (within the wider Manning River Drive Employment Precinct). The forecasts represent the 2020, 2025, 2030 and 2040 future horizon years.

The intersections considered for the purpose of the assessment were:

- The Bucketts Way / Manning River Drive.
- Manning River Drive / Glenthorne Road / Caltex Service Centre Access Road.
- Pacific Highway / Manning River Drive / Old Bar Road.
- Biripi Way / Manning River Drive.

Traffic surveys were undertaken during the AM and PM peak periods on Thursday 26th July 2018 at each of the four study intersections. In addition to the peak surveys, a 24-hour automatic traffic count was undertaken to determine the potential drop-in traffic volumes associated with the proposal.

Intersection analysis was undertaken using SIDRA Intersection 7.0 and concluded the following.

Glenthorne Road/Manning River Drive/Caltex Service Station:

- The existing roundabout form can accommodate the rezoning traffic up until at least 2035 (20 year horizon).

- Beyond 2035, some minor expansion works (two short and dedicated left-turn lanes) would be required to accommodate the 2040 horizon traffic.

Old Bar Road/Manning River Drive/Pacific Highway Ramps:

- The existing roundabout form can accommodate the rezoning traffic up until about 2027.

- With background development and growth only (i.e. ignoring the rezoning traffic), the existing roundabout form would be adequate until about 2030.

- Beyond 2027, a minor upgrade of the existing roundabout (short additional lane on the eastern approach, plus additional circulating lane between the eastern and southern legs) would be needed to accommodate the impact of the rezoning traffic to about 2037. The latter is considered to be a reasonable requirement of the proposed rezoning.

- To accommodate the 2040 traffic, and beyond, upgrading to a full two-lane circulating roundabout would be needed. The latter is not considered to be a reasonable requirement of the proposed rezoning.

The Bucketts Way/Manning River Drive

- The existing roundabout form cannot accommodate traffic at the 2021 horizon, irrespective of the rezoning traffic.

- Beyond 2021 an upgrade of the existing roundabout (short additional left turn lane on the western approach, plus a continuous left turn slip lane from the northern approach) would be needed to offset the impact of the rezoning traffic. The latter is considered to be a reasonable requirement of the proposed rezoning.

- To accommodate the significant background traffic up to a 2030 and 2040 horizon, substantial upgrading of the roundabout (or complete replacement with an alternative intersection form) would be needed.

Biripi Way/Manning River Drive:

- The existing roundabout form can accommodate the rezoning traffic up until about 2029.
- Beyond 2029, an upgrade of the existing roundabout (additional short left-turn lane on the south approach, plus additional circulating lane between the south and west approaches, plus additional short left turn lane on the north approach, plus additional circulating lane between north and east approaches) would be needed to offset the impact of the rezoning traffic. The latter is considered to be a reasonable requirement of the proposed rezoning.
- Since the above upgrading is only needed to accommodate traffic beyond 2029, it would be appropriate to delay such upgrading until a reconsideration closer to the 2029 horizon.
- To accommodate the significant background traffic up to 2040 horizon, substantial upgrading of the roundabout (or complete replacement with an alternative intersection form) would be needed by 2038. The latter is not considered to be a reasonable requirement of the proposed rezoning.

Councils' Transport Team have reviewed the TIA and have indicated that access arrangements from the Glenthorne Road roundabout for existing traffic can be accommodated. A single slip land entry from Manning River Drive into Lot 50 DP 863972 is possible however no egress from Lot 50 DP 863972 into Manning River Drive will be permitted. On this basis exhibition of the planning proposal is supported.

3.C.2.13 Archaeology and Cultural Heritage

The subject land does not contain any listed or potential items of European heritage significance and is not located within close proximity to a heritage conservation area.

An Aboriginal Heritage Impact Assessment (AHIA) was undertaken for the planning proposal and is included at Appendix G. Twenty-six known Aboriginal sites have been recorded within five kilometres of the subject land. No sites of archaeological significance were identified on the subject land during the survey for the planning proposal. One potential archaeological deposit (PAD) was identified at the northern end of the project on the southern side of Stitts Creek, refer to Figure 8. Although the nature of the PAD remains unknown, it will be included with a proposed environmental conservation (E2) zone and will not be located within a development area, therefore no further investigation is necessary for the planning proposal.

Figure 8: PAD location at the northern end of the study area
Source: McCardle Cultural Heritage, August 2018

The AHIA concludes that it is highly unlikely that the subject land would have been favoured for past large-scale Aboriginal occupation but would have been suitable for small-scale camping and hunting and gathering grounds and for travelling to the Manning River.

The AHIA assesses the cumulative impact to Aboriginal heritage in the area to be limited given that:

- the net development footprint (i.e. the area of direct impact) is small and does not affect a high proportion of any particular landform present within the region; and
- a comparable suite of landforms (simple slopes) that are expected to and do contain a similar archaeological resource occur in multiple contexts both within the local area and throughout the region.

Consultation with the Aboriginal community was undertaken for the purpose of documenting the social and cultural significance of the subject land. No aesthetic, historic, scientific or social / spiritual significance was assigned by the Registered Aboriginal Participants (RAPs) to the subject land.

The recommendations in the AHIA are applicable to the development application stage, therefore no further consideration is necessary for the planning proposal.

3.C.3 Has the planning proposal adequately addressed any social and economic effects?

The planning proposal has an overall positive socio-economic impact. An Economic Assessment has been lodged with the planning proposal and is contained at Appendix H. In summary the Assessment found that there are strong economic grounds to support the proposed rezoning of land at Glenthorne for the following reasons:

- Glenthorne is strategically located as a basis of service provision for locals and visitors to the area and is therefore able to ‘tap into’ the economic opportunity that the land’s accessibility and exposure to the Pacific Highway presents. The provision of additional services at the Glenthorne southern gateway will complement the nearby existing

Caltex highway service centre and other automotive services planned for the north of Taree at Cundletown.

- Employment zones on the subject land capitalise on the land's distinctive locational strengths (i.e. highway accessibility and co-location with the existing employment precinct) and has the potential to trigger much needed local investment and job creation.

- The proposal offers the opportunity to incorporate economic and cultural development opportunities in partnership with the Purfleet/Taree Local Aboriginal Land Council.

- The total estimated benefit from stage one of development of the land is likely to equate to approximately $1.73 million annually.

- The Glenthorne rezoning will strengthen the significance of the Manning River Drive Employment Precinct as an important southern entry into Taree. The proposal complements the Northern Gateway precinct, ensuring that Taree captures every opportunity to trade from highway traffic and local resident movements in order to maximise the available local economic benefits.

- The proposed rezoning is consistent with the aims of the draft Manning Valley Local Strategy which seeks to 'grow the local economy' by offering accessible and affordable options for new businesses. This objective is key to current Council and state government initiatives to strengthen the regional economy and to build local resilience in the face of challenging demographic and economic trends.

The planning proposal will result in increased traffic, traffic noise and amenity impacts commensurate with any other industrial and commercial development. This may have an impact, though unlikely to be adverse, on existing residents in the surrounding residential areas. Based upon the economic opportunities but tempered by the gradual increase in traffic, associated noise and change in visual amenity over time it is concluded that development from the planning proposal will have an overall positive community impact. A comprehensive social impact assessment is considered unnecessary in this instance.

Four distinct employment precincts (including B5 Business Development, B6 Enterprise Corridor and IN1 General Industrial) exist north of the planning proposal area, all of which are within a 10 km radius of Taree. These include:

- The Taree CBD and surrounds. It contains a variety of employment zones much of which is developed and, in some instances, transitioning from transport and rural related services to more service-related industries.

- The Brimbin urban release area. This area contains 112 hectares of vacant employment and industrial land. This land is a component of the new town of Brimbin. A detailed master planning process for the new town is scheduled to begin in July 2019. Take up of the employment and industrial land is unlikely to begin in the next 5 years and has been identified for employment generating purposes to employ and service new residents of Brimbin.

- The Northern Gateway Transport Hub at Cundletown. This project area is subject of a current planning proposal (with a Gateway Determination) to establish approximately 67 hectares of road transport and related services / industries. The land has been identified for these purposes because of its proximity to Pacific Highway (Stage 1 located on the north-west corner of the Pacific Highway interchange) and its connection to Taree Airport to the west. Take up of this land will be related primarily to road / air and related services in accordance with a specific clause introduced into GT LEP 2010 to achieve this outcome.

- Kolodong Industrial Estate. This estate, established by Council, is approximately two-thirds developed. The remaining third is heavily vegetated and contains koala habitat making future development in this area problematic without considerable biodiversity offsets in place. Nine small lots are yet to be sold by Council or developed for industrial purposes, while the remaining undeveloped land is proposed to be rezoned for conservation purposes in the new Mid Coast LEP.

Section D – State and Commonwealth Interests

3.D.1 Is there adequate public infrastructure for the planning proposal?

Consultation has been undertaken with the following public authorities during the preparation of the planning proposal to determine the adequacy of public infrastructure for the planning proposal:

- MidCoast Council Water Services.
- NSW Roads and Maritime Services.

MidCoast Council's Water Services Division (MCCWS) have advised that the land is capable of being serviced by the existing water and sewer network with appropriate upgrades.

Development of the area being rezoned would not require any significant up-front public infrastructure upgrades as the road network is capable of servicing the development in its early stages. Road and intersection upgrades are able to be undertaken in stages over the life of the future development of the land when certain development thresholds are met as demonstrated in the TIA at Appendix I.

There is adequate public infrastructure for the planning proposal to proceed.

3.D.2 What are the views of State and Commonwealth public authorities consulted in accordance with the Gateway determination?

The proponents and Council met with the NSW Roads and Maritime Service (RMS) on 2 May 2018. The potential development outcomes were explained in order to provide the RMS with the opportunity to provide feedback and discuss any concerns that should be addressed in the planning proposal. The proponents also requested from the RMS, details of any potential highway upgrades that may have an impact upon the proposal.

The RMS were unable to provide details of any relevant upgrades, stating that there are no works proposed within the RMS' current five year plan that may affect the land or the proposal, and of particular note, there were no current plans to upgrade the Taree South highway interchange.

The RMS advised that modelling would not be required for the highway interchange for the planning proposal, unless modelling and traffic counts for the roundabouts on Manning River Drive indicate that traffic queuing on to the highway may result from the proposal. The RMS' primary concern is whether the development would be likely to cause any queuing back onto the highway. The RMS also stated that they would be concerned if the development included a Highway Service Centre.

As a result of the discussions with the RMS, it was agreed that a TIA for stage 1 of the planning proposal will investigate yield and traffic generated by the potential development of the land for industrial and business purposes, as well as a service station (as this type of development has high traffic volumes and as such provides a more conservative estimate of impact).

In particular, the TIA investigates the split between local traffic and highway traffic and considers whether the planning proposal would have a likely impact on the Pacific Highway and in particular the Old Bar Road / Taree South interchange. This has been considered in detail in the TIA at Appendix I. The modelling results show that the proposal would be unlikely to cause queuing on the Pacific Highway.

Public agency consultation with the following agencies will occur during exhibition of the planning proposal.

- NSW Roads and Maritime Services
- NSW Office of Environment and Heritage
- NSW Rural Fire Service
- TransGrid / Essential Energy
- Telstra / NBN Co
- Taree Airport

Part 4 - Mapping

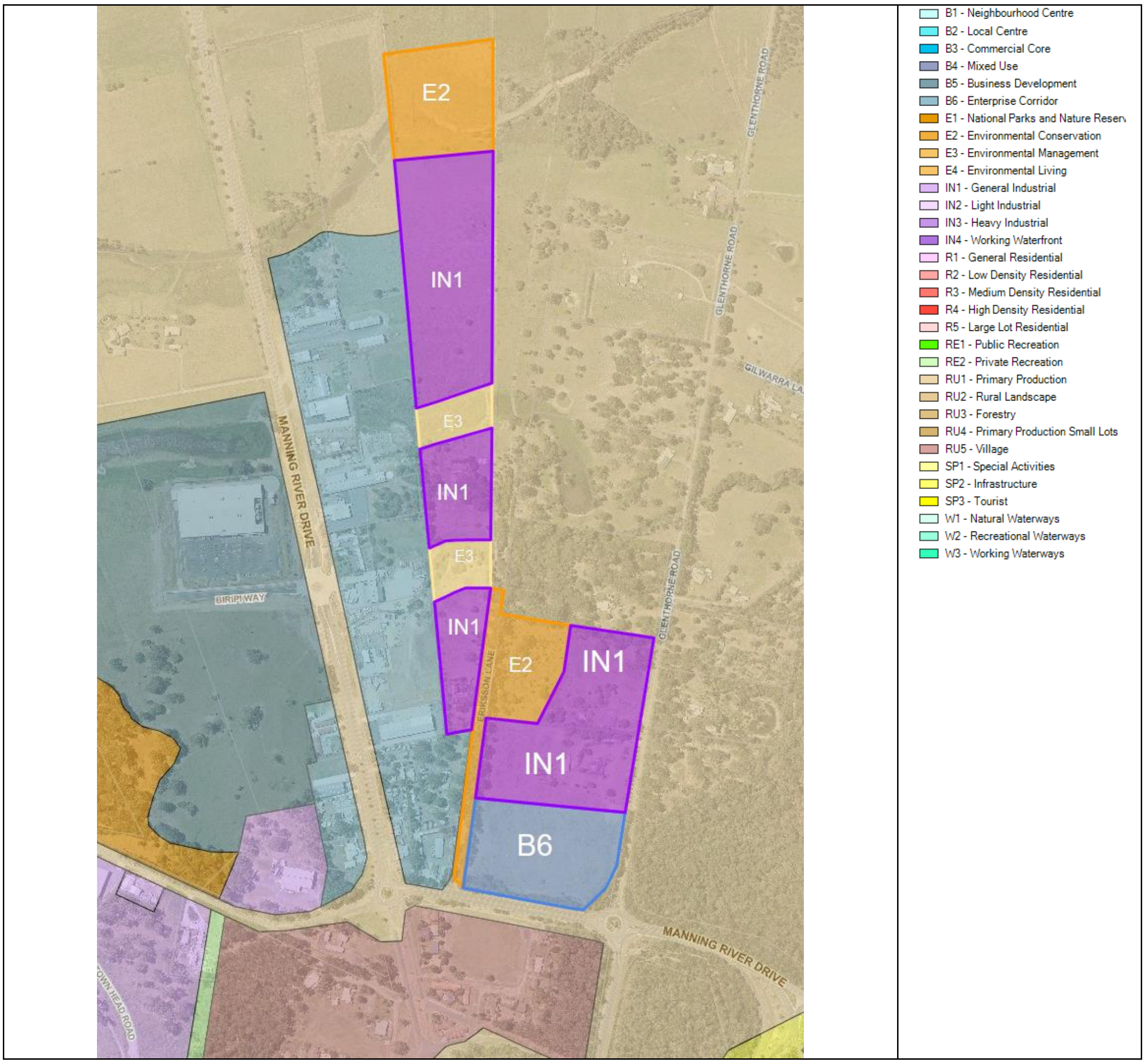
(s.55(2)(d) Maps to be adopted by the proposed instrument)

The proposed amendment to allow for employment lands to be created on the subject land will require amendments to existing map layers/tiles as outlined below.

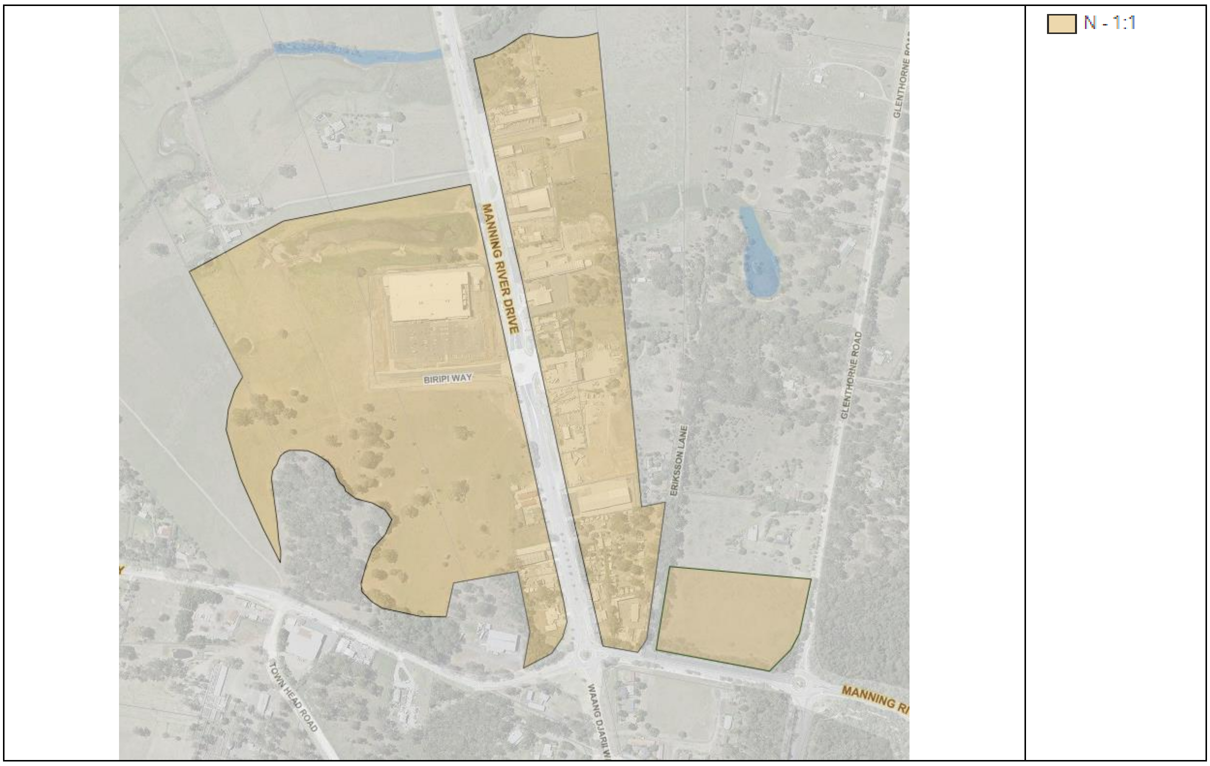
Additional amendments may be identified as the proposal progresses through public exhibition and subsequent stages in the timeline. Should this occur, the planning proposal will be amended and the subsequent amendment to GT LEP 2010 revised to reflect this.

Council will prepare mapping associated with the proposed amendments in accordance with the *Standard Technical Requirements for LEP Maps* for the amended LEP document as follows:

1. The Land Zoning (LZN) Map – Sheet LZN_015A as it affects the subject land would be amended by changing the zone of the subject land from RU1 Primary Production to IN1 General Industrial, B6 Enterprise Corridor, E2 Environmental Conservation and E3 Environmental Management Zones. Note that the RU1 zone currently applies to the land.

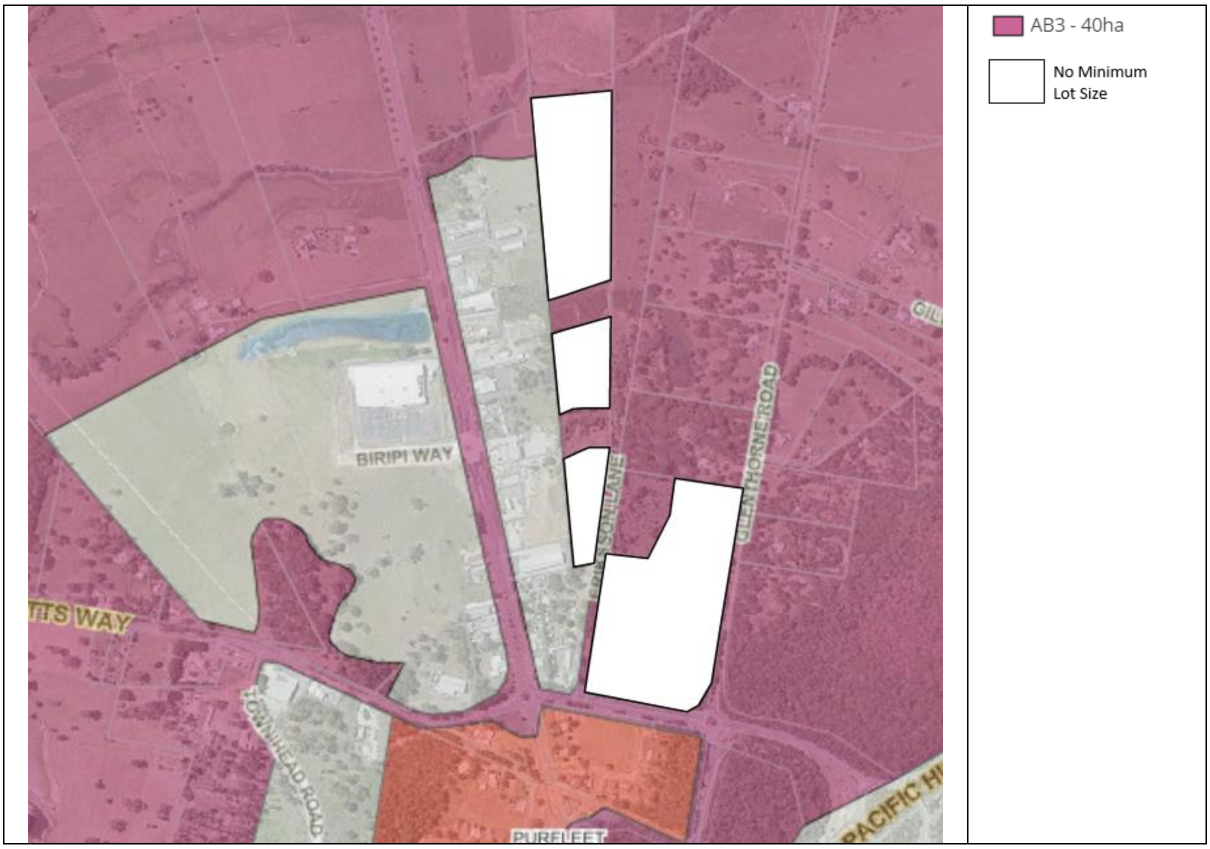


2. The Floor Space Ratio (FSR) Map – Sheet FSR_015A as it affects the subject land would be amended by changing the maximum floor space ratio of part of the B6 Enterprise Corridor zoned Lot 50 DP 863972 to 1 (N). Note that no FSR standard currently applies to the land.



3. The Height of Buildings (HOB) Map – Sheet HOB_015A as it affects the subject land would be amended by changing the maximum building height of part of the B6 Enterprise Corridor zoned Lot 50 DP 863972 to 8.5m. Note that no HOB standard currently exists on the land.

4. The Lot Size (LSZ) Map – Sheet LSZ_015A as it affects the subject land would be amended by removing the minimum lot size applying to Lot 50 DP 863972, Lot 2 DP 573214 and Lot 2 DP 827097 within the IN1 and B6 zones and applying a 40ha minimum lot size to the E2 zone. Note that a 40ha minimum lot size standard currently exists on the land.



Part 5 - Community consultation

In accordance with Section 3.34(2)(c) of the *Environmental Planning and Assessment Act* 1979, this planning proposal will be made publicly available for a minimum of 28 days.

In accordance with Council's adopted consultation protocols the following will also be undertaken:

- Notices in the local newspaper.
- Direct mail notification to potentially affected landowners.
- Exhibition material and all relevant documents will be available on Council's website.

Part 6 - Project timeline

In accordance with the Department of Planning and Environment guidelines, the following timeline is provided, which includes the tasks deemed necessary for the making of this local environmental plan.

Task	Responsibility	Timeframe	Date (approximate)
Council resolution to support the Planning Proposal	Council	-	March 2019
Lodgement of Planning Proposal for Gateway Determination	Council	-	April 2019
Gateway Determination Issued	Minister for Planning		June 2019
Completion of outstanding studies post Gateway	Applicant		June – August 2019
Consultation with Public Authorities in accordance with Gateway Determination	Council	Minimum 21 days	September 2019
Public exhibition of Planning Proposal	Council	Minimum 28 days	April / May 2021
Revision of planning proposal	Council		May 2021
Report to Council	Council	-	June 2021
Making of local environmental plan	Minister for Planning	6 – 8 weeks	July 2021

Part 7 - Conclusion

The primary aims of the planning proposal are to amend the existing Land Zoning, Floor Space Ratio, Height of Buildings, Lot Size and Urban Release Area maps as they affect the subject land to capitalise on the land's locational strengths in order to contribute to growing the local economy and triggering much needed local investment and job creation. This will be achieved by amending the zones on the subject land as follows:

- Lot 50 DP 863972 – B6 Enterprise Corridor and IN1 General Industrial.
- Lot 2 DP 573214 – IN1 General Industrial and E2 Environmental Conservation.
- Lot 2 DP 827097 - IN1 General Industrial, E2 Environmental Conservation and E3 Environmental Management.

- Lot 20 DP 836884 (Eriksson Lane) – E2 Environmental Conservation.

The Proposal is considered to have strategic merit as it:

- Is consistent with the objectives and actions in the *Hunter Regional Plan 2036*.
- Is consistent with the draft Manning Valley Local Strategy.
- Provides a significant contributor to the three core strategies for economic development within the REDS.
- Has distinctive site-specific locational advantages due to its proximity to the Pacific Highway and Manning River Drive, without impacting on highway function; and
- Provides improved amenity at Taree's major entry.

This Planning Proposal identifies relevant environmental, social, economic and site-specific considerations that have been incorporated into the Draft DCP for the site. Requirements within the Draft DCP will require investigation and assessment at the development application stage once the Planning Proposal is endorsed by DPIE and the planning controls within GTLEP 2010 are finalised.

Appendix A – Consistency with Hunter Regional Plan Goals, Directions & Actions

Goal 1 – The leading regional economy in Australia

Direction 1 – Grow Greater Newcastle as Australia's next metropolitan city

Direction 1 is not relevant to this planning proposal as it relates only to the Greater Newcastle area.

Direction 2 – Enhance connections to the Asia-Pacific through global gateways

Direction 2 is not relevant to this planning proposal as it relates only to the Greater Newcastle area.

Direction 3 – Revitalise Newcastle City Centre

Direction 3 is not relevant to this planning proposal as it relates only to the Newcastle city centre.

Direction 4 – Enhance inter-regional linkages to support economic growth

Action 4.1 Enhance inter-regional transport connections to support economic growth.	**Consistent.** The location of the subject land adjacent to a major Pacific Highway interchange, only 2 hours drive north of Newcastle, supports this action.
Action 4.2 Work with stakeholders to upgrade transport network capacity in line with changing demands.	**Not relevant to this planning proposal.** This action relates to public agency infrastructure provision.
Action 4.3 Strengthen and leverage opportunities from the interconnections with other regions, particularly the Pacific Highway, the Golden Highway and the New England Highway.	**Consistent.** The planning proposal strengthens opportunities for interconnections with the North Coast region as it proposes to create an employment lands area located in close proximity to the Pacific Highway on the northern fringe of the Hunter. It is expected that businesses will be attracted from both within the Hunter and from the North Coast Region, Greater Sydney and beyond.
Action 4.4 Promote freight facilities that leverage the Port of Newcastle and its associated freight transport network.	**Consistent.** Whilst the planning proposal is not located in close proximity to the Port of Newcastle it is expected that it will make a contribution to leveraging the Port of Newcastle via potential freight movements, particularly associated with imports and exports.
Action 4.5 Plan for multimodal freight facilities that support economic development of the region and respond to the location of the proposed Freight Rail Bypass.	**Not relevant to this planning proposal.** The proposal does not relate to a multimodal freight facility and is not located in the vicinity of the proposed freight rail bypass.
Action 4.6 Investigate opportunities for logistics and freight growth and other complementary land uses around airports, leveraging investments at Taree and Newcastle airports.	**Consistent**. Although the subject land is not located within direct proximity to the Taree airport, the growth of logistics and freight industries on the subject land is likely to support the use of Taree Airport (being located approximately 6km north) and strengthen the intention of the Northern Gateway project to make Taree a hub for freight and logistics.
Action 4.7 Enhance the efficiency of existing nationally significant transport corridors and	**Consistent.** The subject land will result in development that is appropriate for this location

protect their intended use from inappropriate surrounding land uses.	within close proximity to the Pacific Highway, whilst not encroaching on to the Highway corridor.
Action 4.8 Enable development that relies on access to the Hunter Expressway interchanges,	**Not relevant to this planning proposal.** The proposal is not located in the vicinity of the Hunter Expressway interchanges.
Action 4.9 Balance competing interests and deliver conservation, transport and land use planning objectives in the national pinch point area by: • identifying preferred habitat corridors and priorities for investment in conservation to sustain habitat connectivity; and • developing an integrated management plan for the area.	**Not relevant to this planning proposal.** The proposal is not located in the national pinch point area.
Action 4.10 Prepare a strategy for land along the Hunter Expressway that considers its region-shaping potential.	**Not relevant to this planning proposal.** The proposal is not located along the Hunter Expressway.
Action 4.11 Update the Hunter Regional Transport Plan to ensure there are improved connections to jobs, study and centres for Hunter residents.	**Not relevant to this planning proposal.** This action is the responsibility of State government agencies.
Direction 5 – Transform the productivity of the Upper Hunter	
Direction 5 is not relevant to this planning proposal as it relates only to the Upper Hunter area.	
Direction 6 – Grow the economy of MidCoast and Port Stephens	
Action 6.1 Enhance tourism infrastructure and connectivity, recognising the importance of: • regional and inter-regional connections via the Pacific Highway and the Newcastle and Taree airports and cruise ship gateways; and • local routes such as the Lakes Way and Nelson Bay Road.	**Consistent.** The proposal includes zones that can provide a service for specialised vehicle repair for tourists travelling on the Pacific Highway.
Action 6.2 Enhance links to regional services in Greater Newcastle.	**Not relevant to this planning proposal.** This action is the responsibility of State government agencies.
Action 6.3 Enable economic diversity and new tourism opportunities that focus on reducing the impacts of the seasonal nature of tourism and its effect on local economies.	**Not relevant to this planning proposal.** The proposal would not have an impact on the tourist sector.
Action 6.4 Promote growth of industries that can leverage accessibility provided by the Pacific Highway.	**Consistent.** The rezoning would promote the growth of industries that can leverage efficient access on to the Pacific Highway without requiring heavy vehicles to travel through towns or residential areas.

Action 6.5 Plan for and provide infrastructure and facilities that support the ageing population.	**Not relevant to this planning proposal.** The proposal does not include zones that would directly enable the provision of infrastructure and facilities that would support the ageing population.
Direction 7 - Develop advanced manufacturing, defence and aerospace hubs	
Action 7.1 Facilitate development opportunities on land surrounding Newcastle Airport at Williamtown to cluster emerging high-technology industry, defence and aerospace activities.	**Not relevant to this planning proposal.** The proposal is not located on land surrounding Newcastle Airport.
Action 7.2 Grow and diversify the manufacturing sector through local planning and appropriate planning controls.	**Consistent.** The proposal would provide land to allow growth and diversification of the manufacturing sector by zoning the subject land for uses that include manufacturing.
Action 7.3 Promote manufacturing business export opportunities and become part of global supply chains.	**Consistent.** The proposal would provide land that would allow promotion of manufacturing business export opportunities that are capable of becoming part of global supply chains due to proximity to good transport links, including road and air.
Action 7.4 Facilitate research partnerships between tertiary education providers and businesses.	**Consistent.** The proposal would provide land that could facilitate research partnerships between tertiary education providers and businesses as it provides land suitable for advanced manufacturing, defence and aerospace hubs close to major transport routes.
Action 7.5 Protect strategic defence establishments with appropriate planning controls and compatible adjoining land uses.	**Not relevant to this planning proposal.** The proposal is not located on land within the vicinity of strategic defence establishments.
Direction 8 – Promote innovative small business and growth in the service sectors	
Action 8.1 Implement initiatives to promote small business growth and innovation, particularly in Newcastle City centre and other strategic centres.	**Consistent.** The proposal would allow for implementation of initiatives to support small business growth and innovation.
Action 8.2 Facilitate opportunities for incubator spaces for technology and non-technology early stage businesses and ensure opportunities for new and emerging enterprises are encouraged.	**Consistent.** The proposed zoning would facilitate opportunities for incubator spaces and ensure that suitable land within MidCoast is available for establishment of new and emerging enterprises.
Action 8.3 Improve connectivity to the region's major health and education precincts and strategic centres.	**Not relevant to this planning proposal.** The proposal is not located on land within the vicinity of strategic or major centres for health and education. While the Manning Health Precinct is located in Taree, this proposal will not impact upon it.
Action 8.4 Foster education precincts in Greater Newcastle to encourage a centre of	**Not relevant to this planning proposal.** The proposal is not located within Greater Newcastle.

excellence in tertiary and vocational education.	
Action 8.5 Establish a health precinct around Metford and other hospitals in the region, including Manning Base Hospital at Taree.	**Not relevant to this planning proposal.** The proposal is not located on land within the vicinity of a health precinct. While the Manning Health Precinct is located in Taree, this proposal will not impact upon it
Action 8.6 Determine potential to grow allied health services on land around hospitals and health services at Kurri Kurri, Belmont, Cessnock, Gloucester, Muswellbrook, Singleton, Nelson Bay and Dungog.	**Not relevant to this planning proposal.** The proposal is not located on land near these centres.
Direction 9 – Grow Tourism in the region	
Direction 9 is not relevant to this planning proposal as it does not relate to any zone that facilitates tourist development.	
Direction 10 – Protect and enhance agricultural productivity	
Action 10.1 Protect locations that can accommodate agricultural enterprises from incompatible development, and facilitate the supply chain, including infrastructure, distribution areas, processing facilities and research and development in local plans.	**Consistent.** The proposed zoning would facilitate opportunities for some agricultural enterprises related to supply chains (e.g. distribution centre). The land proposed for rezoning adjoins an existing employment precinct and is not itself suitable for agricultural enterprises. The proximity of the land to the Pacific Highway makes it particularly suitable for employment uses.
Action 10.2 Address sector-specific considerations for agricultural industries through local plans.	**Not relevant to this planning proposal.** The proposal is not related to sector-specific agricultural industries.
Action 10.3 Protect the region's wellbeing and prosperity through increased biosecurity measures.	**Not relevant to this planning proposal.** The proposal does not enable development that relates to biosecurity measures.
Action 10.4 Encourage niche commercial, tourist and recreation activities that complement and promote a stronger agricultural sector and build the sector's capacity to adapt to changing circumstances.	**Consistent.** The proposed zoning would facilitate opportunities for niche commercial activities related to artisan food and drink industries.
Action 10.5 Develop an agribusiness industry strategy in areas experiencing high population growth to retain jobs and agribusiness growth for the Hunter.	**Not relevant to this planning proposal.** The proposal is not located in an area experiencing high population growth.
Action 10.6 Manage Biophysical Strategic Agricultural Land and other important agricultural land as locations for agricultural activities and complementary uses.	**Not relevant to this planning proposal.** The proposal is not located on Biophysical Strategic Agricultural Land.
Direction 11 – Manage the ongoing use of natural resources	
Direction 11 is not relevant to this planning proposal as this direction relates to the mining sector.	
Direction 12 – Diversify and grow the energy sector	

Direction 12 is not relevant to this planning proposal as this direction relates to the energy sector.	
Direction 13 – Plan for greater land use compatibility	
Action 13.1 Identify and protect important agricultural land, including intensive agricultural clusters, in local plans to avoid land use conflicts, particularly associated with residential expansion.	**Consistent.** The proposal is not located on important agricultural land or within an agricultural cluster. The proposal would be unlikely to result in land use conflicts.
Action 13.2 Limit urban and rural housing encroachment into identified agricultural and extractive resource areas, industrial areas and transport infrastructure when preparing local strategies.	**Not relevant to this planning proposal.** The proposal does not facilitate residential development.
Action 13.3 Amend planning controls to deliver greater certainty of land use.	**Consistent.** The proposal delivers greater certainty of land use.
Action 13.4 Provide non-statutory guidance on the types of land uses that would be considered most appropriate, suitable or sympathetic to existing land uses in the Upper Hunter and other areas where land use conflicts occur.	**Not relevant to this planning proposal.** The proposal is for an amendment to an environmental planning instrument as an addition to an existing employment precinct and is not in an area where land use conflicts are experienced
Goal 2 – A biodiversity-rich natural environment	
Direction 14 - Protect and connect natural areas	
Action 14.1 Identify terrestrial and aquatic biodiversity values and protect areas of high environmental value to sustain the lifestyle, economic success and environmental health of the region.	**Consistent.** The proposal includes rezoning areas of high environmental value within the subject land for protection in perpetuity.
Action 14.2 Identify and strengthen biodiversity corridors as places for priority biodiversity offsets.	**Not relevant to this planning proposal.** The land is not known to contain any biodiversity corridors.
Action 14.3 Improve the quality of, and access to, information relating to high environmental values.	**Not relevant to this planning proposal.** The land relates to a proposed rezoning for employment purposes.
Action 14.4 Protect biodiversity by maintaining and, where possible, enhancing existing protection of high environmental value areas; implementing appropriate measures to conserve validated high environmental value areas; developing local strategies to avoid and minimise the impacts of development on areas of high environmental value and biodiversity corridors; and identifying offsets or other mitigation measures for unavoidable impacts.	**Consistent.** The proposal includes areas proposed to be rezoned for environmental conservation (E2) in order to protect the aquatic and terrestrial biodiversity values on the land.
Action 14.5 Secure the long-term protection of regionally significant biodiversity corridors.	**Not relevant to this planning proposal.** The land is not known to contain any regionally significant biodiversity corridors.

Direction 15 - Sustain water quality and security

Action 15.1 Protect water catchments to sustain high quality and dependable water supplies across the region.	**Consistent**. Stormwater detention and treatment measures will ensure that water quality is not reduced as a result of the development.
Action 15.2 Effectively manage surface and groundwater use in agricultural areas to support ecosystem function and food production, and to cater for the increasing demand of urban communities and industry.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Action 15.3 Plan for the security of the region's town water supply.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Action 15.4 Implement catchment-based plans for the ongoing sustainable management and health of estuaries.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Action 15.5 Apply the neutral or beneficial water quality objectives to land use planning in surface and groundwater drinking water catchment areas to minimise the effects of development on waterways, including watercourses, wetlands, groundwater dependent ecosystems, riparian lands, estuaries, lakes, beaches and marine waters.	**Consistent.** The proposal will facilitate stormwater treatment measures that will result in a neutral or beneficial outcome for water quality. The land is not within a drinking water catchment.
Action 15.6 Reduce the risk of introduction or spread of aquatic pests and diseases from new development that may affect fisheries and aquaculture industry practices.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Action 15.7 Incorporate water-sensitive design into development that is likely to have an adverse impact on coastal water catchments, water quality and flows.	**Consistent.** Water sensitive design will be incorporated into the layout of the development to ensure that adverse impacts on water quality are minimised.

Direction 16 – Increase resilience to hazards and climate change

Action 16.1 Manage the risks of climate change and improve the region's resilience to flooding, sea level rise, bushfire, mine subsidence, and land contamination.	**Consistent.** Flood prone areas will be located within an E2 zone to protect infrastructure from increased flooding impacts. A flooding and drainage study will be undertaken after Gateway Determination consistent with the NSW Government's Flood Prone Land Policy and the principles of the Floodplain Development Manual 2005. Post Gateway Determination a preliminary local flooding and drainage assessment will be undertaken. A Concept Stormwater Management Strategy and a geotechnical survey (alluvial soils assessment) will also be undertaken. Part of the land is mapped as bushfire prone however the planning proposal does not involve the introduction of residential zones on the land.

<table>
<tr><td></td><td>Nevertheless, consultation with the Commissioner of the NSW Rural Fire Service will occur under section 56 of the EP&A Act and may result in a requirement for a detailed bushfire hazard assessment to be prepared or site specific controls to be included in the proposed Development Control Plan.

A preliminary contamination assessment will be prepared to confirm that the land is not contaminated, and the land is suitable for the zones and uses proposed.</td></tr>
<tr><td>Action 16.2 Review and consistently update floodplain risk and coastal zone management plans, particularly where urban growth is being
investigated.</td><td>Not relevant to this planning proposal. The proposal is for the creation of employment lands.</td></tr>
<tr><td>Action 16.3 Incorporate new knowledge on regional climate projections and related cumulative impacts in local plans for new urban development.</td><td>Not relevant to this planning proposal. While this proposal is for the creation of employment lands and hence is new urban development, there is no new knowledge of regional climate change projections that have not already been considered under this planning proposal.</td></tr>
<tr><td>Action 16.4 Review and update the Newcastle Mines Grouting Fund and investigate its relevance to other areas.</td><td>Not relevant to this planning proposal. The proposal is for the creation of employment lands in the MidCoast LGA.</td></tr>
<tr><td colspan="2">Goal 3 – Thriving communities</td></tr>
<tr><td colspan="2">Direction 17 – Create healthy built environments through good design</td></tr>
<tr><td colspan="2">Direction 17 is not relevant to this planning proposal as this direction relates to design for communities.</td></tr>
<tr><td colspan="2">Direction 18 – Enhance access to recreational facilities and connect open spaces</td></tr>
<tr><td colspan="2">Direction 18 is not relevant to this planning proposal as this direction relates to planning for active and passive recreation.</td></tr>
<tr><td colspan="2">Direction 19 – Identify and protect the region’s heritage</td></tr>
<tr><td>Action 19.1 Consult with the local Aboriginal communities to identify and protect heritage values to minimise the impact of urban growth and development, and to recognise their contribution to the character and landscape of the region.</td><td>Consistent. An Aboriginal Heritage Impact Assessment was undertaken for the purpose of the planning proposal. As part of that assessment the local Aboriginal community was consulted in accordance with the NSW Government’s <i>Aboriginal Cultural Heritage Consultation Requirements for Proponents (April 2010).</i> In addition, the Purfleet – Taree LALC have been offered floor space in the final built development to run a cultural/retail centre that would benefit the local Aboriginal community at Purfleet. This will be further explored post Gateway.</td></tr>
</table>

Action 19.2 Assist the preparation of appropriate heritage studies to inform the development of strategic plans, including regional Aboriginal cultural heritage studies.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Direction 20 – Revitalise existing communities	
Direction 20 is not relevant to this planning proposal as this direction relates to planning for centres.	
Direction 21 – Create a compact settlement	
Direction 21 is not relevant to this planning proposal as this direction relates to planning for housing.	
Direction 22 – Promote housing diversity	
Direction 22 is not relevant to this planning proposal as this direction relates to planning for housing.	
Goal 4 – Greater housing choice and jobs	
Direction 23 – Grow centres and renewal corridors	
Action 23.1 Concentrate growth in strategic centres, local centres and urban renewal corridors to support economic and population growth and a mix of uses.	**Consistent.** The subject land would provide an extension to the existing Manning River Drive Business Precinct, hence supporting economic growth of Taree and the MidCoast.
Action 23.2 Develop precinct plans for centres to take an integrated approach to transport, open space, urban form and liveable neighbourhoods, and investigate the capacity of centres to accommodate additional housing supply and diversity without compromising employment growth.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Action 23.3 Consider improvements to the public transport network when planning new renewal corridors and precincts.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Action 23.4 Investigate locations for new and expanded centres, including within the Newcastle– Lake Macquarie Western Corridor and Maitland Corridor growth areas, and in the established urban areas that are projected to have high demand for housing growth.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands and is not in the nominated or high growth areas.
Action 23.5 Focus commercial and retail development within existing centres and transport hubs and ensure that locations for new centres are integrated with existing or planned residential development; do not undermine existing centres; encompass high quality urban design; and consider transport and access requirements.	**Consistent.** The subject land would provide an extension to the existing Manning River Drive Business Precinct. It will increase the potential for jobs growth and build upon the region's demonstrated economic strengths.
Direction 24 – Protect the economic functions of employment land	

Action 24.1 Locate new employment land so that it does not conflict with surrounding residential uses.	**Consistent.** The subject land is not located adjacent to residential land and will not conflict with surrounding residential uses.
Action 24.2 Protect the economic functions of employment land by not permitting non-industrial uses unless: • opportunities for urban renewal arise through the relocation of industry and in locations well-serviced by public transport; and • contaminated land can be remediated.	**Not relevant to this planning proposal.** The proposal is for the creation of employment lands.
Action 24.3 Provide for mixed use opportunities and themed employment precincts in local plans.	**Consistent.** The planning proposal includes a mix of business and industrial zoned land that will provide for mixed use opportunities.
Direction 25 – Monitor housing and employment supply and demand	
Action 25.1 Establish and implement an Urban Development Program to develop data on existing zoned land supply and its servicing status, monitor dwelling production and take-up rates, and coordinate the staged release and rezoning of land.	**Not directly relevant to this planning proposal.** The proposal is for the site-specific creation of employment lands.
Action 25.2 Establish and implement an Employment Lands Development Program to develop data on existing and future planned stocks of employment land.	**Not directly relevant to this planning proposal.** The proposal is for the site-specific creation of employment lands.
Action 25.3 Sequence new greenfield urban development that makes efficient use of infrastructure networks and capacity.	**Consistent.** The proposal is for a site-specific rezoning that makes efficient use of existing infrastructure networks and capacity.
Action 25.4 Maintain an adequate supply of employment land that is appropriately serviced and to respond to changing industry demands for land use, location and floor space.	**Consistent.** The proposal will provide employment land that is capable of being appropriately serviced and can respond to changing industry demands for highway-related land-uses and lot sizes to allow greater floor space for manufacturing, transport and logistics services.
Direction 26 – Deliver infrastructure to support growth and communities	
Action 26.1 Align land use and infrastructure planning to maximise the use and capacity of existing infrastructure and the efficiency of new infrastructure.	**Consistent.** The subject land is in close proximity to the Pacific Highway to capitalise on accessibility and exposure. The land’s distinctive locational strengths have the potential to trigger local investment and job creation. Only minor infrastructure upgrades would be required for delivery of the proposal.
Action 26.2 Enable the delivery of health facilities, education, emergency services, energy production and supply, water and wastewater, waste disposal areas,	**Not relevant to this planning proposal.** The proposal is for the site-specific creation of employment lands.

cemeteries and crematoria, in partnership with infrastructure providers.	
Action 26.3 Protect existing and planned major infrastructure corridors and sites, including inter-regional transport routes like the M1 Pacific Motorway and the railway, port and airports, to support their intended functions.	**Not directly relevant to this planning proposal.** The proposal is for the site-specific creation of employment lands. The land is located outside of the Pacific Motorway corridor.
Action 26.4 Coordinate the delivery of infrastructure to support the timely and efficient release of land for development, including working with councils and service providers on inter-regional infrastructure and service delivery issues between growing areas.	**Not directly relevant to this planning proposal.** The proposal is for the site-specific creation of employment lands, though it does rely upon the delivery of efficient inter-regional infrastructure.
Action 26.5 Ensure growth is serviced by enabling and supporting infrastructure.	**Not directly relevant to this planning proposal.** The proposal is for the site-specific creation of employment lands, though it does rely upon enabling and supporting infrastructure.
Action 26.6 Review and finalise the Hunter Special Infrastructure Contributions Plan.	**Not directly relevant to this planning proposal.** This is a State government action.
Direction 27 – Strengthen the economic self-determination of Aboriginal communities	
Action 27.1 Work with the Purfleet–Taree, Forster, Karuah, Worimi, Mindaribba, Awabakal, Bahtabah, Biraban and Wanaruah Local Aboriginal Land Councils to identify priority sites that can create a pipeline of potential projects.	**Consistent.** The proposal includes the potential dedication of floor space to the Purfleet – Taree LALC for an economic self-determination purpose.
Action 27.2 Identify landholdings and map the level of constraint at a strategic scale for each site to develop options for the potential commercial use of the land.	**Not directly relevant to this planning proposal.** The proposal is for the site-specific creation of employment lands, though it does contribute to the commercial use of land.

Appendix B – Consistency with State Environmental Planning Policies (SEPPs)

State Environmental Planning Policy (SEPP)	Response
SEPP No 1—Development Standards	Not applicable (NA).
SEPP No 19—Bushland in Urban Areas	N/A. This SEPP does not apply to the Mid Coast local government area.
SEPP No 21—Caravan Parks	N/A. Development consent is not being sought for a caravan park.
SEPP No 30—Intensive Agriculture	Repealed.
SEPP No 33—Hazardous and Offensive Development	The proposal is consistent with the objectives of the SEPP. The planning proposal would permit with consent potentially hazardous and potentially offensive forms of industry on the industrial zoned land. Any application for potentially hazardous and potentially offensive forms of industry will require consideration of the matters under Clause 13 for the purposes of determining such an application, including a hazard risk analysis. There are no existing or likely future residential zones adjoining the proposed industrial land. A village zone is located on the southern side of Manning River Drive, approximately 45m south of the potential service station site and a caravan park is located approximately 160m west. The risks associated with any current or likely future land uses are low.
SEPP No 36—Manufactured Home Estates	N/A. The proposed zones will not permit a caravan park or manufactured home estate (nor is it appropriate to do so) and as such the provisions of the SEPP are not relevant to this proposal.
SEPP Koala Habitat Protection (2020)	*State Environmental Planning Policy (Koala Habitat Protection) 2020* replaced and repealed the 2019 Koala SEPP. The 2020 SEPP largely reinstated SEPP 44. It is noted that *State Environmental Planning Policy (Koala Habitat Protection) 2021* commenced in March 2021. It applies to all zones within the Mid Coast LGA other than the RU1, RU2 and RU3 zones. Hence SEPP Koala Habitat Protection (2020) applies to the site. The proposal is consistent with the objectives of the SEPP. The proposal seeks to rezone those areas with the highest concentration of Koala feed trees for environmental conservation. A detailed biodiversity assessment (Stage 1 BDAR) has been undertaken to determine and assess Core Koala habitat and other aspects pertaining to SEPP Koala Habitat Protection (2020). The boundaries of the E2 Environmental Conservation zone located within Lot 20 DP 836884 (Eriksson Lane) and on the western portion of Lot 2 DP 573215 have been identified as

State Environmental Planning Policy (SEPP)	**Response**
	such to enable the protection of identified core koala habitat within the bounded areas.
SEPP No 47—Moore Park Showground	Not applicable
SEPP No 50—Canal Estate Development	Not applicable
SEPP No 52—Farm Dams and Other Works in Land and Water Management Plan Areas	Repealed.
SEPP No 55—Remediation of Land	The land has not been identified as contaminated. A preliminary contamination assessment has been prepared and confirms that the land is not contaminated and is land suitable for the zones and uses permitted.
SEPP No 62—Sustainable Aquaculture	Repealed.
SEPP No 64—Advertising and Signage	The planning proposal would permit with consent advertising and signage associated with the likely future commercial and industrial uses. Any application for this type of development would require consideration of the matters under Schedule 1 of the SEPP for the purposes of determining advertising and signage applications. The planning proposal is consistent with this SEPP.
SEPP No 65—Design Quality of Residential Apartment Development	Not applicable
SEPP No 70—Affordable Housing (Revised Schemes)	Not applicable
SEPP (Aboriginal Land) 2019	Not applicable
SEPP (Affordable Rental Housing) 2009	Not applicable
SEPP (Building Sustainability Index: BASIX) 2004	Not applicable
SEPP (Coastal Management) 2018	The land is partly located within the Coastal Environment Area. The application of the proposed E2 and E3 zones on the subject land will ensure that the objectives of the Coastal Environment Area are achieved. The planning proposal is consistent with this SEPP.
SEPP (Educational and Child Care Facilities) 2017	Not applicable
SEPP (Exempt and Complying Development Codes) 2008	The planning proposal would permit certain commercial and industrial development as exempt or complying which are not

State Environmental Planning Policy (SEPP)	Response
	currently permitted, by virtue of the introduction of the IN1 and B6 zones.
SEPP (Gosford City Centre) 2018	Not applicable
SEPP (Housing for Seniors or People with a Disability) 2004	Not applicable
SEPP (Infrastructure) 2007	The planning proposal would permit with consent various forms of traffic-generating development that are to be referred to Roads and Maritime Services (RMS) in accordance with Cl.104 of the SEPP. In determining an application, the consent authority must take in to account any submission from the RMS, as well as the accessibility of the land and any potential traffic safety, road congestion or parking implications. The planning proposal will be referred to the RMS for comment following completion of the detailed traffic assessment and development of the DCP. The future development of the land is likely to require minor alterations to the existing electricity and communications networks in the vicinity of the land. The planning proposal will be referred to TransGrid and Essential Energy for comment.
SEPP (Kosciuszko National Park—Alpine Resorts) 2007	Not applicable
SEPP (Kurnell Peninsula) 1989	Not applicable
SEPP (Mining, Petroleum Production and Extractive Industries) 2007	Not applicable
SEPP (Miscellaneous Consent Provisions) 2007	Not applicable
SEPP (Penrith Lakes Scheme) 1989	Not applicable
SEPP Primary Production and Rural Development 2019	The current zoning of the subject land is RU1 Primary Production. Three (3) watercourses traverse the site; certain routine maintenance of artificial water supply or drainage channel is permissible without consent on land to which this Part applies. A BDAR has been undertaken and accompanies this report with reference to best practices for environmental management and maintaining biodiversity at the site. The planning proposal is consistent with this SEPP.
SEPP (Rural Lands) 2008	Repealed
SEPP (State and Regional Development) 2011	The planning proposal is not State or Regional development but may enable the delivery of those forms of development subject to approval by the relevant determining authority.

State Environmental Planning Policy (SEPP)	Response
SEPP (State Significant Precincts) 2005	Not applicable
SEPP (Sydney Drinking Water Catchment) 2011	Not applicable
SEPP (Sydney Region Growth Centres) 2006	Not applicable
SEPP (Three Ports) 2013	Not applicable
SEPP (Urban Renewal) 2010	Not applicable
SEPP (Vegetation in Non-Rural Areas) 2017	The SEPP applies to land within the proposed zones. Any clearing of vegetation on the subject land would be subject to Council approval unless it is clearing authorised under other legislation. The planning proposal is consistent with this SEPP.
SEPP (Western Sydney Employment Area) 2009	Not applicable
SEPP (Western Sydney Parklands) 2009	Not applicable

Appendix C – Consistency with S9.1 Ministerial Directions

S9.1 Ministerial Direction	Consistency
1. Employment and Resources	
1.1 Business and Industrial Zones	Direction applies and the planning proposal is consistent with direction 1.1 (4). The planning proposal does not reduce the total potential floor space area for employments uses and related public services in business zones. The planning proposal does not reduce the total potential floor space area for industrial uses in industrial zones. The planning proposal seeks to co-locate new industrial and business zoned land within an existing employment lands precinct. The proposed new employment area is consistent with the MidCoast REDS (prepared by the NSW Department of Premier and Cabinet, 2018) focus on industry specialisation and capitalisation on locational advantages, and largely consistent with the area identified in the draft MVLS for expansion of the Manning River Drive Employment Precinct. Hence, this planning proposal is Consistent with this Direction.
1.2 Rural Zones	Direction applies and the planning proposal is inconsistent with direction 1.2 (4a) This inconsistency however can be justified on the basis that the planning proposal would rezone marginal rural land for industrial and business purposes, which is important for the realisation of the outcomes of the MidCoast REDS. The proposed new employment area is consistent with the draft MVLS (June 2016), and the MidCoast REDS. However, the planning proposal can be considered Consistent if it is prepared in accordance with a relevant Regional Plan (1.2(5c)) or is of minor significance (1.2(5d)). This planning proposal meets both of these parts and hence it is Consistent with this Direction.
1.3 Mining, Petroleum Production and Extractive Industries	Direction applies and the planning proposal is consistent with direction 1.3 (3). The planning proposal does not alter the permissibility of mining, petroleum production or extractive industries on the subject land. There are no mines or quarries in proximity to the land or any State or regionally significant resources identified either on, or in close proximity to, the land.
1.4 Oyster Aquaculture	Direction applies and the planning proposal is consistent with direction 1.4 (3). The subject land is located a minimum of 10km upstream of Oyster Aquaculture areas within the Manning River and is not located within close proximity to any Priority Oyster Aquaculture Area. There is unlikely to be a negative impact on water quality on the Manning River as control of stormwater will be required for the development lands and the subject land will be connected to reticulated sewer.
1.5 Rural Lands	Direction applies as the planning proposal will affect land within an existing rural zone (1.5(3a)). While the planning proposal is consistent with some parts under clause 4, it is inconsistent with others.

S9.1 Ministerial Direction	Consistency
	However, as it is deemed to be of minor significance (clause 6(b)) it is therefore consistent with this Direction. The proposed new employment area is consistent with the draft MVLS (June 2016), and the MidCoast REDS
2. Environment and Heritage	
2.1 Environmental Protection Zones	Direction applies and the planning proposal is consistent with direction 2.1 (4). A Biodiversity Assessment Report refer to Section 3.C.1 and Appendix D. The sensitive areas on the land, identified by further detailed ecological assessment of the planning proposal, will be rezoned for environmental conservation purposes. The Biodiversity Assessment Report has been prepared using the Biodiversity Assessment Method under the *Biodiversity Conservation Act 2016* and prepared by an accredited person under the Act.
2.2 Coastal Management	Direction applies and the planning proposal is consistent with direction 2.2 (4). The sensitive areas on the land will be rezoned for environmental conservation purposes to protect the values of the coastal zone and achieve the objects of the *Coastal Management Act 2016*. Under the SEPP (Coastal Management) 2018 no part of the land is located within a coastal vulnerability area or on land affected by Coastal Wetlands, Proximity Area for Coastal Wetlands, Littoral Rainforests, or Proximity Area for Littoral Rainforests. The northern part of Lot 2 DP 827097 is within the Coastal Environment Area and this area has been identified for rezoning to E2 Environmental Conservation. This area and further land within the lot but to the south is also within the Coastal Environment Area and consideration for specific development controls will occur in the preparation of the site specific DCP.
2.3 Heritage Conservation	Direction applies and the planning proposal is consistent with direction 2.3 (4). The land does not contain any listed or potential items of European heritage significance and is not located within close proximity to a heritage conservation area. With respect to Aboriginal heritage, an Aboriginal Heritage Impact Assessment (AHIA) has been undertaken, refer to Section 3.C.2.13 and Appendix G. The AHIA identified a potential Aboriginal deposit (PAD) at the northern end of the subject land that will be conserved through the application of an environmental conservation zone. No other items of heritage significance are known to occur on the land.
2.4 Recreation Vehicle Areas	Not applicable. The planning proposal does not enable land to be developed for the purpose of a recreational vehicle area.
2.5 Application of E2 and E3 zones and Environmental Overlays in Far North Coast LEPs	Not applicable. The subject land is not located on the Far North Coast.

S9.1 Ministerial Direction	Consistency
2.6 Remediation of Contaminated Land	Direction applies and the planning proposal is consistent with direction 2.6 (4). A Preliminary Site Investigation Report has been provided and is found at Appendix F. Based on the results within the Preliminary Site Investigation Report the site is considered suitable for the proposed rezoning. Site preparation works and appropriate site management protocols consistent with legislative requirements will be required at the development application stage.
3. Housing, Infrastructure and Urban Development	
3.1 Residential Zones	Not applicable. No residential zones are proposed.
3.2 Caravan Parks and Manufactured Home Estates	Not applicable. Caravan Parks and Manufactured Home Estates are not permitted in the current RU1 zone nor the proposed zones recommended within the planning proposal.
3.3 Home Occupations	Not applicable. No residential zones are proposed.
3.4 Integrating Land Use & Transport	Under clause 3.4(4) this Direction states that a planning proposal must locate zones for urban purposes and include provisions that give effect to and are consistent with the aims, objectives and principles of: (a) *Improving Transport Choice – Guidelines for planning and development* (DUAP 2001), and (b) *The Right Place for Business and Services – Planning Policy* (DUAP 2001). The planning proposal is consistent with direction 3.4 (4) and the aims, objectives and principles of the above-mentioned publications. The planning proposal involves the creation of additional industrial and business zoned land located in the vicinity of the existing Manning River Drive Employment Precinct. The subject land has direct access to Glenthorne Road and Eriksson Lane and can potentially access, at a later date, to Manning River Drive. The subject land is located close to the Pacific Highway interchange to provide for the efficient movement of freight. *Integrating Land Use and Transport – Improving Transport Choice* (DUAP, 2001) suggests that industrial zones in urban fringe locations are suitable for businesses with significant freight movements and low employment density, which is consistent with the proposed use of the subject land. However, there are existing and frequent bus services along Manning River Drive. Future uses within the planning proposal area will support an increase in the operation of the local (private) public bus service. Extensions to the existing footpath and cycleway network (within the site) will connect the subject land to Taree and be documented in the site specific DCP. Post Gateway Determination an updated Traffic Impact Assessment will be prepared to include internal road and

S9.1 Ministerial Direction	Consistency
	access arrangements, including consideration of a link from Manning River Drive southbound to Glenthorne Road via the subject land.
3.5 Development Near Licensed Aerodromes	The subject land is identified within the Obstacle Limitation Surface Map (Sheet OLS_015A) contained in GT LEP 2010 and hence this Direction applies. The subject land is near a regulated airport, namely Taree Airport. Consistency with this Direction will be demonstrated by consultation with, and consideration of comments from, the lessee / operator of Taree Airport. Consultation with the operators of Taree Airport will occur post Gateway Determination.
3.6 Shooting Ranges	Not applicable. The subject land is not located within close proximity to a shooting range.
3.7 Reduction in non-hosted short-term rental accommodation period	Not applicable. The subject land is not located within the Byron Bay local government area.
4. Hazard & Risk	
4.1 Acid Sulfate Soils	Direction applies and the planning proposal is inconsistent with direction 4.1 (6) which requires an acid sulfate soils (ASS) study prior to the preparation of a planning proposal. An ASS study has not been prepared. The southern half of the subject land contains Class 5 ASS, and the majority of the northern half contains Class 4 ASS. Small portions of Class 3 and Classes 2a and 2b ASS occur in the far north of the land, within an area that will be zoned for environmental conservation, refer to Section 3.C.2.3. Clause 7.1 of GT LEP 2010 contains the standard ASS risk management provisions to appropriately control future development of the land at the DA stage. The inconsistency with direction 4.1 (6) however can be justified on the basis that the soils likely to be impacted upon by future development are Class 4 and 5 and Council has ASS risk management provisions within GT LEP 2010 to consider the impact of development at the DA stage. Therefore, the inconsistency is considered minor and under clause 8(b) it is then considered as being consistent with this Direction.
4.2 Mine Subsidence and Unstable Land	Not applicable. The subject land is not located within a Mine Subsidence District.
4.3 Flood Prone Land	Direction applies and the planning proposal is inconsistent with direction 4.3 (5) which states that a planning proposal must not rezone land within the flood planning areas to a Business or Industrial zone. Flooding and drainage is addressed in Section 3.C.2.4 and identifies that a small

S9.1 Ministerial Direction	Consistency
	portion of the central and northern parts of the subject land are located within Council's Flood Prone Land mapped area. Clause 7.2 of GTLEP 2010 contains the standard flood planning and flood risk management provisions to appropriately control future development of the land. Much of the flood prone land will be contained within an environmental conservation zone and will therefore not be developed. A flooding and drainage study will be undertaken after Gateway Determination to ensure that the proposal is consistent with the NSW Government's *Flood Prone Land Policy* and the principles of the *Floodplain Development Manual 2005*, and to ensure that the development is commensurate with the flood hazard and includes consideration of the potential flood impacts both on and off the subject land. The inconsistency with direction 4.3 (5) however can be justified on the basis that the majority of the flood prone land will be within an environmental conservation zone and a flooding and drainage study will be undertaken after Gateway Determination consistent with the NSW Government's *Flood Prone Land Policy* and the principles of the *Floodplain Development Manual 2005.* Post Gateway Determination a preliminary local flooding and drainage assessment will be undertaken. A Concept Stormwater Management Strategy and a geotechnical survey (alluvial soils assessment) will also be undertaken. Only a very small part of the site is deemed inconsistent with this Direction. As 4.3(9b) allows a minor inconsistency to be deemed consistent, this planning proposal is deemed to be consistent with this Direction.
4.4 Planning for Bushfire Protection	Direction applies and it is not yet possible to determine if the planning proposal is consistent with direction 4.4 (5) and 4.4 (6) which require introduction of controls that avoid placing inappropriate developments in hazardous areas. As identified in Section 3.C.2.2 part of the land is mapped as bushfire prone, however the planning proposal does not include residential land and is unlikely to enable inappropriate development in bush fire prone areas. The proposal does not introduce controls that will prohibit bushfire hazard reduction within APZs. The compliance of any future development with *Planning for Bushfire Protection 2019* will be addressed in detail at development application stage. Consultation with the Commissioner of the NSW Rural Fire Service will occur under Section 3.34 of the EP&A Act, thereby confirming Consistency with this Direction and whether any additional controls need to be included in the Draft DCP.
5. Regional Planning	
5.1 Revoked	Not applicable.

S9.1 Ministerial Direction	Consistency
5.2 Sydney Drinking Water Catchments	Not applicable. The subject land is not located within the Sydney Drinking Water catchment area.
5.3 Farmland of State and Regional Significance on the NSW Far North Coast	Not applicable. The subject land is not located within the NSW Far North Coast.
5.4 Commercial and Retail Development along the Pacific Highway, North Coast	Not applicable. Although the subject land is located near to the Pacific Highway, it does not have frontage to the Pacific Highway, being located approximately 200m west of the Old Bar Road Taree South interchange.
5.5 Revoked	Not applicable.
5.6 Revoked	Not applicable.
5.7 Revoked	Not applicable.
5.8 Second Sydney Airport: Badgerys Creek	Not applicable. The subject land is not located within the vicinity of the second Sydney Airport
5.9 North West Rail Link Corridor Strategy	Not applicable. The subject land is not located within the vicinity of the North West Rail Link Corridor
5.10 Implementation of Regional Plans	Direction applies and the planning proposal is consistent with direction 5.10 (4) requiring planning proposals to be consistent with a Regional Plan release by the Minister for Planning. The relevant Regional Plan is the Hunter Regional Plan 2036. The planning proposal is consistent with all of the relevant goals, directions and actions of the Hunter Regional Plan 2036 as outlined in Section 3.B.1 and as detailed in Appendix A.
5.11 Development of Aboriginal Land Council land	Not applicable. This Direction will eventually apply to all relevant planning proposal authorities however at the point of preparation of this planning proposal the Direction applied only to land in the Central Coast local government area.
6. Local Plan Making	
6.1 Approval and Referral Requirements	Direction applies and the planning proposal is consistent with direction 6.1 (4). The planning proposal does not include any additional provisions relating to concurrence, consultation or referral of development applications.
6.2 Reserving Land for Public Purposes	Direction applies and the planning proposal is consistent with direction 6.2 (4). The planning proposal does not involve the creation of land that would be reserved for public purposes.
6.3 Site Specific Provisions	Direction applies and the planning proposal is consistent with direction 6.3 (4). The planning proposal seeks to rezone the land to an existing zone already applying in the Environmental Planning Instrument.

7. Metropolitan Planning	
7.1 Implementation of A Plan for Growing Sydney	Not applicable. The subject land is not located in the Sydney Metropolitan area.
7.2 Implementation of Greater Macarthur Land Release Investigation	Not applicable. The subject land is not located in the Greater Macarthur area.
7.3 Parramatta Road Corridor Urban Transformation Strategy	Not applicable. The subject land is not located in the Parramatta Road corridor.
7.4 Implementation of North West Priority Growth Area Land Use and Infrastructure Implementation Plan	Not applicable. The subject land is not located in the North West Priority Growth area.
7.5 Implementation of Greater Parramatta Priority Growth Area Land Use and Infrastructure Implementation Plan	Not applicable. The subject land is not located in the Parramatta Priority Growth area.
7.6 Implementation of Wilton Priority Growth Area Interim Land Use and Infrastructure Implementation Plan	Not applicable. The subject land is not located in the Wilton Priority Growth area.
7.7 Implementation of Glenfield to Macarthur Urban Renewal Corridor	Not applicable. The subject land is not located in the Glenfield to Macarthur Urban Renewal Corridor.
7.8 Implementation of Western Sydney Aerotropolis Interim Land Use and Infrastructure Implementation Plan	Not applicable. The subject land is not located in the Western Sydney Aerotropolis Precinct.
7.9 Implementation of Bayside West Precincts 2036 Plan	Not applicable. The subject land is not located in the Bayside West Precinct.
7.10 Implementation of Planning Principles for the Cooks Cove Precinct	Not applicable. The subject land is not located in the Cooks Cove Precinct.
7.11 Implementation of St Leonards and Crows Nest 2036 Plan	Not applicable. The subject land is not located in the St Leonards and Crows Nest Precinct.
7.12 Implementation of Greater Macarthur 2040	Not applicable. The subject land is not located in the Greater Macarthur Precinct.
7.13 Implementation of the Pyrmont Peninsula Place Strategy	Not applicable. The subject land is not located in Pyrmont Peninsula Precinct.

Appendix D – Biodiversity Assessment Report (BDAR)

June 20

BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT:

Rezoning of Lot 50 DP 863972, Lot 2 DP 827097, Lot 2 DP 573214, part Lot 203 DP1202481, and Lot 20 DP 836884, Eriksson Lane, Glenthorne.

Prepared For: **Site R&D** Pty Ltd &
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User Notice

This report is presented on an objective basis to fulfill the stated legislative obligations, consideration and requirements in order to satisfy the client's instructions to undertake the appropriate studies and assessments. It is not directly intended to advocate the proponent's ambitions or interests, but is to provide information required in the determination of development consent by the decision-making authority for the subject proposal.

To the best of our knowledge, the proposal described in this assessment accurately represents the proponent's intentions when the report was completed and submitted. However, it is recognised and all users must acknowledge that conditions of approval at time of consent, post development application modification of the proposal's design, and the influence of unanticipated future events may modify the outcomes described in this document. Completion of this report has depended on information and documents such as surveys, plans, etc provided by the proponent. While checks were made to ensure such information was current at the time, this consultant did not independently verify the accuracy or completeness of these information sources.

The ecological information contained within this report has been gathered from field survey, literature review and assessment based on recognised scientific principles, techniques and recommendations, in a proper and scientific manner to ensure thoroughness and representativeness. The opinions expressed and conclusions drawn from this report are intended to be objective, based on the survey results and this consultant's knowledge, supported with justification from collated scientific information, references/citations or specialist advice.

Furthermore, it is clarified that all information and conclusions presented in this report apply to the subject land at the time of the assessment, and the subject proposal *only*.

This report recognises the fact, and intended users must acknowledge also, that all ecological assessments are subject to limitations such as:

- Information deficits (eg lack of scientific research into some species and availability of information)
- Influences on fauna detectability eg season in which survey is undertaken
- Influences on species occurrence eg stage of lifecycle, migratory, etc
- Time, resource and financial constraints.

All users should take into account the above information when making decisions on the basis of the findings and conclusions of this report.

Document Control Register

Version	Distribution	Date	Approved by:
Rev1	R&D, BSPE	21/3/2020	JB
Rev2	R&D, BSPE	7/6/2020	JB
Rev3	R&D, BSPE	15/6/2020	JB
Rev4	R&D, BSPE, MCC, DPIE	16/6/2020	JB

Conflict of Interest

The BAM assessment and this BDAR have been undertaken in line with the Accredited Assessors Conflict of Interest and professional behaviour code. The assessors declare no conflict of interest.

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GLOSSARY

Abbreviation/Term	Description
BAM	Biodiversity Assessment Method
BAMC	Biodiversity Assessment Method Credit Calculator
BC Act	NSW Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
BSSAR	Biodiversity Stewardship Site Assessment Report
CEEC	Critically Endangered Ecological Community
Development site/site	The area which is subject to the proposed future development including all infrastructure and services.
DNG	Derived Native Grassland
DEE	Commonwealth Department of Environment and Energy
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
EP&A Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FM Act	NSW Fisheries Management Act 1994
GIS	Geographic Information System
GPS	Global Positioning System
HBT	Hollow-bearing tree
KFT	Koala Food Tree
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
LLS	Local Land Service
NSW	New South Wales
OoW	NSW Office of Water
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SEPP	State Environmental Planning Policy

Abbreviation/Term	Description
Site	The area of land subject to the proposed development (development site as defined in s2.1.1.3 of the BAM.
Study Area	The land adjoining the site which may be impacted to varying extents by indirect impacts eg. downstream runoff, changes to hydrology, edge effects and changes to connectivity. A provisional 100m radius is used in line with the literature for the nature of the development.
Subject land	Refers to the land proposed as a development site (s3.1.1.1 (a), but in this case, it refers to the property to demonstrate the development site does not include the entire subject land.
SSD	State Significant Development
SSI	State Significant Infrastructure
TEC	Threatened Ecological Community
VIS	Vegetation Information System
VRZ	Vegetated Riparian Zone under the NSW *Water Management Act 2000*
VZ	Vegetation zone – a zone within a PCT of similar condition, usually due to disturbance
WM Act	NSW Water Management Act 2000

EXECUTIVE SUMMARY

Introduction:

This Biodiversity Development Assessment Report (BDAR) is part of a Planning Proposal to Mid Coast Council (MCC), seeking suitable rezoning to allow future industrial development of Lot 50 DP863972, Lot 2 DP827097, part Lot 2 DP573214, Lot 203 DP1202481 (part), and Lot 20 DP836884, Eriksson Lane, Glenthorne (the property).

The BDAR is prepared to address the NSW *Biodiversity Conservation* (BC) *Act 2016* and *Koala Habitat Protection* SEPP 2019, and the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBCA) *Act 1999* - Matters of National Environmental Significance.

The land subject to the rezoning has a total area of approximately 24ha. The potential development site (including existing developed areas within the footprint) is approximately 21.1ha, with the northern end of Lot 2 DP827097 to remain undeveloped as a drainage reserve grazed by cattle, under the current zoning.

The Planning Proposal is to rezone suitable land (currently zoned RU1 Primary Production) to IN1 General Industrial and B6 Business Enterprise, with existing watercourses (which contain Endangered Ecological Communities) to be zoned E2 Environment Protection. Lot 2 DP573214 is likely to also be zoned E2 apart from the existing dwelling area in the southeast which is considered suitable for industrial or similar development.

A new road linking Glenthorne Rd to an upgraded Eriksson Lane is proposed to be the primary access for the northwest lots, with another potential option for access west to Manning River Drive via Lot 203 DP1202481.

A subsequent DA is to be lodged for subdivision and industrial development of Lot 50 DP863972, Lot 2 DP827097 and part of Lot 20 DP836884 (Eriksson Lane), which is owned by the proponent or road reserve. The DA does not include Lot 2 DP573214 as it is privately owned and the owner has expressed no desire for development. This BDAR will be updated for that DA.

Current Landuses:

A dwelling currently exists on Lot 50 and Lot 2 DP573214, and two on Lot 2 DP827097. Lot 203 DP1202481 is already developed into commercial/industrial developments.

Most of lots are all largely cleared or have been partially cleared historically, most likely originally for dairy farms and now beef grazing. Exotic grasses thus predominate over much of the site, and indicate cultivation. Cattle and/or horses are kept on Lot 50 and Lot 2 DP827097, with boundaries fenced with barbed wire. Regrowth in good condition is occurring on Lot 2 DP573214, with Eriksson Lane's road reserve and a small patch on Lot 2 DP827097 containing the only near intact remnant forest on-site.

A dam about 400m^2 has been excavated at the head of the partially cleared drainage line in the southern end of Lot 2 DP827097 behind the industrial area that adjoins to the west. Another previously cleared drainage line which crosses around the middle of this Lot has had levee banks put across it to create two dams that are now essentially a sedgeland.

Until the recent catastrophic fire events of late 2019/early 2020 in the locality including the site, fire appears to have been excluded for at least 20 years as indicated by the vegetation during a preliminary constraints assessment in 2018 (JBE 2018). High intensity fire has since burnt out most of the large remnant to the east of Lot 50, and burnt the western end of Lot 2

DP573214 and some small patches in the east. It also almost completely burnt out the adjacent lot to the north (Lot 3 DP573214), which was subsequently almost entirely cleared by the owner. The northern end of Eriksson Lane was also intensively burnt, removing the groundcover and small tree layer that was previously noted here.

The southern two thirds of Eriksson Lane was unburnt, as was the remainder of the site.

Landscape Features:

The site lies on the eastern fringe of an existing industrial estate, and is bound by Manning River Drive to the south. Rural land ranging from small to medium holdings adjoin its north and eastern boundaries.

The site falls within the NSW North Coast IBRA region and Karuah-Manning IBRA sub-region, and mostly on the Port Macquarie Coastal Ramp, with the northern end of Lot 2 DP827097 on Manning - Macleay Coastal Alluvial Plains.

It does not contain an Area of Outstanding Biodiversity Value, or an Important or Coastal Wetland, but the northern half of Lot 2 DP827097 may be underlain by Acid Sulfate Soils (mostly low probability).

The land is largely flat with a gentle undulations on Lot 2 DP827097 due to two drainage lines (1st and 2nd order), with the north of Lot 2 falling to the Manning River floodplain to Stitts Creek in the far northern end.

Soils are mapped alluvial at the 1:25 000 scale over most of Lot 2 DP827097, with the remainder being residual.

The site is not mapped as falling within a regional or sub-regional corridor. The nearest corridor is the Khappinghat Nature Reserve corridor, which is <2km south and east. In the landscape context, the site lies at the northern extremity of a spur of habitat which has at least tenuous connectivity to the key regional habitat to the south and east which mostly comprises conservation reserves and State Forests (most of which was catastrophically burnt out in the 2019-2020 fire event).

The site has no significant local corridor values given physical barriers west, north and south; and remnant vegetation onsite largely only falls in the Eriksson Lane road reserve, a small patch of dry sclerophyll adjacent to fragmented habitat on private land, and scattered trees. Only habitat generalists and species capable of moving across a hostile landscape matrix are likely to move across the site at varying levels of risk.

Native Vegetation:

Native vegetation cover within the buffer area is approximately 39% and is assigned to the 30-70% cover class.

Three PCTs in 11 vegetation zones (VZs) were identified on the site:

- PCT 1262 - Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast: Dominates the site over 8 VZs, most of which are modified to pasture.
- PCT 1740 - Tall Spike Rush freshwater wetland: Restricted to dam within the southern drainage line.

- PCT 1064 - Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion: Restricted to narrow band in the southern drainage line.
- PCT 1737 - *Typha* rushland: Dominates the middle drainage line, formed by clearing of the original vegetation and damming the watercourse.

The dominant forest PCT was extremely difficult to assign due to lack of high confidence matches to current PCTs in the database.

PCTs 1740, 1064 and 1737 were in moderate condition despite disturbance and weed invasion. Only 3 of the PCT 1262 VZs had vegetation integrity (VI) >20.

Endangered Ecological Communities:

Quaternary soil landscape mapping shows the site contains alluvial soils on most of Lot 2 DP827097, however most of the original native vegetation has long been cleared and displaced by pasture.

PCT 1064 was a good match for the EEC - *Swamp Sclerophyll Forest on Coastal Floodplains*, but could be a derivative of the EEC - *Subtropical Floodplain Forest on Coastal Floodplains* which occurs downstream on adjoining land within the same watercourse. PCTs 1740 and 1737 were considered to qualify as the EEC – *Freshwater Wetland on Coastal Floodplains,* although they occur in artificial habitats, and are probably derived from other Coastal Floodplain EECs.

Threatened Species:

Two Species Credit species have been recorded to date: Koala and Southern Myotis. Several other threatened microchiropteran bats (Ecosystem Credits) were also detected.

Some marginal potential habitat in broad generic terms occurs for two terrestrial orchids that require targeted survey in the specified seasons, or an expert report to verify they are unlikely to occur. *Diuris flavescens* is the most important as this species is listed as a Serious and Irreversible Impacts (SaII) threshold species. The best and majority of potential habitat for the orchids falls on Lot 2 DP573214 which is proposed to be retained and rezoned as E2. The remainder falls within the Eriksson Lane road reserve and edges of a paddock with a higher content of native groundcovers, but lack of close proximity records, edge effects and other disturbances significantly discount their potential to occur there.

Impact Assessment Summary:

The future development concept over Lot 2 DP827097 and lot 50 DP863972 and part of Eriksson Lane predominantly proposes development over the VZs with VI<20 in line with the avoid/minimise principles of the BC Act. Lot 2 DP573214 is not proposed to form part of this future development proposal, which was assessed per the BAM.

The most significant habitat impacted by the future development proposal is:

- The middle part of VZ 2 which is Eriksson Lane. This VZ contains most of the hollow-bearing trees and mature KFTs on site (identified Core Koala Habitat under the SEPP). It also contains some marginal potential habitat for *Diuris flavescens* and another locally recorded orchid (*Pterostylis chaetophora*) that requires seasonal survey, but are considered to have very low potential of occurring. The proposal only impact the middle section which is highly degraded by existing use as an access, mowing and weed invasion, but contains some low value hollow-bearing trees and a number of Koala food trees.

- VZ 7 which comprises a small patch (<0.3ha) of Tallowwood and Forest Gums, which is identified as Core Koala Habitat under the SEPP. The practicality of retaining this VZ has issues with changes to hydrology, long term connectivity and management, and public liability which would need to be resolved effectively.
- Loss of PCT 1740 which occurs within a small dam, and the western end of PCT 1064 and 1737 for the western access road and associated infrastructure. These are all EECs, although the Freshwater Wetland EECs are likely to be artificially derived from the original *Swamp Sclerophyll Forest* EEC. The road is however best located along its proposed alignment on Lot 2 as it minimises fragmentation and vehicle strike, and impacts on VZ 2 in Eriksson Lane.

Eriksson Lane is an RMS-owned road and the proponent has an expectation of using this dedicated road reserve, however consideration of ecological as well as engineering constraints to a design which best minimised loss of mature vegetation here.

Prescribed biodiversity impacts are generally considered a low risk, not applicable, or can be mitigated via complying with standard controls and measures. eg. stormwater management.

Diuris flavescens is a Serious and Irreversible Impact (SaII) candidate species, and if confirmed present within the development footprint, will initiate a modification to avoid a SaII. This plant has a restricted distribution with no close proximity records, and the potential habitat affected is highly degraded, hence the likelihood of occurrence is low.

A range of mitigation measures are proposed including offset planting of KFTs under a Vegetation Management Plan in the drainage reserves and allowing natural regeneration on Lot 2 DP573214 if it is zoned E2; re-use of fallen hollow-bearing trees as habitat features in the drainage reserves; fauna welfare during vegetation removal; and control of secondary impacts such as erosion and sedimentation.

Ecosystem credits will be required to offset loss of VZs with VI>20, and Species credits for the loss of Southern Myotis and Koala habitat. In the unlikely outcome of *Pterostylis chaetophora* being found by future survey, credits would be required for this species as well. A BAM calculation was made assuming presence of these orchids and the quantum of total credits currently required are as follows:

VZ	PCT ID	Candidate SaII	VI	Direct impact (ha)	Biodiversity Risk Weighting	Credits required
1	1262	No	38.9	0.09	1.5	1
2	1262	No	65.5	1.15	1.5	28
7	1262	No	52.8	0.24	1.5	5
8	1740	No	36.5	0.04	1.75	1
9	1064	No	38.5	0.07	2	1
10	1737	No	59.8	0.16	1.75	4
					Total:	**40**

Name	Legal Status	Candidate Sall	Biodiversity Risk Weighting	Species Credit	Credits required
Southern Myotis (*Myotis macropus*)	V-BCA	No	2	Known habitat	22
Koala (*Phascolarctos cinereus*)	V-BCA V-EPBCA	No	2	Breeding habitat	21
Pterostylis chaetophora	V-BCA	No	2	Known habitat	38
Pale Yellow Doubletail (*Diuris flavescens*)	CE-BCA CE-EPBCA	**Yes**	3	Known habitat	60
				Total	**143**

Koala Habitat Protection SEPP:

State Environmental Planning Policy (*Koala Habitat Protection*) 2019 replaced SEPP 44 – *Koala Habitat Protection* from March 1 2020. The draft *Koala Habitat Protection Guideline* (DPIE 2020) outlines the assessment process for Development Applications that impact Koala habitat where no approved Koala Plan of Management (KPoM) is in place.

The Koala Development Application Map (KDAM) maps all tree cover on the site as highly suitable Koala habitat. At the site scale, only VZ 1, 2 and 7 actually contain Koala food trees apart from a single tree on the western side of VZ 5; such trees are absent in other VZs and paddock trees north of the second drainage line on Lot 2 DP DP827097 are non-browse or exotic species.

Due to loss of native vegetation and exceeding the Biodiversity Offsets Scheme threshold, the future development concept was assessed under Tier 2.

Survey confirmed a low intensity of Koala usage, with only a few scats observed in the preliminary constraint assessment, with no Koalas observed despite the site habitat being some of the only remaining unburnt habitat in the locality at the time of survey. This and records within 2.5km plus dominance of VZ 1, 2 and 7 by preferred KFTs confirmed the site is Core Koala Habitat under the SEPP.

The site is not considered to have any key corridor or linkage value at the landscape or local scale for the Koala, being located on the edge of a spur of habitat off the large body of known habitat south and southeast where a metapopulation is known to occur. Major physical barriers north (pasture followed by the Manning River), east (Pacific Highway), south (Manning River Drive) and west (industrial estate, cleared land and Manning River Drive) are key limitations. Although Koalas have been recently recorded crossing such barriers west and south, these are high risk and not ideal for long term population viability.

In terms of the ecology of the Koala and the survey results, the site appears to be infrequently visited by a member of the local Koala aggregate. Ecologically, it may be the fringe of the home range of a Koala/s potentially residing in the remnant east of the site on Lot 1; used as support habitat by dispersing Koalas and sub-dominant males on the edge of home ranges to the south or east (particularly after the recent fire); or used as a stepping stone for Koalas making landscape movements after the breeding season.

The proposal will see loss of 1.48ha (including 0.72ha of primary preferred KFTs) in VZ 2 and 7, and will retain over 4ha of these trees (in VZ 1 and the residual of VZ 2. Connectivity from VZ 1 on Lot 2 will remain as is to the nearest mapped Core Koala Habitat to the east. The vegetated riparian zones (VRZs) of the drainage lines could also be planted with KFTs to offset habitat loss.

Dog attack risk is not likely to be increased as the proposal is not for residential development. Vehicle strike risk is currently high adjacent to the site, and could be incrementally increased on Glenthorne Rd and the upgrade of most of Eriksson Lane to a formal road, but short length of the roads and intersections should reduce this risk. No pools are likely, and current bushfire patterns should largely remain (Lot 2 will require periodic fuel reduction if retained and allowed to regenerate). Fences will most likely exclude Koalas from the industrial area, which is preferred to minimise adverse situations. Increases in diseases in Koalas or their habitat is considered a low risk which can be managed given no resident population is present; and anthropogenic impacts limited given existing impacts and no resident population.

A range of measures are provided to mitigate the impacts of the proposal.

EPBC Act MNES:

1. World Heritage Properties: The site/study area is not listed as a World Heritage area nor does the proposal affect any such area.

2. Ramsar Wetlands of International Significance: No Ramsar wetland occurs on or adjacent to the site, nor does the proposal affect a Ramsar Wetland.

3. EPBC Act listed Threatened Species and Communities: The Koala (Vulnerable), Grey-headed Flying Fox (Vulnerable), Swift Parrot (Critically Endangered) and White-throated Needletail (Vulnerable) are known or considered potential occurrences in the study area to varying levels of significance, but for most the site only qualifies as a small area of generic potential foraging habitat within their very large ranges. These were assessed and not considered likely to be significantly impacted. *Diuris flavescens* has a remote probability of occurrence in VZ 1 and 2. If present within the development footprint, removal of any of these plants would be considered a significant impact and trigger referral.

4. Migratory Species Protected under International Agreements: No migratory species is likely to be significantly affected by the proposal.

5. Nuclear Actions: The proposal is not a nuclear action.

6. The Commonwealth Marine Environment (CME): Listed as relevant to the site though is not within the CME nor does it affect such.

7. The Great Barrier Reef Marine Park: The proposal does not affect the Great Barrier Reef Marine Park.

8. National Heritage: The site does not contain an item of National Heritage.

9. A water resource, in relation to coal seam gas development and large coal mining development: The proposal is not a mining development.

1 INTRODUCTION

1.1 Purpose of the Report

This firm has been requested to undertake a Biodiversity Development Assessment Report (BDAR) for a Planning Proposal seeking suitable rezoning to allow future industrial development of Lot 50 DP863972, Lot 2 DP827097, part Lot 2 DP573214 and Lot 20 DP836884, Eriksson Lane, Glenthorne.

The BDAR forms part of a Planning Proposal to Mid Coast Council (MCC). An access west to Manning River Drive via Lot 203 DP1202481 is also proposed, but this land is already used for industrial purposes hence no rezoning is proposed.

This BDAR will subsequently form part of a subsequent Development Application (DA) to MCC for subdivision and industrial development of Lot 50 DP863972, Lot 2 DP827097 and part of Eriksson Lane (part Lot 20 DP836884). This land is owned entirely by the proponent or is road reserve. Lot 2 DP573214 is privately owned by another adjoining landholder, and is not part of this DA. It is expected that this BDAR will be updated prior to finalisation of the DA after seasonal threatened orchid surveys have been completed or an expert report obtained.

The BDAR is prepared to address the NSW *Biodiversity Conservation* (BC) *Act 2016* and *Koala Habitat Protection* SEPP 2019, and the Commonwealth *Environment Protection and Biodiversity Conservation* (EPBCA) *Act 1999* - Matters of National Environmental Significance.

1.2 Assessment Roles

This BAR has been prepared by the following who have are Accredited Persons under the NSW *Biodiversity Conservation Act 2016* (BC Act).

- Jason Berrigan (BAAS 18079)
- Matthew Bailey (BAAS 18021)

2 STAGE 1: BIODIVERSITY ASSESSMENT

2.1 Description of the Development Site

The subject land consists of the following lots which have a total area of approximately 24ha (see **Figure 2**):

- Lot 50 DP863972
- Lot 2 DP827097
- Lot 2 DP573214
- Lot 20 DP836884 (Eriksson Lane)
- Lot 203 DP1202481 (part)

The rezoning site (including existing houses, sheds and the industrial land on Lot 203) is approximately 21.1ha (20.65ha minus the currently developed area), with the northern end of Lot 2 DP827097 to remain undeveloped as a drainage reserve grazed by cattle, under the current zoning.

The future development site for the DA has a footprint of approximately 14.91ha.

2.1.1 The Rezoning and Development Proposal

A development concept plan for the rezoning and DA is provided in **Figure 3**.

The Planning Proposal is to rezone the identified land (currently zoned RU1 Primary Production) to IN1 General Industrial and B6 Business Enterprise, with existing watercourses (which contain Endangered Ecological Communities) to be zoned E2 Environment Protection.

Lot 2 DP573214 is largely recommended to be zoned E2, apart from the existing dwelling area in the southeast which is nominated to be zoned industrial.

The primary access to the proposed industrial subdivision and Pacific Highway is via a new road (Road 3) linking Glenthorne Rd west across an unformed section of Eriksson Lane to the northwest future lots via Road 2, with a secondary alternate access (Road 1) west to Manning River Drive via Lot 203 DP1202481.

As detailed above, the future DA is for subdivision of Lot 50 DP863972, Lot 2 DP827097 and part of Eriksson Lane (part of Lot 20 DP836884) to establish the industrial estate and subsequent DA's for the individual lots. The future development is to be staged, with Lot 50 to be subdivided and developed first.

2.1.2 Site Landuses

2.1.2.1 Past and current landuses

A dwelling currently exists on Lot 50 and Lot 2 DP573214, and two on Lot 2 DP827097. Lot 203 DP1202481 has been recently (since the 2012 imagery used for mapping was taken) developed into industrial land with large sheds, sale yards for cars and trucks, and mechanic workshops.

The lots are all largely cleared or have been cleared historically, most likely originally for dairy farms and now beef grazing. Exotic grasses thus predominate over much of the site, and indicate cultivation. Cattle and/or horses are kept on Lot 50 and Lot 2 DP827097, with boundaries fenced with barbed wire.

Lot 2 DP573214 has not been maintained for about 3-5 years, allowing recruitment of eucalypts from the remnant stand in Eriksson Lane to form a low woodland in its west. A number of older recruit eucalypts (mostly Tallowwoods) <20 years old form small patches in the middle to east, with a groundcover that is mostly native grasses and herbs, suggesting this land has not been widely cultivated.

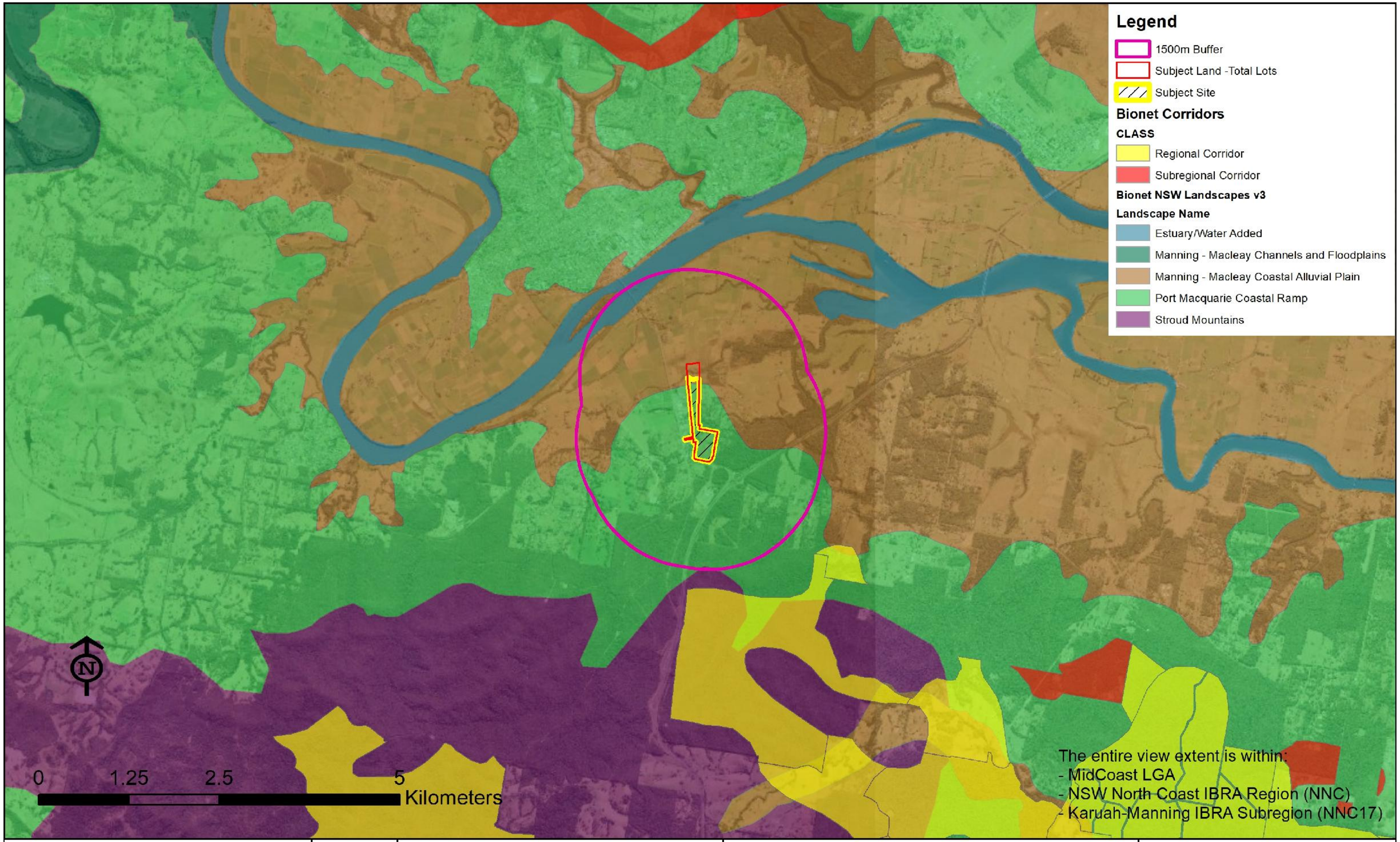
Some cars and parts associated with the business on Lot 203 are stored on the southern end of Lot 2 DP827097. A large lawn with ornamental landscaping and a small orchard is maintained around the house on Lot 50.

A dam about 400m^2 has been excavated at the head of the drainage line in the southern end of Lot 2 DP827097 behind the industrial area that adjoins to the west. Another drainage line which crosses around the middle of this Lot has had levee banks put across it to create two dams that are essentially a sedgeland.

2.1.2.2 Fire

Until the recent catastrophic fire events of late 2019/early 2020 in the locality including the site, fire appears to have been excluded for at least 20 years as indicated by the vegetation during a preliminary constraints assessment in 2018 (JBE 2018).

Figure 1: Location of subject land



The entire view extent is within:
- MidCoast LGA
- NSW North Coast IBRA Region (NNC)
- Karuah-Manning IBRA Subregion (NNC17)

Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Location Map - Corridors and Bionet NSW Landscapes

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

Scale: 1:65 000
Job Number: J2019-35
Revision: A

Figure 2: Subject land and subject site/development site

The entire view extent is within:
- MidCoast LGA
- NSW North Coast IBRA Region (NNC)
- Karuah-Manning IBRA Subregion (NNC17)

This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

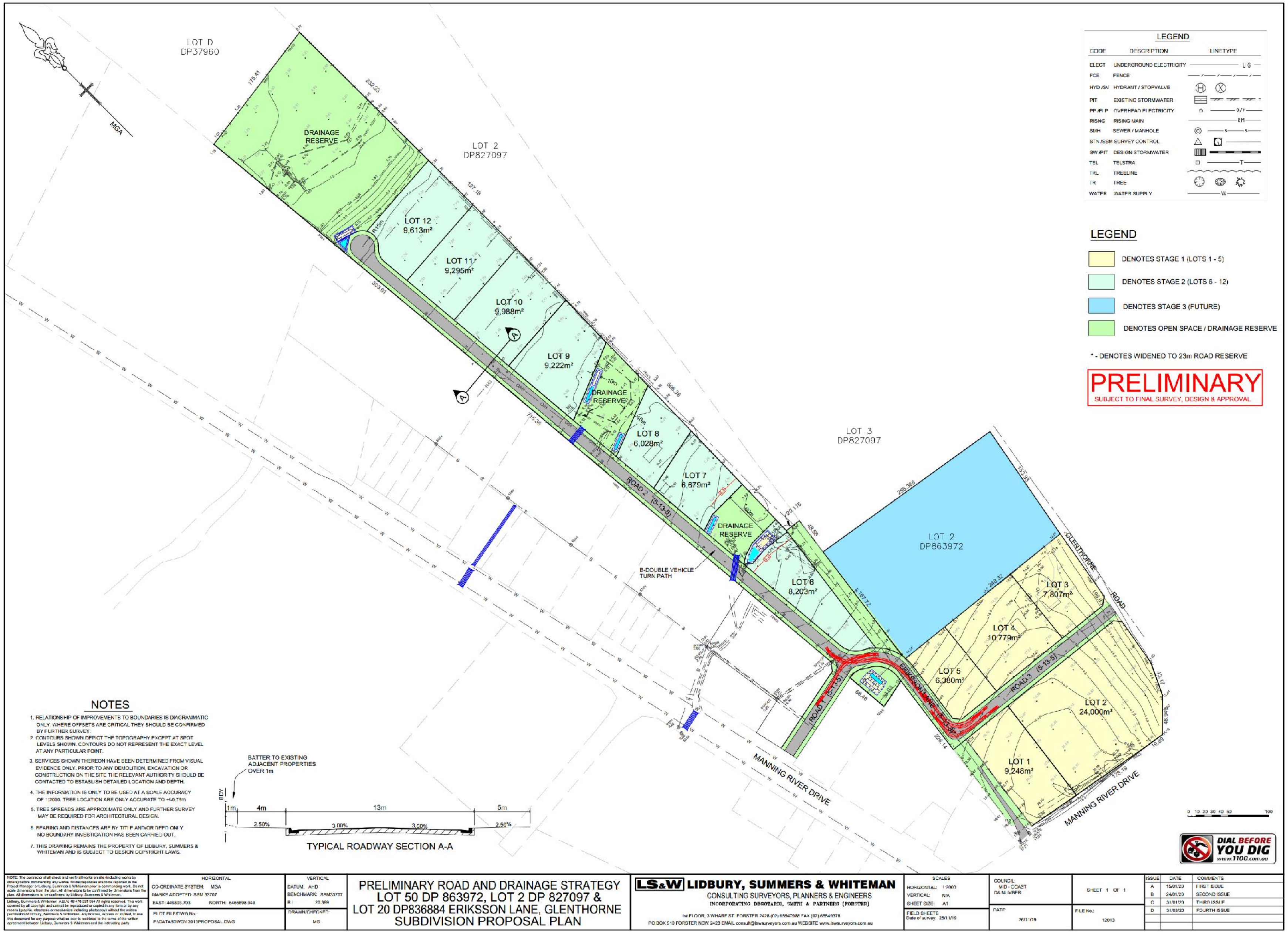
Figure Name: Subject Site and Subject Land

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

Scale: 1 :8,500
Job Number: J2019-35
Revision: A

Figure 3: Development concept



LEGEND

CODE	DESCRIPTION	LINETYPE
ELECT	UNDERGROUND ELECTRICITY	UG
FCE	FENCE	
HYD /SV	HYDRANT / STOPVALVE	H X
PIT	EXISTING STORMWATER	
PP /ELP	OVERHEAD ELECTRICITY	O/H
RISNG	RISING MAIN	RM
SMH	SEWER / MANHOLE	S
STN /SSM	SURVEY CONTROL	△
SW /PIT	DESIGN STORMWATER	
TEL	TELSTRA	T
TRL	TREELINE	
TR	TREE	
WATER	WATER SUPPLY	W

LEGEND

🟨	DENOTES STAGE 1 (LOTS 1 - 5)
🟩	DENOTES STAGE 2 (LOTS 6 - 12)
🟦	DENOTES STAGE 3 (FUTURE)
🟩	DENOTES OPEN SPACE / DRAINAGE RESERVE

* - DENOTES WIDENED TO 23m ROAD RESERVE

PRELIMINARY
SUBJECT TO FINAL SURVEY, DESIGN & APPROVAL

NOTES

1. RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE OFFSETS ARE CRITICAL THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.
2. CONTOURS SHOWN DEPICT THE TOPOGRAPHY EXCEPT AT SPOT LEVELS SHOWN. CONTOURS DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT.
3. SERVICES SHOWN THEREON HAVE BEEN DETERMINED FROM VISUAL EVIDENCE ONLY. PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO ESTABLISH DETAILED LOCATION AND DEPTH.
4. THE INFORMATION IS ONLY TO BE USED AT A SCALE ACCURACY OF 1:2000. TREE LOCATION ARE ONLY ACCURATE TO +/-0.75m
5. TREE SPREADS ARE APPROXIMATE ONLY AND FURTHER SURVEY MAY BE REQUIRED FOR ARCHITECTURAL DESIGN.
6. BEARING AND DISTANCES ARE BY TITLE AND/OR DEED ONLY. NO BOUNDARY INVESTIGATION HAS BEEN CARRIED OUT.
7. THIS DRAWING REMAINS THE PROPERTY OF LIDBURY, SUMMERS & WHITEMAN AND IS SUBJECT TO DESIGN COPYRIGHT LAWS.

BATTER TO EXISTING ADJACENT PROPERTIES OVER 1m

NOTE: The contractor shall check and verify all works on site (including works by others) before commencing any works. All discrepancies are to be reported to the Project Manager or Lidbury, Summers & Whiteman prior to commencing work. Do not scale dimensions from the plan. All dimensions to be confirmed by dimensions from the plan. All dimensions to be confirmed by Lidbury, Summers & Whiteman.

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HORIZONTAL
CO-ORDINATE SYSTEM: MGA
MARKS ADOPTED: SSM 33707
EAST: 449803.703 NORTH: 6465898.949
PLOT FILE/DWG No.:
F:\DATA5\DWG\12013PROPOSAL.DWG

VERTICAL
DATUM: AHD
BENCHMARK: SSM33707
R.L. 20.399
DRAWN/CHECKED:
MG

PRELIMINARY ROAD AND DRAINAGE STRATEGY
LOT 50 DP 863972, LOT 2 DP 827097 &
LOT 20 DP836884 ERIKSSON LANE, GLENTHORNE
SUBDIVISION PROPOSAL PLAN

LS&W LIDBURY, SUMMERS & WHITEMAN
CONSULTING SURVEYORS, PLANNERS & ENGINEERS
INCORPORATING DEGOTARDI, SMITH & PARTNERS (FORSTER)
1st FLOOR, 3 WHARF ST, FORSTER 2428 (02) 65547988 FAX (02) 65549378
PO BOX 510 FORSTER NSW 2428 EMAIL consult@lswsurveyors.com.au WEBSITE www.lswsurveyors.com.au

SCALES
HORIZONTAL: 1:2000
VERTICAL: N/A
SHEET SIZE: A1
FIELD SHEETS
Date of survey: 25/11/19

COUNCIL:
MID - COAST
DA NUMBER:
DATE:
26/11/19

SHEET 1 OF 1
FILE No.:
12013

ISSUE	DATE	COMMENTS
A	15/01/20	FIRST ISSUE
B	24/01/20	SECOND ISSUE
C	31/01/20	THIRD ISSUE
D	31/03/20	FOURTH ISSUE

High intensity fire in the summer of 2020 has since burnt out most of the large remnant to the east of Lot 50, and burnt the western end of Lot 2 DP573214 and some small patches in the east. It also almost completely burnt out the adjacent lot to the north (Lot 3 DP573214), which was subsequently almost entirely cleared by the owner. The northern end of Eriksson Lane was also intensively burnt, removing the groundcover and small tree layer that was previously noted here. Regeneration has since occurred here and rapidly on Lot 2 DP573214.

The southern two thirds of Eriksson Lane was unburnt, as was the remainder of the site

2.1.2.3 Weeds

Weeds occur in variable abundance.

Pasture grasses and exotic herbs are most common in the areas cleared historically for pasture (eg. Lot 50), and in proximity to the existing dwellings where ornamentals have been planted and lawns established. The adjacent industrial estate appears to be an ongoing source for weeds and nutrients, as are road verges eg. Glenthorne Lane.

Lantana is common along Eriksson Lane and adjacent in Lot 17. It forms dense entanglements around remnant trees on Lot 2 DP573214, some of which were partially burnt in the recent fire.

Asparagus spp*. and *Ochna serrulata** occur at times along Eriksson Lane, which in general has a high weed content in the low stratums.

2.1.3 Adjacent landuses

Lot 2 DP827097 adjoins an existing industrial estate along Manning River Drive and abuts a manufactured housing estate to the south, which adjoins the southern end of Eriksson Lane, with a landscape supply centre to the southwest.

Cleared rural land on the Manning River floodplain adjoins the northern end of Lot 2 DP827097. Small rural holdings adjoin the northeast of Lot 2, and north and east of Lot 2 DP573214.

Lot 1 DP1048115 comprises a large vacant and fully forested lot east of Lot 50, and adjoins the dual carriageway of the Pacific Highway. Manning River Drive adjoins the south of Lot 50.

Lot 17 DP836884 and Lot 55 DP863972 form the frontage to Manning River Drive, and both are covered with immature regrowth dry sclerophyll forest. Lantana and a range of roadside weeds are common on Lot 17.

2.1.3.1 Websites/Databases

- BioNet Vegetation Classification (http://www.environment.nsw.gov.au/NSWVCA20PRapp/search/keysearch.aspx#):
- Bionet Atlas (DPIE 2020a) (http://www.bionet.nsw.gov.au/):
- Threatened Biodiversity Data Collection (DPIE 2020b):
- BOSET tool (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap)
- Key Fish Habitat maps (https://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps.
- Native Vegetation Regulatory map (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=NVRMap): accessed 19/2/2020
- EPBC Act Protected Matters Search Tool (http://www.environment.gov.au/epbc/pmst/)
- Six Maps (http://maps.six.nsw.gov.au):

- NSW Planning Portal (https://www.planningportal.nsw.gov.au/find-a-property)
- NSW Coastal SEPP viewer (http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement)
- NSW Koala Habitat Protection SEPP viewer (https://webmap.environment.nsw.gov.au/Html5Viewer291/index.html?viewer=KoalaSEPP.htm5) accessed 6/3/2020.

2.1.3.2 Spatial Data

Spatial data encompassing the site boundary and development site was made using the layout provided by the proponent.

Aerial base map data was obtained from DFSI NSW databases (noting the imagery is dated 2012 and does not show recent development to the west over the last 7 years), with cadastral data obtained from DFSI digital cadastral database. Mapping for stream orders was obtained from DFSI NSW Hydrography database.

The following spatial datasets were utilised during the development of this report:

- Mitchell Landscapes Version V3.1 (OEH 2016a);
- Interim Biogeographic Regionalisation of Australia (IBRA) Version 7 (DotEE 2013);
- Directory of important wetlands (DotEE 2010);
- NSW Wetlands (OEH 2010);
- SEPP (Coastal Management) 2018 (DPE 2018)
- Port Macquarie-Hastings Council LGA Vegetation Mapping (Biolink 2013a)
- Port Macquarie-Hastings Council LGA Koala Habitat Mapping (Biolink 2013b)
- Fauna Corridors and Key Habitats for North East NSW (OEH 2010)
- NSW National Parks and Wildlife Service (NPWS) Estate (OEH 2011)
- Troedson A.L. & Hashimoto T.R. (2008). Coastal Quaternary Geology – north and south coast of NSW. Geological Survey of New South Wales, Bulletin 34.

Mapping undertaken during the site assessment was conducted using a hand-held GPS unit (GDA94). Mapping has been produced using a Geographic Information System (GIS; ArcGIS 10.5).

2.1.3.3 Reports

- Darkheart Eco-Consultancy (2004) Flora and Fauna Survey and SEPP 44 Assessment of proposed Purfleet Pacific Highway Service Centre (Southbound) on Lot 18 DP 835273. Unpublished report to Luke and Company Pty Ltd. Darkheart Eco-Consultancy, Port Macquarie.

- JBE (2019). Preliminary ecological constraints assessment for future development of Lot 50 DP 863972, Lot 2 DP 827097, Lot 2 DP 573214 and Lot 20 DP 836884, Eriksson Lane and Glenthorne Road, Taree South. Unpublished report to Blue Sky Planning. JBEnviro, Port Macquarie.

- Naturecall (2016). Statutory ecological assessment for a proposed organic waste processing facility on part Lot 1 DP 776006, The Buckett's Way, Tinonee. Unpublished report to Greater Taree Council

- Naturecall (2015). Statutory Ecological Assessments for Rural-Residential Subdivision of Lot 175 DP 753202, Alpine Drive, Tinonee. Unpublished report to PDA Services, Taree. Naturecall Environmental, Port Macquarie.

- Orogen (2008). Major Project 05_0038 preferred project report, rural residential subdivision. Report no. 406097_REO_002.doc. Prepared for Tinonee Joint Venture by Orogen, Tuncurry, NSW.

2.2 Legislative Framework

The following table summarises the relevant legislative considerations assessed in this report:

Table 1: Legislative pathways

Name	Relevance to the project	Report Section
Commonwealth		
Environmental Protection and Biodiversity Conservation Act 1999	Matters of National Environmental Significance have been identified on or near the site. This report assesses impacts to MNES and concludes that the development is not likely to have a significant impact on MNES.	4
State		
Environmental Planning and Assessment Act 1979	This report forms part of a Planning Proposal submitted under s56 of the EP&A Act and will form part of the information to be placed on public exhibition. It also forms part of a future DA and may be updated before public exhibition for this purpose, pending the outcome of the Planning Proposal and seasonal orchid surveys.	All sections
Biodiversity Conservation Act 2016	The clearing associated with the proposal exceeds the minimum area threshold specified in s7.2 of the Act, thus a BDAR is thus required. The site does not contain an area of Sensitive Biodiversity Value Land (SBVL. The development is not eligible for the streamlined module.	2, 3
Fisheries Management Act 1994	The development does not appear to involve impacts to Key Fish Habitat, does not involve harm to marine vegetation, but crossing of the two drainage lines may constitute “dredging, reclamation or obstruction of fish passage”. A permit and/or consultation under the FM Act is required.	Not addressed in this report
Local land Services Amendment Act 2016	The LLS Act does not apply to areas of the state to which the SEPP Vegetation applies. Review of the Native Vegetation Regulatory Map shows the property is covered by the LLS Act as it zoned RU1. No assessment under the LLSA is required as Planning Proposal and DA is being lodged under Part 4.	No further assessment required.
Water Management Act 2000	Lot 2 DP827097 contains a 1st and 2nd order stream. The project involves works on waterfront land and therefore requires a Controlled Activity Approval under s91 of the WM Act. The two streams will require vegetated buffers 10 and 20m wide from top of each bank respectively.	Not addressed in this report
State Planning Instruments		
Vegetation SEPP (VSEPP)	The Vegetation SEPP applies to development that does not require consent under Part 4 of the EP&A 1979 on land zoned Urban, or E2, E3, E4 or R5. No assessment under the VSEPP is required as the land is zoned RU1. As a DA is being lodged for future subdivision after the Planning Proposal is completed, the SEPP will not apply to clearing approved under Council consent.	No further assessment required.

Name	Relevance to the project	Report Section
Coastal SEPP	The proposed development is not located on land that is mapped as a Coastal Wetland or Littoral Rainforest hence does not trigger off Designated Development. The land is also not mapped as being within a Proximity Area for Coastal Wetlands or Littoral Rainforest	No further assessment required.
Koala Habitat Protection SEPP 2019	The MCC LGA is listed under the SEPP and hence assessment is required.	5

2.3 Landscape Features

2.3.1 IBRA Regions and Mitchell Landscapes

The site falls the following regions:

Table 2: Biodiversity regions and landscapes

IBRA region	Area within site (ha)
NSW North Coast	All
IBRA subregion	**Area within site (ha)**
Karuah Manning	All
Mitchell Landscapes	**Area within site**
Port Macquarie Coastal Ramp	Lot 50, Eriksson Lane, Lot 2 DP573214, most of Lot 2
Manning - Macleay Coastal Alluvial Plains	Northern end of site including proposed drainage reserve in northern end of Lot 2 DP827097

2.3.2 Native Vegetation Extent

Vegetation within the study area and the 1500m buffer area was assessed using aerial photographic interpretation, field survey results and existing vegetation mapping within a GIS (ArcGIS10.5) (see 2.3.8 Site Context). The extent of native vegetation within the study site and buffer is outlined in the following table:

Table 3: Native vegetation extent

Area within the site (ha)	Area within the 1500m buffer area (ha)
21.1ha (20.65ha excluding Not Assessed area)	430ha

The aerial imagery used is dated from 2012, and more recent Google Earth imagery shows:

- Lot 203 has been recently developed into industrial land. It was previously parkland in form.
- A number of other previously undeveloped lots east and west of Manning River Drive industrial area are now developed. Most were either just pasture/lawn.

- Lot 3 DP573214 has recently been largely cleared after the 2019-2020 major bushfire event. This site was largely forested around an existing dwelling at the eastern end. A new boundary fence is being erected along the western boundary.

2.3.3 Rivers and Streams

The property contains three watercourses on the *Water Management (General) Regulation 2018* hydroline spatial data 1.0 and on the 1:25 000 topographic map shown on the SIX viewer, as shown in **Figure 4**. Buffers identified in the BAM (OEH 2017) are shown in Figure 4.

Table 4: Rivers and streams

Type	Location	Order	BAM (2017) / WM Act Vegetation Riparian Zone
1 drainage line (ephemeral stream)	Within drainage line at southern end of Lot 2 DP827097.	1st order	10m each side of waterway if WM Act applies
1 drainage line (ephemeral stream)	Within drainage line in lower third of southern end of Lot 2 DP827097.	2nd order	20m each side of waterway if WM Act applies
Creek	Stitts Creek passes through northern end of Lot 2 DP827097 outside site, on subject land.	4th order	40m each side of waterway if WM Act applies

2.3.4 Wetlands

No Coastal Wetland is mapped as occurring on or adjacent. No Important Wetlands are mapped within the site or the 1500m buffer, as shown in Figure 4 and 5.

2.3.5 Connectivity Features

The site contains the connectivity features shown in **Figure 1**.

2.3.5.1 Regional Corridors

Regional corridors are typically >500m wide and provide a link between major and/or significant areas of habitat in the region. Ideally they are of sufficient size to provide habitat in their own right and at least twice the width of the average home range area of fauna species identified as likely to use the corridor (Scotts 2003).

The site is not mapped as falling within a regional corridor. The nearest corridor is the Khappinghat Nature Reserve corridor, which is <2km south and east. This essentially interlinks Kiwarrak State Forest to Khappinghat Nature Reserve, linking south to the more tenuous Frogalla Swamp corridor which passes over cleared rural and rural-residential lands to the coast.

Despite this mapping, in a regional context, the site lies at the mid-northern fragmented extremity of a very large body of intact forest primarily comprising Kiwarrak State Forest to Khappinghat Nature Reserve, to private lands with native vegetation around Old Bar. It lies on the western of a spur of remnant forest comprised of a mix of swamp forest to wet and dry sclerophyll bisected lengthways by the Pacific Highway that essentially peters out before the primary physical barrier posed by the Manning River due to clearing rural land north, west and increasingly east. This spur is not a key corridor at the landscape scale.

2.3.5.2 Sub-Regional Corridors

Sub-regional corridors connect larger landscaped features and are of sufficient width to allow movement and dispersal (generally >300m), but may not provide substantial species habitat (Scotts 2003).

No sub-regional corridors are mapped in proximity to the site.

2.3.5.3 Local Corridors and Habitat Links

Habitat links are evaluated in this report as links from habitat on-site directly to similar habitat on adjacent land. These would be used by fauna, which depend solely or at least partially on the site and adjacent habitats for all of their lifecycle requirements (eg a colony of Brushtailed Phascogale), and/or dispersal (eg Koalas). Local corridors are larger habitat links or an aggregation of links which provide connections between remnant patches of habitat and landscape features, and are used for larger scale movement of genes and/or animals eg dispersal, colonisation, nomadic seasonal movements, etc. Due to their relatively small area and width (they may be <50m), these corridors and links are vulnerable to edge effects (Scott 2003, Lindenmayer and Fisher 2007).

The site has no significant local corridor values, as intact remnant vegetation largely only falls in the Eriksson Lane road reserve, a small patch of dry sclerophyll adjacent to fragmented habitat on private land, and scattered trees.

Eriksson Lane is a narrow linear remnant that has poor direct connectivity to any other remnant vegetation south, the Manning River Drive posing a significant physical and behaviour barrier to non-flying fauna potentially moving from the larger expanse of forest habitat further south. Despite this, a neighbour reported a Koala crossing south near this area in weeks preceding the survey.

Regrowth vegetation on Lot 17 and 55 provide a link between Eriksson Lane and Lot 1 to the east. This could be used by small passerine birds, terrestrial and arboreal mammals as well as frogs and reptiles, but as habitat degrades to urban woodland in the existing industrial estate to the west of Lot 2 DP827097, this is not an effective link for most species. Again, the Koala has demonstrated some tolerance of rural to urban woodland (eg. Wilkes and Snowden 1998), and two Koalas were reported crossing Manning Valley Way to the west after the recent major bushfire event, despite security and sheet metal fencing occurring along the boundary of the existing industrial estate.

Lot 1 DP1048115 to the east has ready connectivity to Lot 2 DP 573214 broken only by Glenthorne Rd, which is a gravel road which to some extent limits speed, and is subject to low traffic volume. Fauna such as Koalas could move across Lot 2 to each Eriksson Lane and west to urban woodland west of Lot 2 DP827097.

VZ 7 has a tentative link/stepping stone value for gliders and Koalas from modified habitat to the east on Lot 2 DP1045690 and Lot 3 in the east, to another small patch west on Lot 35 DP606484. This remnant has been underscrubbed historically and is mostly Thick-leaved Mahogany but also contains a few younger Forest Red Gums. A couple of Forest Red Gums occur in the parkland cleared residual of Lot 202 immediately south of Lot 35, and the undeveloped Lots 25 and 28 fronting Manning River Drive (only containing exotic grassland maintained as lawns) provide a very tenuous link for Koalas across nearly 400m of open paddock on the other side of the dual carriageway to the next remnant of forest north of The Bucketts Way. Due to fencing along the eastern boundary of the industrial estate, this gap of undeveloped industrial land provides the only direct route west for Koalas from the site, with a recent report of two Koalas crossing this area in January after the major fire event (Tanya Cross MCC, pers. comm.) in this general area possibly evidencing this.

The two drainage lines in the southern end of Lot 2 DP827097 essentially terminate on or just over the western boundary due to the existing industrial estate. These run east, but vegetation ranges from relatively intact forest to a large dam on a maintained rural-residential lot, hence have some constraints on upstream movements.

2.3.6 Areas of Geological Significance and Soil Hazard Features

The site contains no areas of geological significance but has soil hazard features as outlined in **Table 5** and shown in **Figure 6**.

Table 5: Areas of geological significance and soil hazard features

Area of geological significance or soil hazard feature	Feature type	Area
Low probability of occurrence of Acid Sulphate Soils	ASS (LAp4(p)) OEH 2010	5.68ha
High probability of occurrence of ASS	ASS (HAp2) OEH 2010	0.02

2.3.7 Areas of Outstanding Biodiversity Value

The site does not contain Areas of Outstanding Biodiversity Value.

2.3.8 Site Context

2.3.8.1 Method applied

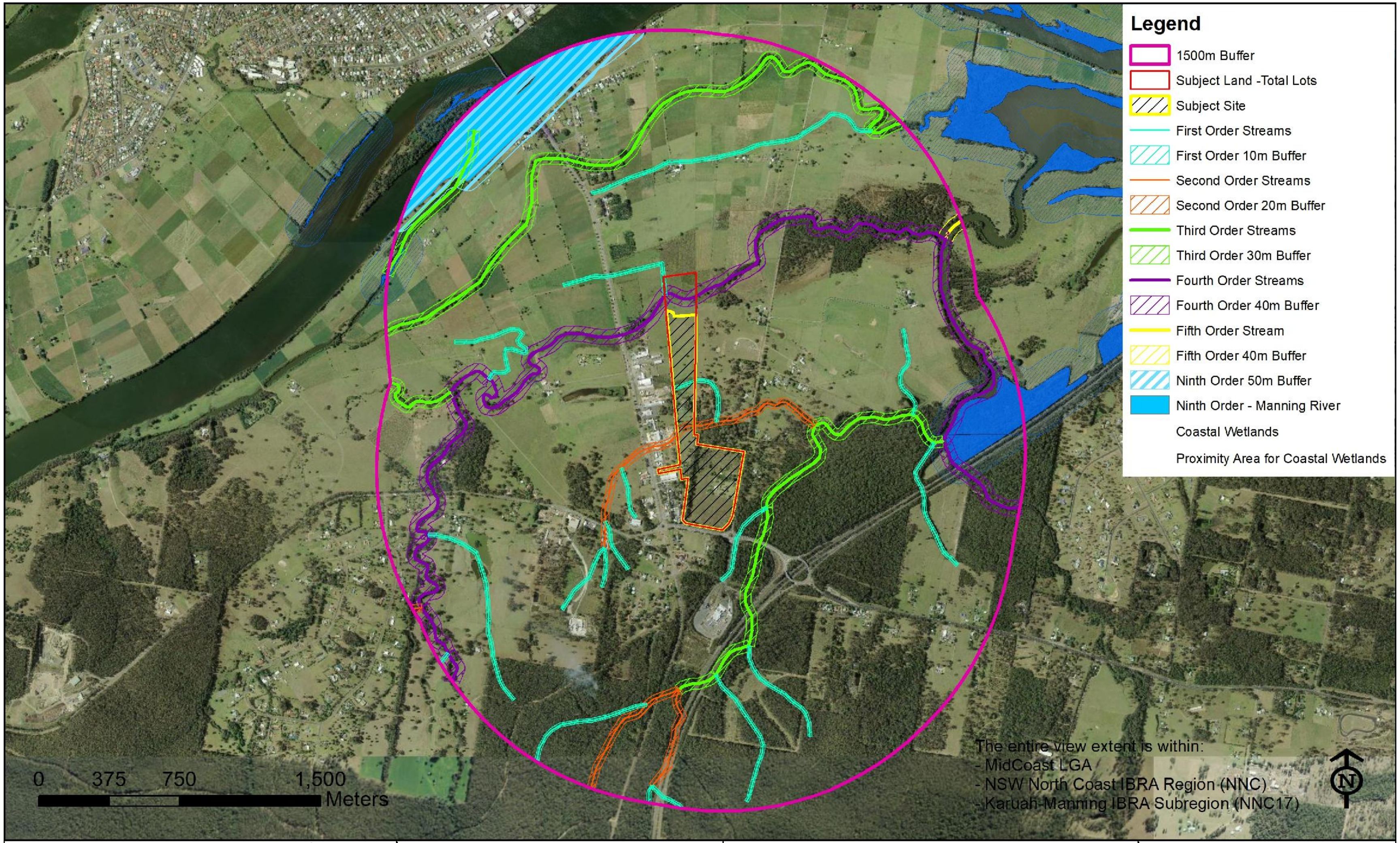
The site-based method has been applied to this development in accordance with section 4.3 of BAM (OEH 2017). Accordingly, a 1.5km buffer zone was used to assess the landscape around the development Site (Figure 1).

2.3.8.2 Percent native vegetation cover in the landscape

The current percent native vegetation cover in the landscape was assessed in ArcGIS 10.5 using aerial imagery sourced from Department of Finance, Services & Innovation (DSI) 2020 (public/NSW Imagery) viewed at 1:500 map scale. The Greater Taree LGA Vegetation Map 2006 was initially used to assess vegetation subject to polygon rectification for increased accuracy.

Approximately 429.89ha of native vegetation was mapped within the 1101.44ha buffer area (total buffer area (1152.54ha) – water bodies (51.06ha). Native vegetation cover within the buffer area is approximately 39% and is assigned to the 30-70% cover class. Native vegetation cover is shown on **Figure 8**.

Figure 4: Watercourses and wetlands relative to subject land and site



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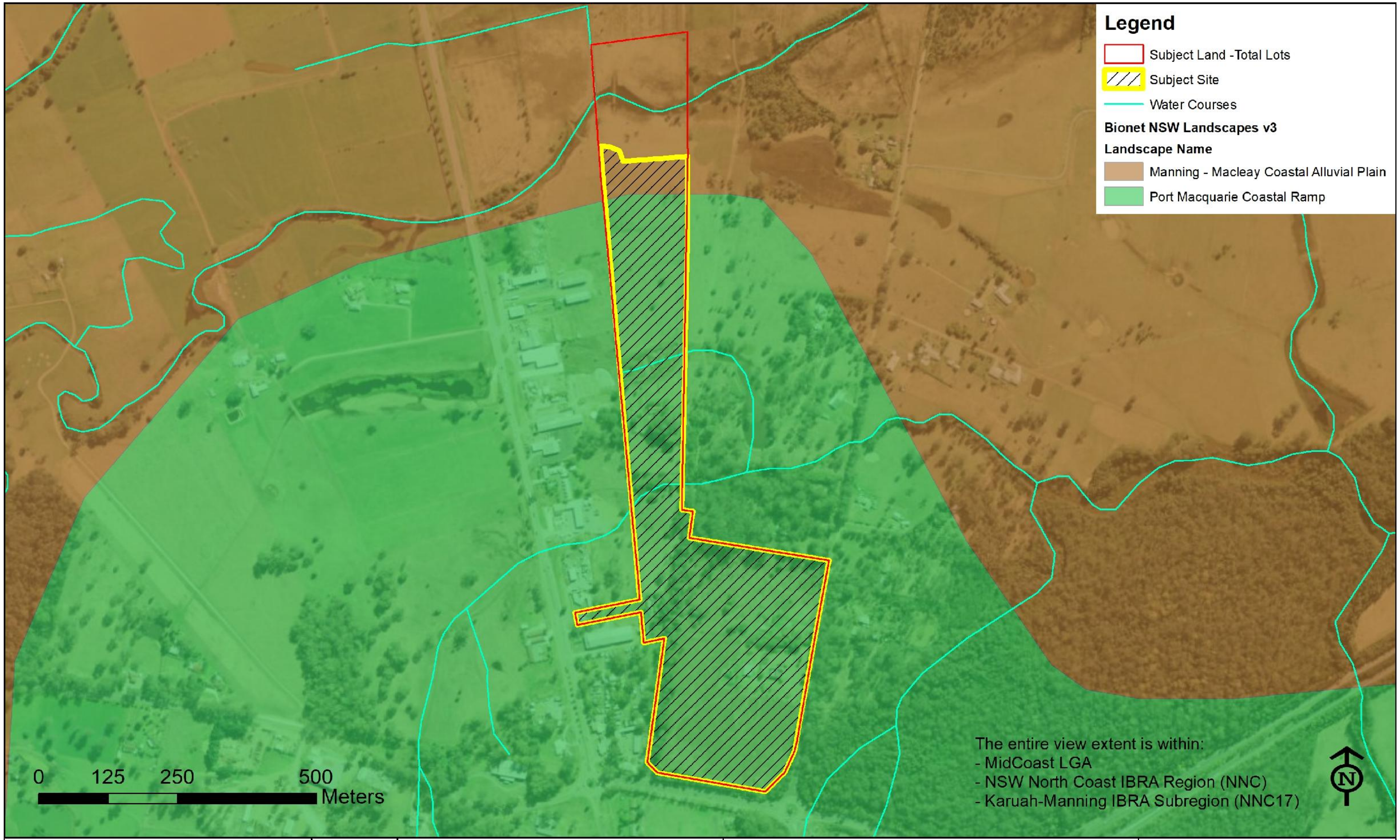
Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Location Map - Streams and Wetlands
Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne
Client: Glenthorne Industries

JBEnviro

Scale: 1 :25,000
Job Number: J2019-35
Revision: A

Figure 5: Corridors and Mitchell Landscapes relative to site



The entire view extent is within:
- MidCoast LGA
- NSW North Coast IBRA Region (NNC)
- Karuah-Manning IBRA Subregion (NNC17)

This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

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Page: 1 of 1

Figure Name: Site Map - Corridors and Bionet NSW Landscapes

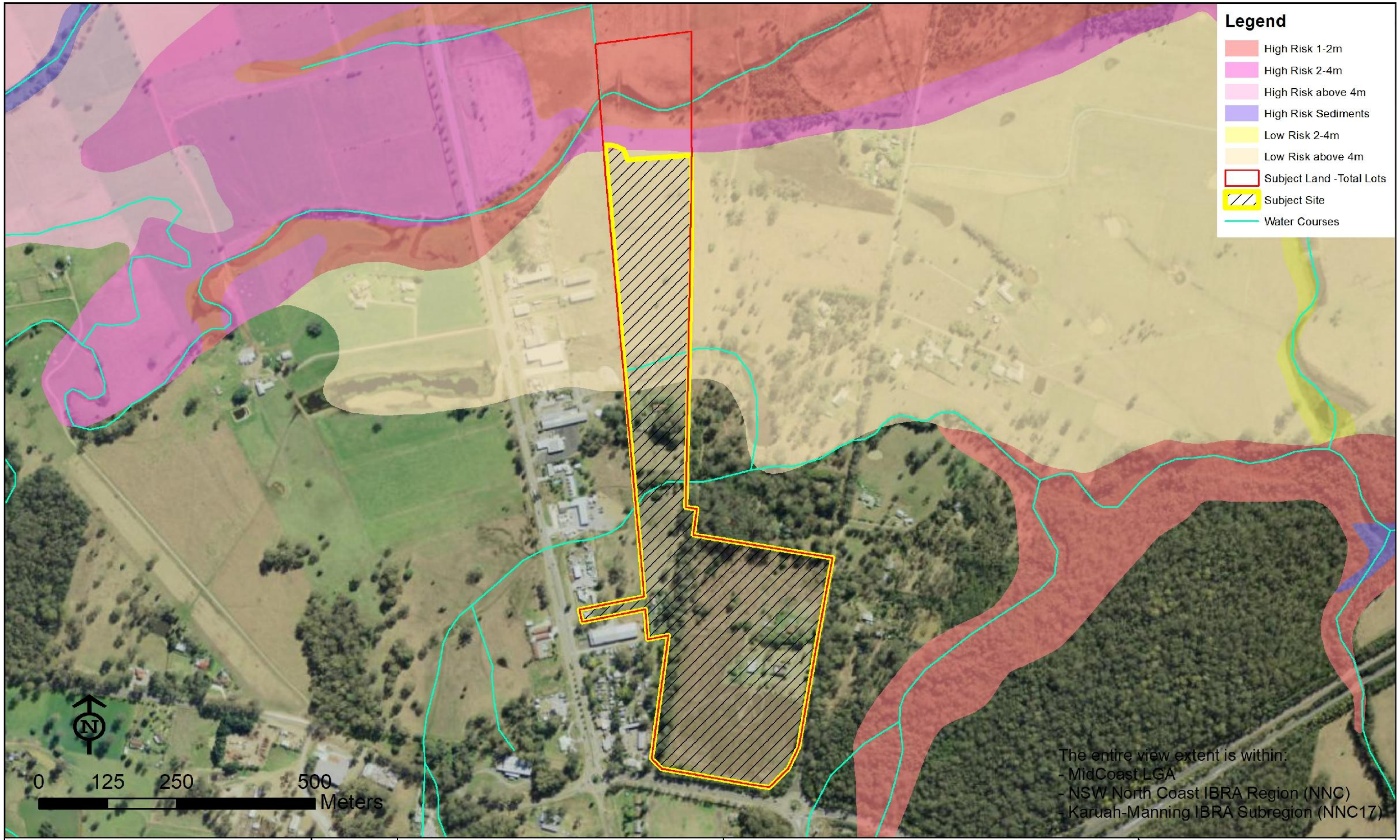
Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

Scale: 1 :8,500
Job Number: J2019-35
Revision: A

Figure 6: Acid Sulfate Soils Risk relative to site



This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Site Map - Acid Sulphate Soils Risk

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884
Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

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Scale: 1:8 500
Job Number: J2019-35
Revision: A

2.3.8.3 Patch size

A patch is defined in the BAM (2017) and BAM Operational Manual (2018) as an area of intact native vegetation that occurs on the subject land/site. The patch may extend onto adjoining land beyond the footprint of the subject land, and for woody ecosystems, includes native vegetation separated by ≤100 metres from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to ≤30 metres. Intact vegetation must contain all structural layers (strata) characteristic of the PCT. Patch size is required to be assessed as 1 of 4 classes per vegetation zone mapped, being <5ha, 5-24ha, 25-100ha or >100ha.

Patch size was calculated using aerial imagery via a select process in ArcGIS as well as the field validated map of vegetation types identified for the study site. A patch size was assigned to each vegetation zone as per the BAM (2017). A vegetation zone is defined as an area of native vegetation on the site that is the same PCT and has a similar broad condition state.

Native vegetation within the subject land was considered intact and connected to a large area of intact, connected, native vegetation extending in all directions within a minor matrix of cleared/partly cleared non-intact native and exotic vegetation. Based upon vegetation mapping and air photo interpretation beyond the subject land, the total area of this patch of native vegetation was calculated as >100 ha, and is therefore within the >100 ha class as shown below:

Table 6: Patch size

Vegetation Zone	Patch size area (ha)
Vegetation Zone 1 – PCT 1262 (moderate1) – assessed as not intact	0
Vegetation Zone 2 – PCT 1262 (moderate2) – assessed as intact	>100ha (approx. 10 235ha)
Vegetation Zone 3 – PCT 1262 (low1) – assessed as not intact	0
Vegetation Zone 4 – PCT 1262 (verylow1) – assessed as not intact	0
Vegetation Zone 5 – PCT 1262 (low2) – assessed as not intact	0
Vegetation Zone 6 – PCT 1262 (low3) – assessed as not intact	0
Vegetation Zone 7 – PCT 1262 (moderate3) – assessed as not intact	0
Vegetation Zone 8 – PCT 1740 (moderate) – assessed as intact	<5ha (0.04ha)
Vegetation Zone 9 – PCT 1064 (high) – assessed as not intact	0
Vegetation Zone 10 – PCT 1737 (moderate) – assessed as intact	<5ha (1.3ha)
Vegetation Zone 11 – PCT 1262 (verylow2) – assessed as not intact	0

2.4 Native Vegetation

2.4.1 BAM Method

Part of the site was burnt during the unprecedented 2019/2020 fire season, and hence the application of the *Guideline for applying the Biodiversity Assessment Method at severely burnt sites: Biodiversity Development Assessment Report/Biodiversity Certification Assessment Report* needs to be considered.

This Guideline was released in February 2020 when BAM plots were being completed under the current accepted fee proposal with the client, with an explanatory webinar hosted by DPIE on the 18/3/2020 clarifying the application of the Guideline.

Due to an earlier deadline for the Planning Proposal's lodgment, this BDAR has been completed via applying the standard BAM. A retrospective assessment of the Guideline is provided as follows to justify this approach, noting that none of recent burnt area falls into the proposed development footprint that is required to be cleared: all such land is to be retained in the Planning Proposal and DA.

The Google Earth Engine Burnt Area Map (GEEBAM) in **Figure 7** shows VZ 1 and VZ 2 have areas of "canopy partially affected" and "canopy fully affected". This requires an evaluation of the site under the criteria in Table 1 of the Guideline as follows:

Table 7: Burnt Sites Guideline – severely burnt qualification assessment

Feature	Descriptive characteristics for severely burnt vegetation	Patch size area (ha)
Species richness	The range of species present before the fire are burnt and/or cannot be identified. Dominant species cannot be easily identified until regeneration occurs	VZ 1: Only western half of this VZ was burnt. Regeneration of the groundcover has been significant due to significant rainfall, matching pre-fire structure and floristics. Pre-fire photos show Whisky Grass may been more abundant than present. Many native species which would not have been detected previously were detectable. Dominant species in canopy, understorey and groundcover readily identified. Some young shrubs provide representative indicator of pre-fire representation. PCT identified. VZ 2: Only very northern end of this VZ burnt. Canopy species readily identifiable, but lower stratums largely absent apart from some regenerating groundcover. Pre-fire photos demonstrate the change, but the PCT was identified. Condition of remainder is considered sufficiently representative of the PCT overall.
Growth form: trees	Canopy trees are killed and/or canopy is consumed or largely consumed with most leaf material charred/scorched. Epicormic growth, if present, is not well developed (<1m long).	Both affected parts of the VZs show scorching of the canopy but very few trees were killed. Epicormic growth in VZ2 is present but just <1m on larger trees. Epicormic growth is advanced in VZ1 and approaching former branch development (most trees here were young saplings).
Growth form: shrubs, forbs, ferns and other	All understorey plants are consumed or largely consumed (some charred). Re-growth, if present, is immature (very few species have attained full height).	VZ1: Yes, shrub layer burnt but young plants common. Dead plants appear to be young rainforest plants and exotics. VZ2: yes, understorey demonstrably removed based on pre-fire photos (JBE 2018).

Feature	Descriptive characteristics for severely burnt vegetation	Patch size area (ha)
Growth form: grasses and grass-like	Ground cover is consumed, or largely consumed. Evidence of ground scorch is present. Re-growth, if present, consists predominately of new re-sprouting growth (native vegetation).	VZ1: Groundcover was consumed but excellent regeneration back to near pre-fire levels in terms of density, dominated by native species and essentially same structure as pre-fire. May raise VI slightly compared to pre-fire where Whisky Grass and other exotic grasses were noted. VZ2: Yes. Completely removed by fire – re-sprouting species present including cryptic species.
Logs	Logs (if expected to have been previously on site) are absent or largely consumed.	VZ1: Log pile burnt, some destroyed as indicated by charcoal bed. This may have negatively affected VI. VZ2: Narrow VZ hence was no major logs present pre-fire.
Litter cover	Pre-fire surface litter (if expected) is consumed. Soil organic layer is consumed or largely consumed. New leaf may be occurring where the canopy was burnt but not scorched	VZ1: Yes, totally consumed in affected portion. Soil organic matter appears less impacted. Dead leaves recently shed creating a shallow layer. New leaf very common. VZ2: Yes, totally consumed in affected portion. Soil organic matter appears less impacted. Dead leaves recently shed creating a shallow layer. New leaf very common
Ash	White ash deposition and charred organic matter is present to several centimetres depth.	VZ1 appears normal as indicated by regenerating except perhaps in the log pile where fire burnt hotter and longer. No white ash. Some localised surface charring in VZ1.

Conclusion:

The Guideline recommends Table 2 to be addressed if the combination of criteria in Table 1 determines the site is *severely burnt*; or if the GEEBAM shows the site as one of the specific burnt categories.

As noted above, part of the site is mapped on the GEEBAM, but the fire severity and its ability to impact the standard application of the BAM is limited due to the fact that the majority of the VZs are unburnt; and regeneration in VZ 2 is extremely advanced due to heavy rainfall received post-fire. It thus marginally meets the other criteria.

Reviewing Figure 2 of the Guideline for assessment options, Option 1 would apply ie. assess the VI using unburnt sections of the VZ (or data collected pre-fire) and replicate plot data in the BAM-C if needed.

As the minimum effort was readily met in unburnt VZ1 without sampling in the burnt area, no extraordinary extrapolation was required. Similarly, a representative plot was able to be taken in the burnt portion in addition to an unburnt portion in VZ2 to capture representative floristics and structure.

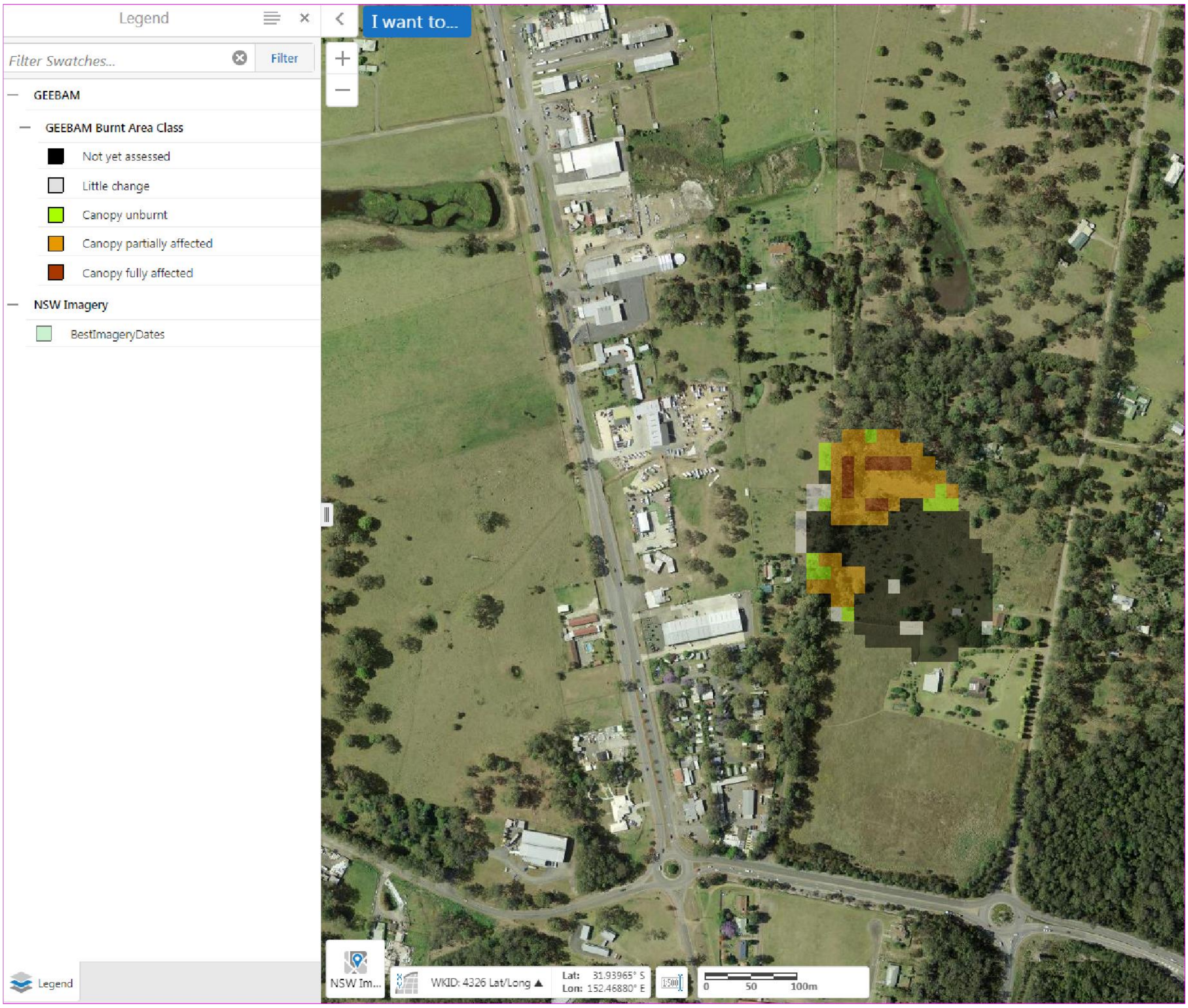
It is thus considered that normal application of the BAM is sufficient in this instance to achieve representative VI data, and complete application of the Guideline (eg. maps of pre-burnt and burnt vegetation in the 1500m buffer) is superfluous.

Notwithstanding this, for this BDAR, the following has been considered or undertaken in principle with the Guidelines to provide a representative assessment for the purposes of the Planning Proposal:

- Fire intensity was not a limitation in determining PCT.
- Assessed Native Vegetation Cover pre-fire (site and 1500m buffer) using pre-fire aerial photography.
- Located plots in VZ 2 in an unburnt area meeting minimum effort, and used this data for rest of VZ (given minimum effort met, the fire had no effect on the VI score and extrapolation is redundant); and locating a plot in a burnt and unburnt part of VZ 1. Recovery level in VZ 1 is expected to offset any adverse weightings in the BAMC calculations eg. low leaf litter levels balanced by high level of native species, very similar pre-fire structure, and low level of High Threat and Environmental weeds.
- Fire pattern did not affect random location of plot sites.
- Fire extent did not affect minimum effort requirements, hence no need to replicate “virtual” plots in BAMC.
- No need for surrogate plots offsite or adjacent.

<table>
<tr><th>Feature</th><th>Descriptive characteristics for severely burnt vegetation</th><th>Patch size area (ha)</th></tr>
<tr><td colspan="3">• VZ 1 species identification was exceptionally high as many cryptic and grass species flowering, hence estimations of previous diversity are not required/considered a limitation.
• Assumed presence where previous survey (JBE 2018) justifies eg. orchids still require seasonal survey in burnt habitats during their flowering season.
• More than sufficient habitat remained for confident and representative Species Credit fauna species survey to confidently determine pre-fire presence/absence of Specie Credit fauna species.
• Neither VZ falls within a potential Threatened Ecological Community.
• Only 1 HBT lost during fire, but was not within a plot.
• No loss of any Species Credit flora species that depends on counts for the species polygon.
• VZ1 is expected to be rezoned as E2, and burnt proportion of VZ 2 to be retained, hence no credits would be generated from data collected from burnt plots.</td></tr>
</table>

Figure 7: GEEBAM map of the subject land



2.4.2 BAM survey effort

The BAM plot based survey was undertaken within the subject site by Matthew Bailey on 19/2/2020 to the 22/2/2020, with review by Jason Berrigan from 20-28/2/2020. The following tables summarises the BAM effort. In addition to this survey, the entire site was traversed numerous times during other aspects of the survey, and also pre-fire (JBE 2018).

Plot locations are shown in **Figure 9**. All field data collected at full-floristic and vegetation integrity plots is included in **Appendix 4**.

The existing dwellings, sheds and developed land on Lot 203 was not assessed due to lack of vegetation.

Table 8: BAM vegetation survey effort on the site

PCT ID	Veg Zone	Condition	Area (ha)	Plots Required as per BAM (2017)	No. Full floristic composition/PCT identification/Vegetation Integrity Plots	No. Function Plots
1262	1	moderate	3.66	2	2	2
1262	2	moderate	1.98	1	1	1
1262	3	low	4.46	2	2	2
1262	4	very low	4.8	2	2	2
1262	5	low	1.25	1	1	1
1262	6	low	1.71	1	1	1
1262	7	moderate	0.24	1	1	1
1740	8	moderate	0.04	1	1	1
1064	9	moderate	0.31	1	1	1
1737	10	moderate	0.67	1	1	1
1262	11	very low	1.55	1	1	1

2.4.3 Plant Community Types

Four PCTs were determined in 11 vegetation zones (VZs) due to disturbance from non-fire impacts.

Two of the VZs are artificial habitats (dams) and the structure and floristics may not represent the original vegetation communities (most likely originally a swamp forest). These were best fits based on matches to the current floristics and structure.

Identification of the dominant PCT was extremely difficult due the fact the only near intact vegetation including remnant canopy on site occurs in Eriksson Lane, and appears to be an eclectic mix which may straddle an edaphic ecotone; and the intensity of alteration by previous clearing and pastoralism. It is possible that currently cleared parts of the site originally contained a series of merge zones of a complex mosaic of PCTs grading from Quaternary sediments of various ages through elevation to colluvial and residual soils, and this may account for the patterns observed in some VZs eg. VZ 1, 2 and 7.

The options considered for this PCT were Blackbutt-dominated PCTs such as 686, 695 and 699, as Blackbutt occurs on Lot 1 to the east and dominates vegetation east of the highway, and Lot 3 to the north of Lot 2 DP573214. These were eliminated due to being outside described landscape or geographic range; understorey not being a clear match (groundcover had the best match but all were more mesophyllic in lower stratums); Blackbutt is not dominant both on site, on Lot 1 or other remnant vegetation along Glenthorne Rd or in forest to south around the highway service centre on similar edaphic positions; and Tallowwood, Forest Red Gum, White Stringybark and Mahogany species were not listed as characteristic in these PCTs.

Searches for Forest Red Gum PCT matches quickly eliminated all PCTs with this species as dominant or co-dominant due to being outside the IBRA sub-region and landscape; being associated with species which do not occur in the sub-region; or only containing 1 or 2 matching canopy species and usually a mis-match for lower stratums. PCT 1598 (Forest Red Gum grassy open forest on floodplains of the lower Hunter) was perhaps the closest match *per se*, but was north of its known range, and the canopy association of Forest Red Gum was with two species absent from the site and study area.

Searches for Tallowwood-dominated PCTs generally yielded no clear matches, with associations often being fern-dominated groundcovers; Sydney Blue Gum and Brush Box were not co-dominant; outside the range of the PCT (landscape and IBRA sub-region); and absence of the other canopy dominant species.

PCT 1262 was identified as the best Tallowwood and site match due to meeting IBRA sub-region, geographical context, and a very good match with lower stratums (more so on land south around Purfleet and along Glenthorne Rd which was inspected for comparison). However, 3 of the 6 canopy species were not present on site, most conspicuously Grey Gum. This PCT however appears to dominate vegetation south of the site and on along Glenthorne Rd in a similar edaphic situation south of the site, and contains Forest Red Gum and Sydney Blue Gum in variable abundance.

Review of the Greater Taree City Council (PAJE 2006) mapping determined two potential PCT types in the locality: Blackbutt dominated (RN17-37); or Small-fruited Grey Gum-Grey Ironbark – Broad-leaved Mahogany (RN17-62/FE 52), with another variant including Forest Red Gum (RN17-65). Remnant forest on site, east and north is mapped as the Blackbutt-dominated community, but Blackbutt is rare on site and only common in patches along Glenthorne Rd. The document for this mapping (PAJE 2006) has no detailed profiles to review, but the notes on local variants including Forest Red Gum suggested PCT 1262 was the best fit given the current range of PCTs to select from.

Thus PCT 1262 was finally selected as the PCT for most of the site, in the absence of any other compelling evidence to the contrary for a PCT that was a better fit. The release of the East Coast PCT mapping later in 2020 may provide better PCT matches, and future BDARs will rely on that information to refine PCT selection for the site.

Figure 8: Native vegetation cover within 1500m^2 buffer

The entire view extent is within:
- MidCoast LGA
- NSW North Coast IBRA Region (NNC)
- Karuah-Manning IBRA Subregion (NNC17)

This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Location Map - Native Vegetation Cover

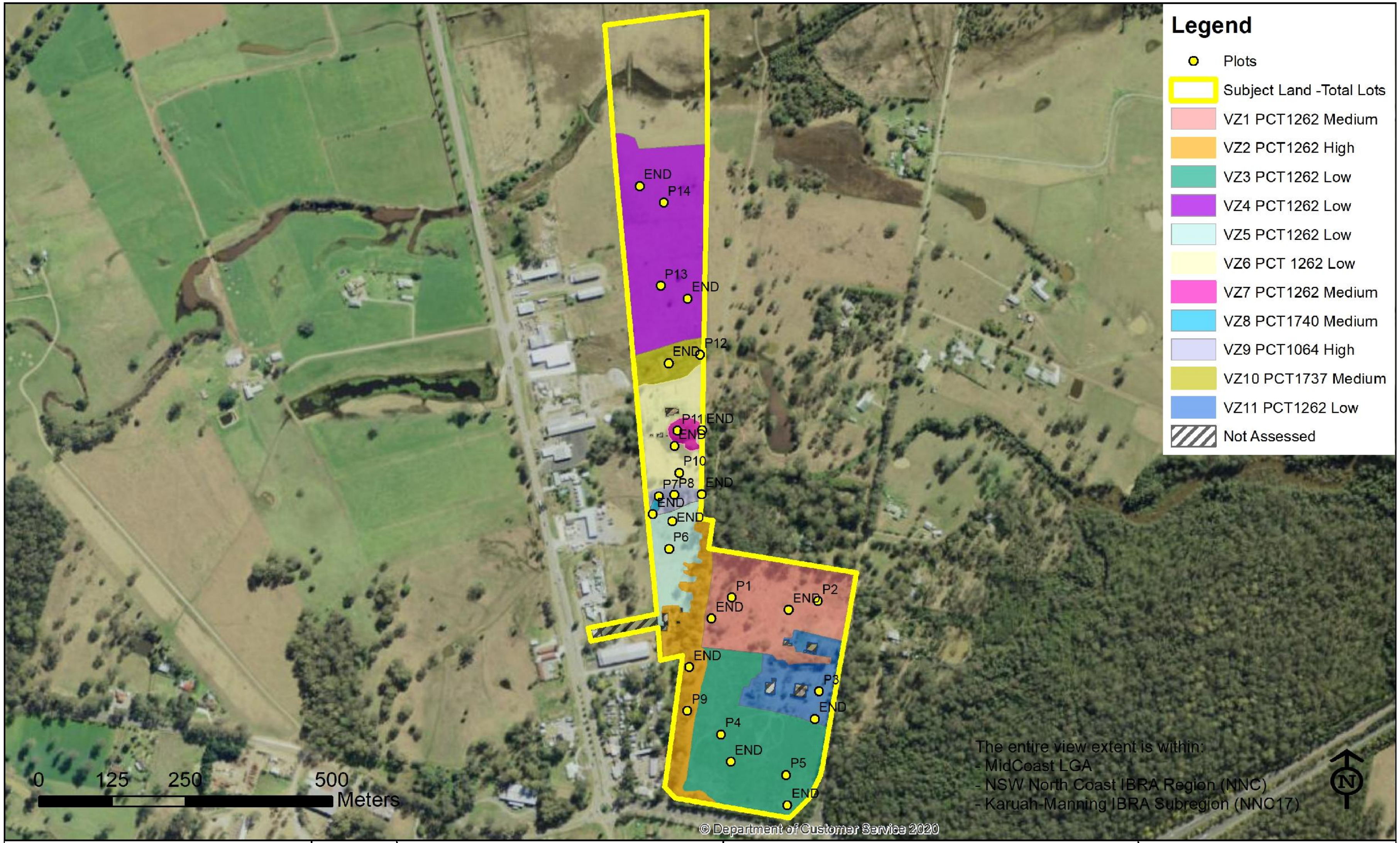
Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

Scale: 1 :25,000
Job Number: J2019-35
Revision: A

Figure 9: Plot locations, vegetation zones and PCTs



Project Manager: JB
Drawn By: MB
Date: 5/06/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Vegetation Zones, PCTs and Plot Locations

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

Scale: 1 :8,000
Job Number: J2019-35
Revision: A

2.4.3.1 VZ1 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Dominates Lot 2 DP573214
Condition	Moderate. Previously cleared with some clumps of pasture species mainly near the dwelling, but overall groundcover is dominated by natives. Rapidly being colonised by eucalypts in the west.
Extent within Development Site	3.66ha
Description	(a) Canopy: *Structure and Species*: Consists of patches of regrowth in the western end, along the northern boundary, and along southwest side of existing dwelling on Lot 2. Dominated by Tallowwood (*Eucalyptus microcorys*) with Forest Red Gums (*E. tereticornis*) 6-10m high with trunk diameter at breast height (DBH) 10-20cm, with a few older Tallowwood 18-24m high with trunk DBH 30-40cm. A mature Pink Bloodwood (*Corymbia intermedia*) occurs near the existing dwelling with some younger trees, and a few Grey Ironbark (*E. siderophloia*) and Tallowwood saplings occur near Glenthorne Rd. (b) Understorey: No true stratum as most trees on site are the young Tallowwood and Forest Red Gums, but are some Black Wattle (*Acacia melanoxylon*) around 4-6m high around sheds near the dwelling, and a patch of Narrow-leaved Paperbarks (*Melaleuca linariifolia*) in the northwest. (c) Shrub Layer: *Structure and Species*: Not really a true stratum. Consists of dense lantana patches under the clumps of trees around the existing dwelling and northeast clump. Post-fire, some young eucalypts are regenerating in the western end (<2m tall). Some scattered *Pultenaea villosa*, *Breynia oblongifolia* and *Pimelea linifolia*. (d) Ground Layer: *Structure and Species:* Varies soil moisture content and disturbance, ranging from sparse to moderately dense. Height generally ranges from 0.2-1m. The eastern end has a higher content of exotic grasses, especially near the dwelling where Common Paspalum (*Paspalum dilatatum**) and patches of Vasey Grass (*P. urvillei**) mix with Couch (*Cynodon dactylon*) plus a lesser mix of native and exotic herbs and grasses. North of here and also west of the old sheds, Kangaroo Grass (*Themeda triandra*) with some weed content dominates outside the patch of trees, under which Bladey Grass (*Imperata cylindrica*), Weeping Grass (*Microlaena stipoides*) and *Oplismenus aemulus* dominate. The remainder of site after the recent fire, has seen a major shift back to predominantly native cover dominated by Weeping Grass, *Fimbristylis dichotoma*, Slender Bindweed (*Polymeria calycina*) and *Tricoryne elatior*, with Whiteroot (*Pratia purpurascens*), Bladey Grass, *Paspalum distans, Lomandra filiformis* and a variety of herbs. Where drainage is poor in a localised area in the northwest, *Ishaemum australe, Fimbristylis dichotoma, Goodenia bellidifolia* spp. *argentea* and *Carex* spp.

	sedge are more abundant. Patches of *Setaria sphacelata** and Paspalum also occur around a former log pile and towards the southern boundary. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Generally limited to some Glycines, with a patch of Blackberry (*Rubus fruticosus* L. agg.) in the northwest corner.
Justification for PCT Identification	As detailed above.
TEC Status	Does not correlate to any TEC under NSW or Commonwealth legislation – see section 2.4.3.

2.4.3.2 VZ2 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Dominates Eriksson Lane, with remnants on edges of adjacent paddocks evidenced by native groundcover and remnant trees.
Condition	Moderate. Contains senescent trees but lower stratums have at times very high weed infestation, and undergrowth has been underscrubbed at some time.
Extent within Development Site	1.98ha
Description	(a) Canopy: *Structure and Species*: Consists of mix of immature to senescent trees with trunk DBH 20-110cm, 18-24m high. Floristics vary with location. Middle and southern end dominated by Tallowwood with Thick-leaved Mahogany (*E. carnea*) with associates including Grey Ironbark, Pink Bloodwood (*Corymbia intermedia*), White Stringybark (*E. globoidea*), White Mahogany (*E. acmenoides*) and Sydney Blue Gum (*E. saligna*). Northern end has a localised dominance of Forest Red Gum with Blackbutt (*E. pilularis*) and Tallowwood. (b) Understorey: Sparse, consisting of suppressed canopy species (mainly Pink Bloodwood and Tallowwood) 10-25cm trunk DBH, 5-10m tall with some common rainforest species (eg. *Rapanea howittiana, Clerodendrum tomentosum*), wattles and Cherry Ballart (*Exocarpos cupressiformis*). Narrow-leaved Paperbarks, Prickly Paperbark, Geebungs (*Persoonia* spp.), wattles and Cheese Tree occurred more commonly in the northern end before the fire. This VZ also includes plantings around a dwelling which comprise a mix of native and exotic tree species eg. *Stenocarpus sinuatus*, Spotted Gums and Broad-leaved Paperbarks. (c) Shrub Layer: *Structure and Species*: Generally sparse except where lantana dominates in patches. Southern end contains a dense patch of Castor Oil Plant (*Ricinus communis**).

	Breynia oblongifolia plus a number of young wattles and rainforest pioneers generally comprise this stratum where present. (d) Ground Layer: *Structure and Species:* Varies with soil moisture content and disturbance, ranging from sparse to moderately dense. Height generally ranges from 0.2-1m. At times heavy leaf litter dominates this stratum. Otherwise, variable mix of a range of roadside weeds (eg. Paddies Lucerne, *Bidens pilosa*, Ehrharta erecta*, Paspalum mandiocanum**), and Bracken Fern (*Pteridium esculentum*), native grasses and herbs eg. Bladey Grass, *Oplismenus aemulus*, Whiteroot, *Lomandra filiformis*, *L. longifolia*, and *Dichondra repens*. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Generally limited to some Glycines, *Hardenbergia violacea*, Wombat Berry (*Eustrephus latifolius*); plus some exotic passionfruit, *Ipomoea cairica**, and Blackberry.
Justification for PCT Identification	As detailed above. The Forest Red Gum – Tallowwood – Blackbutt was considered to possible be another PCT and hence Vegetation Zone, however no clear match could be found, and it was considered likely that this was an ecotone between >2 PCTs as a result of a gradual change in elevation, drainage and soil type, with localised dominance being a relic of the disturbance history. While this VZ is predominantly within the Eriksson's Lane road reserve and is mature to senescent forest with all lower stratums at least partially present over the majority, some of this VZ includes mature trees in the adjacent pasture and around a dwelling where groundcover is regularly mown on Lot 2 DP827097; some native grassland with a single Tallowwood on Lot 50 adjacent to the road reserve; and a sliver of immature regrowth in the southwest corner of Lot 50.
TEC Status	Does not correlate to any TEC under NSW or Commonwealth legislation – see section 2.4.3.

2.4.3.3 VZ3 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Dominates Lot 50.
Condition	Low. This PCT has been historically cleared and was reported to have been used for a herb farm, hence some cultivation is expected to have occurred, and it is periodically slashed. This VZ is also fenced and grazed by cattle, which reduced the cover to ground level prior to rainfall in late January - early February which saw a major change and enable highly accurate species identification. Native cover composition increases in proximity to adjacent remnant native vegetation.
Extent within Development Site	4.46ha

Description	(a) Canopy: Absent (b) Understorey: Absent (c) Shrub Layer: Reduced by slashing to seedling eucalypts with a few shrubs such as *Acacia ulicifolia* <50cm high near remnant vegetation. (d) Ground Layer: *Structure and Species:* Varies with soil moisture content and disturbance, but moderately dense. Height generally ranges from 0.2-1m. Dominated by a complex mix of native and exotic grass and herb species. Dominant natives were *Tricoryne elatior*, Scented-top Grass (*Capillipedium spicigerum*), *Goodenia bellidifolia* spp. *argentea*, Bristly Cloak Fern (*Cheilanthes distans)*, Weeping Grass, and Centella. Exotics included Purpletop (*Verbena rigida**), Carpet Grass (*Axonopus fissifolius**), *Setaria sphacelata**, *Oxalis corniculata**, Catsear (*Hypochaeris radicata**), and Paspalum. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Generally limited to some Glycines.
Justification for PCT Identification	As detailed above.
TEC Status	Does not correlate to any TEC under NSW or Commonwealth legislation – see section 2.4.3.

2.4.3.4 VZ4 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Dominates the northern end of Lot 2 DP827097
Condition	Extremely disturbed. The original PCT has essentially been displaced by historical clearing and cultivation for improved pasture.
Extent within Development Site	4.8ha

Description	(a) Canopy: Consists of a few scattered trees, most of which are Camphor Laurel (*Cinnamonum camphora**). (b) Understorey: Absent (c) Shrub Layer: Absent. (d) Ground Layer: *Structure and Species:* Moderately dense but kept low by grazing to <10cm. Dominated by a mix of exotic grass and herb species. Dominant species are Carpet Grass, Paspalum, and Kikuyu (*Pennisetum clandestinum**), with Fireweed (*Senecio madagascariensis**), Violet Crabgrass (*Digitaria violascens*)*, Purpletop and Paddies Lucerne. Natives occur in low abundance eg. Centella, *Ranunculus inundatus,* Whiteroot and *Juncus* spp. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Absent.
Justification for PCT Identification	As detailed above.
TEC Status	Does not correlate to any TEC under NSW or Commonwealth legislation – see section 2.4.3.

2.4.3.5 VZ5 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Dominates the paddock in the southern end of Lot 2 DP827097 where a dwelling occurs.
Condition	Low. Historically cleared with some fill stored on eastern side. Few scattered trees. Groundcover is more native than VZ4, but Couch could be a pastoral introduction not a relic.
Extent within Development Site	1.25ha
Description	(a) Canopy: *Structure and Species*: Consists of few scattered trees of native and exotic varieties eg. Cadaghi (*Corymbia torelliana**), Forest Red Gum and a single Prickly Paperbark (*Melaleuca styphelioides*). (b) Understorey: Absent. (c) Shrub Layer: Absent apart from some Wild Tobacco (*Solanum mauritianum* *) and Inkweed (*Phytolacca octandra**) on the fill. (d) Ground Layer: *Structure and Species:* Moderately dense but limited by grazing to <20cm.

	Dominated by a mix of Paspalum, Couch, Crabgrass (*Digitaria sanguinalis**) and Violet Crabgrass, with Catsear, Purpletop, and Fireweed with a few native herbs and grasses. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Absent.
Justification for PCT Identification	As detailed above.
TEC Status	Mapped as occurring on Quaternary (Pleistocene) alluvials, but only native vegetation is some common herbs, grasses and sedges which suggest the last vestiges of a Coastal Floodplain EEC. Unknown if below 1:100 ARI but industrial estate adjoining is not elevated, suggesting not. Hence appears unlikely to be even an extremely degraded and hence non-viable EEC.

2.4.3.6 VZ6 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Dominates the middle section of Lot 2 DP827097 around the clump of forest that comprises VZ7, between the two drainage lines on site.
Condition	Low. Historically cleared with the associated original dwelling on the Lot. Numerous sheds and landscaping occurs.
Extent within Development Site	1.71ha
Description	(a) Canopy: *Structure and Species*: Consists only a remnant Thick-leaved Mahogany and a planted Moreton Bay Fig (*Ficus macrophylla*) west of the house, and a line of fur pines along fencelines in the south and southwest. (b) Understorey: Consist of planted exotic (eg. *Spathodea campanulata**), and native ornamentals and fruit trees, including several *Macadamia tetraphylla*. (c) Shrub Layer: Consist of planted and native ornamentals. (d) Ground Layer: *Structure and Species:* Moderately dense but limited by grazing to <20cm. Dominated by a mix of exotics and native grasses, herbs and weeds ie. Paspalum, Couch, Oxalis, Carpet Grass, Violet Crabgrass, *Fimbristylis dichotoma*, *Dichanthium sericeum,* with Purpletop, and Fireweed with a few native herbs and grasses. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Some *Desmodium varians*.
Justification for PCT Identification	As detailed above.

TEC Status	While mapped as occurring on Quaternary (Pleistocene) alluvials, Thick-leaved Mahogany is not listed as an indicator species in any of the Coastal Floodplain Final Determinations. Thick-leaved Mahogany to west also indicates not prone to elevated watertable or standing water, hence alluvial processes not a key influence. Unknown if below 1:100 ARI but dwelling is not elevated, suggesting not. Hence appears unlikely to be even an extremely degraded and hence non-viable EEC.

2.4.3.7 VZ7 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Comprises an isolated mixed age patch near the dwelling on Lot 2 DP827097 between the two drainage lines.
Condition	Moderate. Consists of two remnant trees with a dense stand of immature regrowth trees, with a very disturbed lower stratums subject to stock camping and grazing, and a former outdoor BBQ area.
Extent within Development Site	0.24ha
Description	(a) Canopy: *Structure and Species*: Consists of mix of immature to senescent trees with trunk DBH 30-100cm (average 40-60cm), 18-24m high. Dominated by Tallowwood, Forest Red Gum and Pink Bloodwood. (b) Understorey: Sparse, consisting of suppressed canopy species (mainly Pink Bloodwood), with a few Camphor Laurel 10-25cm trunk DBH, 5-15m tall. (c) Shrub Layer: *Structure and Species*: Absent (d) Ground Layer: *Structure and Species:* Moderately dense but low (<30cm). Dominated by mix of native and exotic herbs and grasses ie. Paddies Lucerne, Stinking Roger (*Tagetes minuta**), Oriental Motherwort (*Leonurus japonicas***)**, *Phyllanthus tenellus*, Bidens pilosa**, *Oplismenus aemulus, O. imbecillis*, Wandering Jew (*Commelina cyanea*), Centella, Weeping Grass, Whiteroot, and Panic Veldt Grass. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Generally limited to some Glycines plus some exotic passionfruit.
Justification for PCT Identification	As detailed above. This patch of novel Forest Red Gum – Tallowwood – Pink Bloodwood was considered as another PCT and hence vegetation Zone, however no clear match could be found. It is considered to simply be a subset of the original PCT which has been completely modified from its original character.

TEC Status	While mapped as occurring on Quaternary (Pleistocene) alluvials, Tallowwood is not listed as an indicator species in any of the Coastal Floodplain Final Determinations. Dominance of Tallowwood indicates not prone to elevated watertable or standing water, hence alluvial processes not a key influence. Unknown if below 1:100 ARI but dwelling is not elevated, suggesting not. Not considered to be an EEC.

2.4.3.8 VZ8 PCT 1740: Tall Spike Rush freshwater wetland

PCT	PCT 1740: Tall Spike Rush freshwater wetland
Percent cleared	70%
Formation	Freshwater Wetlands
Class	Coastal Freshwater Lagoons
Location	Comprises the dam in the western end of the southern drainage line on Lot 2 DP827097
Condition	Moderate. This is an artificial habitat derived from clearing PCT1064 to create a small dam. Prone to scouring from upstream stormwater and ongoing weed infestation.
Extent within Development Site	0.04ha
Description	(a) Canopy: *Structure and Species*: Absent (b) Understorey: Absent. (c) Shrub Layer: Absent (d) Ground Layer: *Structure and Species:* Moderately dense but low (<30cm). Covers about 90% of the dam. Dominated by Water Paspalum (*P. distichum*) with Slender Knotweed (*Persicaria decipiens*), Parrot's Feather (*Myriophyllum aquaticum**), *Ludwidgia peploides*, *Elaeocharis acuta*, and water lilies (*Nymphaea alba**, *N. caerulea*). Frogsmouth (*Philydrum lanuginosum*) is also common in parts, as is a filamentous green algae. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Absent
Justification for PCT Identification	This was the best fit for this VZ although Giant Spikerush was absent.
TEC Status	**Yes**. Lies on alluvial soils in a topographic feature listed in the Final Determination with demonstrable active alluvial processes, and vegetation matches BC Act EEC - *Freshwater Wetlands on Coastal Floodplains*.

2.4.3.9 VZ9 PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion

PCT	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion
Percent cleared	75%
Formation	Forested Wetlands
Class	Coastal Swamp Forests
Location	Dominates the southern drainage line on Lot 2 DP827097 between the two dwellings
Condition	Moderate. Possibly regrowth lacking emergent eucalypts which appear to occur downstream on adjacent land. Grazed by cattle but weed content is low.
Extent within Development Site	0.31ha
Description	(a) Canopy: *Structure and Species*: Consists of mix of immature to mature often multi-stemmed trees with trunk DBH 15-30cm (average 20-630cm), 5-8m high. Dominated by Prickly Paperbarks and Narrow-leaved Paperbark. *Melaleuca nodosa* appears downstream off site with Forest Red Gums and Pink Bloodwood. (b) Understorey: No true stratum. (c) Shrub Layer: *Structure and Species*: Absent except for young Cockspur (*Maclura cochinchinensis*) and Camphor Laurel. (d) Ground Layer: *Structure and Species:* High level of cover but open, <50cm. Dominated by mix of native sedges, grasses and herbs, with some exotic grasses and herbs. Most common species were Whiteroot, Weeping Grass, Wandering Jew, *Dichondra repens, Cyperus eragrostis*, Carex appressa,* Parrots Feather, *Ranunculus inundatus*, *Juncus usitatus*, Drooping Sedge (*Carex longebrachiata*), Elaeocharis acuta, Couch, Knob Sedge (*Carex inversa)*, Centella, Carpet Grass, *Setaria parviflora** and *Hydrocotyle sibthorpioides.* (e) Lianas, scramblers, epiphytes, mistletoe etc.: Glycines, Monkey Rope (*Parsonsia straminea*), with some Tongue Orchid (*Dendrobium linguiforme*). Few *Amyema* spp. mistletoe noted.
Justification for PCT Identification	Very good match floristically in canopy and mid stratum, but not groundcover. Other PCT options had Swamp Oak or other non-matches in these stratums. Readily meets other criteria.
TEC Status	**Yes**. Lies on alluvial soils in a topographic feature listed in the Final Determination with demonstrable active alluvial processes, and vegetation matches BC Act EEC – *Swamp Sclerophyll Forest on Coastal Floodplains*.

2.4.3.10 VZ10 PCT 1737: Typha rushland

PCT	PCT 1737: Typha rushland
Percent cleared	70%
Formation	Freshwater Wetlands
Class	Coastal Freshwater Lagoons
Location	Comprises the twin dams in the central drainage line on Lot 2 DP827097 just north of the second dwelling
Condition	Moderate. This is an artificial habitat probably derived from clearing PCT1064 to create two small dams tentatively separated by earthen fill crossings (the upstream one is lower), with a break in the lower crossing allowing some free flow of water. Prone to ongoing weed infestation from upstream terminus of both the watercourse and this community. Self-mulching habitat of dominant species is however developing a deep humic layer limiting surface water depth. Some edge dredging has occurred in past to create cattle drinking points.
Extent within Development Site	0.67ha
Description	(a) Canopy: *Structure and Species*: Absent (b) Understorey: Absent. (c) Shrub Layer: Absent (d) Ground Layer: *Structure and Species:* Moderately dense and often tall (>1m). Covers about 90% of the dams. Dominated by Marsh Club Rush (*Bolboschoenus caldwellii*) and Narrow-leaved Cumbungi (*Typha orientalis*), with *Sagittaria montevidensis*, Persicaria decipiens, P. strigosa*, Water Paspalum, Parrot's Feather, *Ludwigia peploides, Elaeocharis acuta*, and Lesser Joyweed (*Alternanthera denticulata).* Water Ribbons (*Triglochin procera*) occurs occasionally, as does green filamentous algae. (e) Lianas, scramblers, epiphytes, mistletoe etc.: Absent
Justification for PCT Identification	This was the best fit for this VZ as no other *Typha* dominated PCT is listed, despite being north of the reported range. *Typha* has probably invaded and displaced the original aquatic vegetation.
TEC Status	**Yes**. Lies on alluvial soils in a topographic feature listed in the Final Determination with demonstrable active alluvial processes, and vegetation matches BC Act EEC - *Freshwater Wetlands on Coastal Floodplains*.

2.4.3.11 VZ11 PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast

PCT	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast
Percent cleared	30%
Formation	Wet sclerophyll forest (Grassy sub-formation)
Class	Northern Hinterland Wet Sclerophyll Forests
Location	Dominates the house yards on Lot 50 and Lot 2 DP573214.
Condition	Completely modified to maintained lawns and gardens, although dwelling on Lot 2 is now derelict. Small orchard at rear of house on Lot 50. Rear of Lot 2 dwelling where sheds occur heavily infested with lantana.
Extent within Development Site	1.55ha
Description	(a) Canopy/Understorey/Shrub: *Structure and Species*: Generally consists of ornamental exotic cypress pines and palms, some native trees and shrubs (ie Spotted Gum, *Melastoma affine*) planted along boundaries or in yards. (b) Ground Layer: *Structure and Species:* Moderately dense but limited by grazing to <20cm. Dominated by a mix of exotics and native grasses, herbs and weeds ie. Buffalo Grass (*Stenotaphrum secundatum*), *Sporobolus affinis**, Carpet Grass, *Eragrostis brownii, Themeda triandra,* Catsear, and Couch. (c) Lianas, scramblers, epiphytes, mistletoe etc.: Absent apart from exotic climbers.
Justification for PCT Identification	As detailed above for this PCT.
TEC Status	While mapped as occurring on Quaternary (Pleistocene) alluvials, Thick-leaved Mahogany is not listed as an indicator species in any of the Coastal Floodplain Final Determinations. Thick-leaved Mahogany to west also indicates not prone to elevated watertable or standing water, hence alluvial processes not a key influence. Unknown if below 1:100 ARI but dwelling is not elevated, suggesting not. Hence appears unlikely to be even an extremely degraded and hence non-viable EEC.

Photo 1: VZ 1 PCT 1262 west end (post-fire March 2020)

Photo 2: PCT 1262 – east end

Photo 3: VZ2 PCT 1262 – Erikson's Lane central view south

Photo 4: VZ2 PCT 1262 – northern end prior to recent fire (2018)

Photo 5: VZ 3 PCT 1262

Photo 6: VZ 4 PCT 1262

Photo 7: VZ 5 PCT 1262

Photo 8: VZ 6 PCT 1262 (view towards VZ 7)

Photo 9: VZ 7 PCT 1262

Photo 10: VZ 8 PCT 1740

Photo 11: VZ 9 PCT 1064

Photo 12: VZ 10 PCT 1064

Photo 13: VZ 11 PCT 1262

2.4.4 TECs

2.4.4.1 NSW

The site contains two EECs, with a third in the study area (within 100m of the site), as follows and shown in **Figure 10**.

> ***Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions***

The EEC – *Freshwater Wetlands on Coastal Floodplains*, is comprised by the sedgeland dominated by Cumbungi within a relic watercourse just north of the northern dwelling on Lot 2 DP827097. This community qualifies as an EEC on the following criteria (NSWSC 2004a):

- Occurs in the specified region and Local Government Area (LGA).
- Occurs on mapped alluvial soils (Troedson and Hashimoto 2005).
- Occurs within a topographical unit described in the Final Determination ie. depressions, flats, drainage lines, backswamps, lagoons and lakes.
- Structure and floristics correlate with the Final Determination.

The local occurrence of this EEC in this watercourse here extends off-site east and west to extend within the remainder of the relic watercourse, which due to filling in the west and modification to a dam in the east, is essentially a billabong. A channel has been dug along the northern side, and the wetland is divided by two crossings joined by a 300mm pipe – the eastern one being the more elevated and used. Weeds are present in the form of *Myriophyllum* spp. on site, with *Setaria* spp. being very common on the western boundary and in the upstream portion.

A dam in the drainage line to the south does not qualify as this EEC although it is largely vegetated with native wetland vegetation, as artificial structures are excluded from this EEC.

Stitts Creek in the northern end of Lot 2 also qualifies as a derived example of this EEC, but is another local occurrence as it does not have a direct fluvial connection and hence exchange of genetic materials between both occurrences would be limited to major flood events and movement of waterfowl.

Both occurrences historically would have been enclosed by forested wetlands, most likely comprising the following EEC.

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

This EEC comprises the small stand of *Melaleuca styphelioides* in the drainage line between the two dwellings on Lot 2 DP827097. This EEC is actually a derived stand from the EEC – *Subtropical Floodplain Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions*, which occurs in a limited area on adjoining land to the east of Lot 2 (as detailed subsequently).

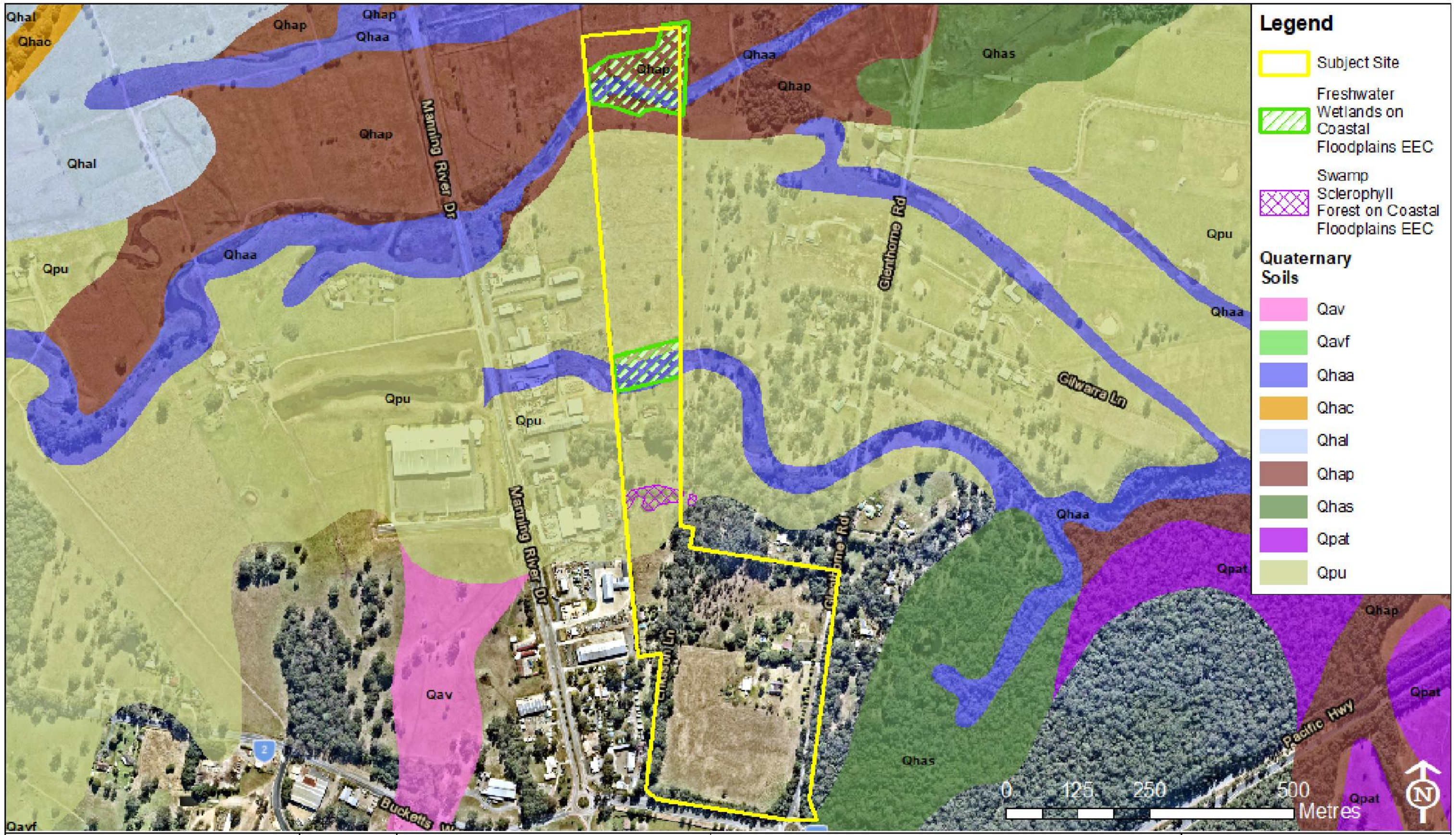
This community qualifies as this EEC as:

- Occurs in the specified region and Local Government Area (LGA).
- Occurs on mapped alluvial soils.
- Occurs within a topographical unit described in the Final Determination.
- Structure and floristics correlate with the Final Determination.

This EEC is likely to have been derived from historical clearing of the EEC - *Subtropical Floodplain Forest,* which as noted below dominates the lower reaches of the watercourse down to and east of Glenthorne Rd. Both EECs share the same understorey on site (*M. nodosa* is not listed as an indicator of this EEC, but *M. styphelioides* is) and groundcover species. Only a single young Pink Bloodwood occurs in the site remnant, hence its overall character is currently reflected as this EEC. Downstream off site, Forest Red Gum and Grey Ironbark appear to have an association with an understorey of Melaleuca.

All of the Coastal Floodplain Final Determinations reflect the complex intergrades of these EECs, which the site evidences.

Figure 10: EECs on site



This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: DK
Date: 16/05/2018
Map Projection: MGA Zone56
Datum: GDA94
Page: 1 of 1

Figure Name: Quaternary soil landscape and EEC
Site: Glenthorne Industrial Planning Proposal
Client: Blue Sky Planning

Aerial Imagery Source:
Nearmap 08 August 2017

Scale: 1:8,500
Job Number: J2017-35
Revision: A

Subtropical Floodplain Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

This EEC occurs on adjacent land to the east along the 1st order watercourse down to and east of Glenthorne Rd.

This EEC is indicated by the dense understorey of *M. nodosa* with emergent canopy trees comprising Pink Bloodwood, Grey Ironbark and Forest Red Gum. The extent of this EEC appears to be limited due to the small catchment of the watercourse and local clearing, but *M. nodosa* also extends over the same ridgeline where the lithic influences appear to dominate, not alluvial as discussed below (or possibly much older alluvials that are in secondary stages of soil formation and no longer subject to ecological processes associated with a Coastal Floodplain). Hence *in situ* soil profile tests are needed to confirm the extent of this EEC.

This EEC varies from good condition to a low condition (clearing to parkland), with disturbance history indicating previous clearing, with current grazing by domestic stock being the main threat.

Other areas of alluvial soils:

As shown in Figure 10, other areas of Lot 2 are also mapped as being on alluvial soils. The low ridgeline between the two areas of *Freshwater Wetland* EEC are virtually completely non-native vegetation and hence the EEC has effectively been rendered dysfunctional here. Similarly south of the *Swamp Sclerophyll Forest* EEC, the vegetation is essentially exotic pasture with a few trees comprising the last vestiges of the original EEC.

The clump of forest (VZ 7) southeast of the northern dwelling on Lot 2 occurs on mapped alluvial soils (see Figure 10), however while Forest Red Gum and Pink Bloodwood are indicative of the EEC – *Subtropical Floodplain Forest on Coastal Floodplains*, Tallowwood is not (NSWSC 2004a). Thick-leaved Mahogany also comprises many trees in the clump to the west on the same landform on Lot 35. Both species are considered to indicate residual soil influences dominate or the soils are no longer subject to alluvial processes definitive of this EEC, hence this area is also not considered to be an EEC or EEC habitat.

2.4.4.2 Commonwealth

No relevant EECs listed under the EPBC Act occur on-site.

Downstream of the northern end of the drainage reserve on Lot 2, is a patch of the EEC - *Coastal Swamp Oak Forest of New South Wales and South East Queensland*.

2.4.5 Vegetation Integrity Assessment

The Vegetation Integrity (VI) assessment using the Credit Calculator (BAMC) results are summarised in the following table:

Table 9: Vegetation integrity

PCT ID	Veg Zone	Condition	Area (ha)	Composition Condition Score	Structure Condition Score	Function Condition Score	Current vegetation integrity score
*1262	1	moderate	3.66	43.5	42.7	31.6	38.9
*1262	2	moderate	1.98	91.2	37.9	81.4	65.5
1262	3	low	4.46	39.8	27.1	4.2	16.6
1262	4	very low	4.8	4.2	0	0.9	0.5
1262	5	low	1.25	15.4	2.3	0	0.6
1262	6	low	1.71	15.1	2.2	0.3	2.2
1262	7	moderate	0.24	55.7	40.3	65.6	52.8
1740	8	moderate	0.04	71.4	18.7	-	36.5
1064	9	moderate	0.31	77.9	48.4	15.1	38.5
1737	10	moderate	0.67	62.5	57.1	-	59.8
1262	11	very low	1.55	14.3	0	2.2	0.9

*indicates VZs which were partially impacted by fire. Yellow fill indicates below threshold for Ecosystem Credits.

2.5 Threatened Species

2.5.1 Fauna Habitat Assessment

To inform the assessment of ecosystem credit species predicted to occur within the site in accordance with Section 6.2 of the BAM (OEH 2017), and to assist in developing a list of candidate threatened species requiring further assessment in accordance with Section 6.4 of the BAM (OEH 2017), a qualitative evaluation of habitat on the site was undertaken.

2.5.1.1 Methodology

The site was surveyed to determine the available potential habitats, and the support value of these habitats for threatened species. Habitats were defined according to parameters such as:

- Structural and floristic characteristics of the vegetation e.g. understorey type and development, crown depth, groundcover density, etc.
- Degree and extent of disturbance e.g. fire, logging, weed invasion, modification to structure and diversity, etc.
- Soil type and suitability e.g. for digging and burrowing.
- Presence of water in any form e.g. dams, creeks, drainage lines, soaks.
- Size and abundance of hollows and fallen timber.
- Availability of shelter e.g. rocks, logs, hollows, undergrowth.
- Wildlife corridors, refuges and proximate habitat types.

- Presence of mistletoe, nectar, gum, seed, sap, etc. sources.

2.5.1.2 Results

The following table summarises the results of the habitat evaluation survey:

Table 10: Habitat evaluation results

Habitat attribute	On-site values	Significance
Aquatic/wetland habitat	• Tall sedgeland: Cumbungi-dominated billabong on Lot 2 offers very good frog habitat with good quality water (clear and running at time of survey) and very dense cover, with numerous basking opportunities. Constrained however by Plague Minnow and bound by pasture, as well as upstream industrial zone. • Drainage line and dam: In southern end of Lot 2, this dam offers good frog habitat but limited edge refugia due to low height of vegetation. Remainder of drainage line has a narrow channel with no significant pools.	• Tall sedgeland: Some generic potential for Green and Golden Bell Frog, but likelihood constrained by lack of nearby records. Too small for threatened waterfowl – at most a Black-necked Stork may briefly forage during non-breeding movements. • Drainage line and dam: As for tall sedgeland but less value as poor cover for Green and Golden Bell Frog, and less suitable for waterfowl.
Marine/estuarine habitats eg estuarine, rocky foreshores, open beaches, open ocean.	Absent	N/A
Caves, cliffs, overhangs, etc	Absent	N/A
Logs and stumps	Logs limited to a few logs on Lot 2 DP573214 where a small windrow was once piled. This was severely burnt during the 2019/2020 bushfire event and limited remnants of the logs remain with no significant hollows. Some minor refuge values if become overgrown with vegetation again. Some logs also occurred on the crossing of VZ 10. These provided refuge for reptiles and frogs. The largest and most significant hollow-bearing tree onsite (a very large Tallowwood) with a major fire scar and numerous trunk and branch hollows fells onto this lot in the last fire event. This tree contains a number of hollows in the main trunk and limbs that have fallen. No significant stumps.	Some large enough for Quoll dens in the recently fallen Tallowwood, but isolation of site from known habitat south and highly likely fox and feral cat presence plus poor prey options discounts occurrence likelihood to very low to unlikely. Limited generic refugia for prey species.

Habitat attribute	On-site values	Significance
Groundcover/shrub layer/undergrowth	Groundcover only well developed on Lot 2 DP573214 due to a lapse in maintenance. It consist of a variable mix of native and exotic grasses, offering no significant value for granivores or cover dependent threatened species due to poor connectivity with similar cover, open structure and previous maintenance history. About 50% of this burnt in the recent fire event, including dense lantana under some regrowth Tallowwoods, but this had regenerated very well by the time of survey due to recent rain. Shrub layer/undergrowth is generally limited to the road reserves where it is often dominated by weeds including lantana. Some localised but large brambles of lantana on Lot 2 DP573214 which was recently burnt. This offers some generic refuge and foraging habitat for small passerine birds.	No particular threatened species considered likely to occur. Considered too open and isolated for Common Planigale and Eastern Chestnut Mouse. Potential habitat for exotic rodents which may add to prey base.
Leaf Litter	Well developed, often deep in the Eriksson Lane road reserve, where offers very good habitat for common reptiles and arthropods. Absent or only thin layer elsewhere.	No potential for any significant fauna as dependent species are likely to have been long displaced by historical clearing (eg. Long-nosed Potoroo).
Wattles, Melaleucas, Callistemons and Banksias (shrub layer)	No Banksias. Melaleucas and wattles common where understorey present but low diversity – species with small inflorescences, hence poor nectar source but provide an insect attractant.	Source of prey attractant in form of insects and honeyeaters, offering some marginal habitat for Squirrel Glider. No significant nectar sources for Eastern Pygmy Possum eg. banksias.
Yangochiropteran bat habitats	In general, the site forms part of a wider modified landscape which contains a mosaic of remnant forest, pasture, small patches of forest and scattered trees. The site and study area mostly offers suitable structure for bat species capable of foraging along the forest/grassland interface, and using flyways along quiet roads. Potential roosts occur in hollow-bearing trees and limited accumulation of decorticating bark in Forest Red Gums and Blackbutts.	Little and Eastern Bent-wing Bats, East-coast Freetail Bat, Greater Broad-nosed Bat considered low to highly likely to use site as minute to minor portion of their wider local foraging range. Southern Myotis considered likely in study area. Generic potential for roosting in tree hollows.

Habitat attribute	On-site values	Significance
	Three dams offer some potential for foraging by Southern Myotis, with large dam (>0.6ha) on Lot 4 DP573214 to the east offers ideal foraging habitat. During wetter years, Stitts Creek in northern end of Lot 2 DP827097 would offer foraging habitat.	
Fruiting species	Limited to a few Cheese Trees and exotic palms and fruit trees.	Not preferred vegetation type for potential foraging habitat for Wompoo Fruit-dove, Rose-crowned Fruit-Dove and Barred Cuckoo Shrike. Some low value as potential forage habitat for Grey-headed Flying Fox.
Flowering canopy trees.	Forest Red Gum flowers in autumn-early winter hence is important to nectar dependent species, some of which range interstate. Other species are spring-summer to early autumn flowers.	Species present preferred by Squirrel Glider, Grey Headed Flying Fox, Yellow-bellied Glider, Little Lorikeet, Swift Parrot plus passerine birds which offer potential prey to diurnal raptors.
Sap sources	Forest Red Gum, Pink Bloodwood, Sydney Blue Gum are preferred sap sources for the Yellow-Bellied Glider and Squirrel Glider (Lindenmayer 2002, NPWS 1999, Smith et al 1995, NPWS 2002c, Gibbons 2002). These are overall very common on site.	Very good potential sap source range for gliders, but no sap incisions noted suggesting Yellow-bellied Gliders absent and Squirrel Gliders unlikely to occur.
Allocasuarinas	Very rare – few senescent Forest Oak in Eriksson Lane.	These oaks generally provide nesting material for birds, and useful quantities of leaf litter, but their greatest value is to the Glossy Black Cockatoo, whose diet in this region is primarily based on Black She-oak and Forest Oak (NPWS 1999, OEH 2017b, Clout 1989, Birds Australia 2017, pers. obs.). The site does not offer any potential value to this bird.
Tree hollows	Limited to 15 trees generally in Eriksson Lane road reserve (see **Figure 11**) which contain hollows (one has a long bark fissure that offers some potential for bat roosting), 1 tree in VZ 7, and 4 termitaria. Most are in very large senescent trees, but most have only small (<5cm diameter opening) with some medium large (<15cm) hollows in a few trees. Many of the hollows are in narrow branches	Major constraint on hollow-obligate fauna in terms of spatial distribution and size range of hollows on site. Hollows noted uncommon on land to south of Lot 2 DP573214. Forest east of Lot 50 also appears fairly even-aged and immature. Few small to medium hollows in remaining trees on Lot 3 DP573214. No suitable hollows for owls or

Habitat attribute	On-site values	Significance
	and offer very limited value. See **Appendix 3** for details and photos. One tree (H1) contains a very large hollow (>15cm) diameter and was inspected by ladder and confirmed to be uninhabitable. The other large hollow in another Blue Gum (H4) was also inspected but found to be shallow and fills with water (staining evident in **photo 15**). If retained, a number of other trees will develop hollows in the medium term due to senescence. Some (including HBTs) however have major structural defects however (eg. basal fire scars) which limit longevity and safety near dwellings/structures.	cockatoos.
Prey species	Likely presence of rabbits/hares, House Mouse, Black Rat, possums and probably bandicoot and antechinus for forest owls. Passerine birds in low diversity and abundance – dominance by medium sized woodland species at time of survey but would vary with season.	Moderate chance for infrequent visitation by local pair of forest owls which are known to use fragmented rural habitats on the fringe of their territory eg. Masked Owl. Likely to form part of range for locally recorded threatened raptors such as the Square-tailed Kite and Little Eagle, with site only forming minute part of a large area of potential foraging habitat within these species very large foraging range. Poor habitat values for Quoll.

Photo 14: Open large cavity in H1

Photo 15: Water holding hollow in H4

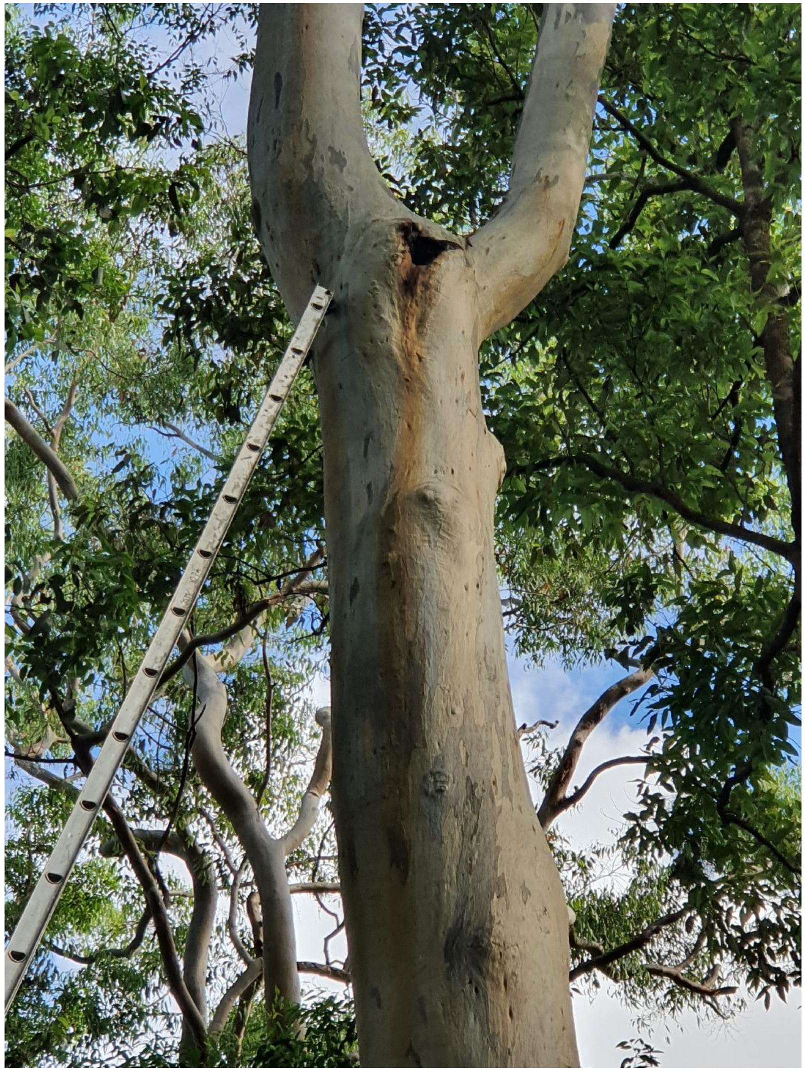


Figure 11: Hollow-bearing trees on site

The entire view extent is within:
- MidCoast LGA
- NSW North Coast IBRA Region (NNC)
- Karuah-Manning IBRA Subregion (NNC17)

This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Hollow-bearing Trees

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

Scale: 1:7 000
Job Number: J2019-35
Revision: A

2.5.2 Ecosystem Credit Species

The BAMC predicted the occurrence of Ecosystem Credit threatened fauna species listed in the following table. These were evaluated as per Steps 1 and 2 of s6.4 of the BAM in **Table 11** after survey. Those marked ^{DC} indicate Dual Credit species.

Potential occurrence was evaluated on the basis of presence/absence of habitat within the site; distribution of the species in scientific literature, Bionet and the Threatened Biodiversity Profile Database (OEH 2019b); ecological information in scientific literature and the Threatened Biodiversity Profile Database; literature records in the bioregion within similar habitat; and the results of site survey (see section 2.5.3.3).

Those listed as likely to occur were included in the BAMC calculations.

Table 11: Ecosystem Credit species evaluation

Species	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria met	Sensitivity to gain class	Sall	Justification for inclusion/exclusion
Magpie Goose (*Anseranas semipalmata*)	V	-	N/A	Moderate	No	Excluded: Vagrant in this part of its range; dams too small.
^{DC}Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	Foraging: N/A	High	Yes	**Included**: Not in mapped area and extremely vagrant in sub-region. No history of sightings in locality and few true winter flowering species present. Rare chance of vagrant occurrence opportunistically using Forest Red Gums in VZ 2 and 7.
Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)	V	-	N/A	Moderate	No	**Included** – generic potential habitat but only single record in locality.
Australasian Bittern (*Botaurus poiciloptilus*)	E	E	Waterbodies: Yes, generically. Brackish or freshwater wetlands: Yes, generically	Moderate	No	Excluded: Dams too small for this cryptic species. Swamp forest also too small for roosting.

Species	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria met	Sensitivity to gain class	Sall	Justification for inclusion/exclusion
DC Curlew Sandpiper (*Calidris ferruginea*)	E	CE	Other: Yes Other: Yes As per mapped area: No	High	No	Excluded: Dams too small for this cryptic species.
DC Great Knot (*Calidris tenuirostris*)	V	CE	Other: Yes Other: Yes As per mapped area: No	High	No	Excluded: Dams too small for this cryptic species.
DC Glossy Black Cockatoo (*Calyptorhynchus lathami*)	V	-	Foraging: Presence of *Allocasuarina* and *Casuarina* species	High	No	Excluded: Insignificant foraging habitat as few trees are senescent and no suitable hollows to nest on site.
Spotted Harrier (*Circus assimilis*)	V	-	Generic foraging habitat	High	No	**Included**: Not detected by survey, but very large home range. Some generic foraging potential.
Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)	V	-	N/A	High	No	Excluded: Not detected by survey and marginal habitat due to fragmentation, no proximate records for this sedentary species.
Barred Cuckoo-shrike (*Coracina lineata*)	V	-	Known from the Harrington rainforest	Moderate	No	Excluded: No or minimal fruiting species/very degraded. Not detected by survey
Varied Sittella (*Daphoenositta chrysoptera*)	V	-	N/A	Moderate	No	**Included**: Not detected by survey but site habitat adjoins a larger area of potential habitat, and recorded in similar habitat in sub-region.
Spotted-tailed Quoll (*Dasyurus maculatus*)	E	E	N/A	High	No	Excluded: Local records and extensive potential habitat interconnected to site to south, but only very tentatively and any Quoll would be subject to extreme risks.

Species	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria met	Sensitivity to gain class	Sall	Justification for inclusion/exclusion
Black-necked Stork (*Ephippiorhynchus asiaticus*)	E	-	Shallow, open freshwater or saline wetlands or shallow edges of deeper wetlands within 300m of these swamps: Yes	Moderate	No	**Included:** VZ10 has low chance of being used for brief opportunistic foraging especially when preferred habitat is drought impacted, during non-breeding range.
White-fronted Chat (*Epthianura albifrons*)	V	-	N/A	Moderate	No	Excluded: This species is restricted to coastal saltmarsh which is absent on site or the study area**.**
Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)	V	-	N/A	High	No	**Included:** Supra-canopy forager, small chance of flying over VZ1 and 2 as part of local foraging movements. Potential roots in tree hollows.
Little Lorikeet (*Glossopsitta pusilla*)	V	-	N/A	High	No	**Included**: Assumed present as preferred foraging species common and local records. Generic potential to breed in hollows
DCWhite-bellied Sea Eagle (*Haliaeetus leucogaster*)	V	-	N/A	High	No	Excluded: No nests and no significant foraging habitat
DCLittle Eagle (*Hieraaetus morphnoides*)	V	-	Foraging: N/A	Moderate	No	**Included**: Generic potential for foraging. No nests.
Comb-crested Jacana (*Irediparra gallinacea*)	V	-	Waterbodies: yes Freshwater wetlands with a good cover of floating aquatic vegetation: Marginal.	Moderate	No	Excluded: The dams are too small, and the larger dam in VZ10 is dominated by unsuitable habitat.
Black Bittern (*Ixobrychus flavicollis*)	V	-	Waterbodies: Yes Land within 40m of freshwater and estuarine wetlands, in areas of permanent water and dense vegetation	Moderate	No	Excluded: Dams too small for this cryptic species. Swamp forest also too small for roosting.

Species	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria met	Sensitivity to gain class	Sall	Justification for inclusion/exclusion
DCSwift Parrot (*Lathamus discolor*)	E	CE	Foraging: N/A	Moderate	Yes	**Included**: Localised clump of preferred forage species – very rare chance of foraging opportunistically as small part of habitat in locality and LGA, but no local records. Not mapped as Important Area of habitat.
DCBroad-billed Sandpiper (*Limicola falcinellus*)	V	-	Other: N/A	High	No	Excluded: Dams not preferred habitat for this species which is predominantly estuarine, and far too small
DCBlack-tailed Godwit (*Limosa limosa*)	V	-	Other: N/A	High	No	Excluded: Dams not preferred habitat for this species and far too small.
DCSquare-tailed Kite (*Lophoictinia isura*)	V	-	Foraging: N/A	Moderate	No	**Included**: Assumed present although not detected by survey as large territory and recorded widely in region in similar habitats.
East-coast Freetail-bat (*Micronomus norfolkensis*)	V	-	N/A	High	No	**Included**: Recorded foraging on site. Generic potential foraging and roosting habitat.
DCLittle Bentwing Bat (*Miniopterus australis*)	V	-	Foraging: N/A	High	Yes	**Included**: Recorded foraging on site. Potential non-breeding roosting habitat in tree hollows.
DCEastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	V	-	Foraging: N/A	High – foraging	No	**Included**: Foraging habitat – probable call identification on site.
DCBarking Owl (*Ninox connivens*)	V	-	Foraging: N/A	High	No	Excluded: Not detected by survey. No local records.
DCPowerful Owl (*Ninox strenua*)	V	-	Foraging: N/A	High	No	**Included**: Marginal chance of foraging on fringe of territory.

Species	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria met	Sensitivity to gain class	Sall	Justification for inclusion/exclusion
^{DC}Eastern Osprey (*Pandion cristatus*)	V	-	N/A	Moderate	No	Excluded: No evidence of nesting detected by targeted survey. No foraging habitat.
Yellow-bellied Glider (*Petaurus australis*)	V	-	Hollows bearing trees: Yes.	High	No	Excluded: Not detected by survey
^{DC}Koala (*Phascolarctos cinereus*)	V	V	Foraging: N/A	High	No	**Included**: Core Koala Habitat identified on-site.
Golden-tipped Bat (*Phoniscus papuensis*)	V	-	N/A	High	No	Excluded: No preferred habitat which is a mosaic of wet and dry sclerophyll forest rich in vines and understorey preferred by spider prey; and lack of bird species whose nests it uses for roosts.
Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*)	V	-	N/A	Moderate	No	Excluded: Not detected by survey, which given sedentary nature and easy to detect, demonstrates absence.
Long-nosed Potoroo (*Potorous tridactylus*)	V	-	Other: N/A Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest): No	High	No	Excluded: Extremely modified habitat with negligible cover for this species which is extremely vulnerable to foxes. Foxes extremely likely to be present. No records in proximity and major barriers/threats to dispersal.
Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*)	V	-	N/A	High	No	Excluded: Not preferred habitats, and not detected by survey. Appears to be restricted to coastal habitats in LGA.
^{DC}Grey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Foraging: N/A	High	No	**Included**: Highly likely to forage on site when flowering trees, as minute part of local range during local occurrence.
Superb Fruit-Dove (*Ptilinopus superbus*)	V	-	N/A	Moderate	No	Excluded: Lacks preferred food species, rainforest or dense and extensive rainforest understorey, and not adjacent to any such habitat.

Species	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria met	Sensitivity to gain class	Sall	Justification for inclusion/exclusion
Australian Painted Snipe (*Rostratula australis*)	E	E	N/A	Moderate	No	Excluded: Dams too small and no wet meadow habitats.
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	V	-	N/A	High	No	**Included**: Assumed present as recorded in similar habitat in the sub-region. Potential foraging and roosting habitat.
Greater Broad-nosed Bat (*Scoteanax rueppellii*)	V	-	N/A	High	No	**Included**: Moderate to high potential to forage over site as small part of larger area of habitat, and roost in tree hollows. Assumed present with default call identification.
Diamond Firetail (*Stagonopleura guttata*)	V	-	N/A	Moderate	No	Excluded: Not normally found on coast; site does not contain true grassy woodland habitat preferred by this species; and the area present of marginal potential habitat is small and located on the fringe of a cul-de-sac of slightly better habitat to east. Not detected by survey.
Freckled Duck (*Stictonetta naevosa*)	V	-	N/A	Moderate	No	Excluded: Dams far too small.
Common Blossom-bat (*Syconycteris australis*)	V	-	N/A	High	No	Excluded: No potential roosting habitat and not preferred foraging habitat. Not adjacent to preferred habitat.
^{DC}Masked Owl (*Tyto novaehollandiae*)	V	-	Foraging: N/A	High	No	**Included**: Foraging: Not detected but assumed present as large territory and recorded locally in similar habitats.
^{DC}Terek Sandpiper (*Xenus cinereus*)	V	-	Foraging: N/A	High	No	Excluded: Dams far too small.

2.5.3 Species Credit Species Potential Occurrence Assessment

2.5.3.1 Threatened Flora

2.5.3.1.1 Local records

Bionet (OEH 2020a) and the literature record 7 threatened species in the locality. Those not predicted by the BAM were added to the assessment, except for Native Guava (*Rhodomyrtus psidioides*) which is not listed in the BOAMS.

2.5.3.1.2 Species credit species potential occurrence assessment

A list of SCS potentially occurring in the study are was derived in accordance with s6.4 of the BAM, including information from the TBDC. Potential for these species to occur in is evaluated below in line with s6.3 and s6.4 of the BAM.

Table 12: Candidate species credit species assessment - flora

Common Name	NSW listing status	EPBC Listing status	Survey Season	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded/Targeted Survey
Dwarf Heath Casuarina (*Allocasuarina defungens*)	E	E	All year	North of Bulahdelah: Yes	High	2	No	Excluded: Unsuitable habitat.
Charmhaven Apple (*Angophora inopina*)	V	V	All year	South of Wootton: No	High	2	No	Excluded: Way beyond known range (restricted distribution) and unsuitable habitat.
Trailing Woodruff (*Asperula asthenes*)	V	V	Oct-Dec	N/A	High	2	No	**Included**: Potential habitat in swamp forest and around dams.
Netted Bottle Brush (*Callistemon linearifolius*)	V	-	Oct-Jan	N/A	Moderate	1.5	No	Excluded: Outside known northern limit (Nelson Bay), no local records and not found.
Leafless Tongue Orchid (*Cryptostylis hunteriana*)	V	V	Nov-Jan	N/A	Moderate	1.5	No	**Included**: Marginal potential habitat but no LGA records, but cryptic nature requires survey.

Common Name	NSW listing status	EPBC Listing status	Survey Season	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate SaII	Included/Excluded/Targeted Survey
Spider orchid (*Dendrobium melaleucaphilum*)	E	-	Aug-Sep	N/A	High	2	No	**Included:** Targeted survey required as marginal generic potential habitat.
Pale Yellow Doubletail (*Diuris flavescens)*	CE	CE	Sep-Oct	N/A	Moderate	3	Yes	**Included:** Targeted survey required as marginal generic potential habitat and local records
Rough Doubletail (*Diuris praecox*)	V	V	August	Within the Parish boundaries of Forster, Eurunderee, Fens, Tomaree, Stowell and Stockton: No	Moderate	1.5	No	Excluded**:** Marginal potential in dry sclerophyll forest, but well outside known range.
Slaty Red Gum (*Eucalyptus glaucina*)	V	V	All year	N/A	High	2	No	**Included**: Red Gums need confirmed identification
Eucalyptus parramattensis subsp. *decadens*	V	V	All year	N/A	High	2	No	Excluded: Site well outside restricted range.
Eucalyptus seeana population in the Greater Taree local government area	EP	-	All year	Within the Greater Taree LGA: yes	High	2	No	**Included:** Red Gums need confirmed identification
Big Nellie Hakea (*Hakea archaeoides*)	V	V	All year	N/A	High	2	No	Excluded: Site well outside restricted range.
Noah's False Chickweed (*Lindernia alsinoides*)	E	-	Nov-Feb	Damp areas or adjacent to riparian areas (including disturbed areas); swamps: yes Shallow, freshwater area: yes	High	3	Yes	**Included:** Targeted survey required as generic potential habitat in drainage lines.

Common Name	NSW listing status	EPBC Listing status	Survey Season	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded/Targeted Survey
Maundia triglochinoides	V	-	Nov-Feb (all year)	Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep; semi-permanent/ephemeral wet areas; swamps: Yes Shallow swamps up to 1 m deep; waterbodies: yes	High	2	No	**Included:** Targeted survey required as generic potential habitat and local records
Biconvex Paperbark (*Melaleuca biconvexa*)	V	V	All year	N/A	High	2	No	**Included:** Targeted survey required as generic potential habitat
Grove's Paperbark (*Melaleuca groveana*)	V	-	All year	N/A	High	2	No	Excluded: Not suitable habitat – found on hills and ridgelines on shallow soils.
Tall Knotweed (*Persicaria elatior*)	V	V	Dec-May	Semi-permanent wet areas: yes Or within 50m of swamps: yes Or within 50m of waterbodies: yes Including wetlands or within 50m: yes	High	2	No	**Included:** Targeted survey required as generic potential habitat
Scant Pomaderris (*Pomaderris queenslandica*)	E	-	All year	N/A	High	2	No	**Included:** Targeted survey required as generic potential habitat
Pterostylis chaetophora	V	-	Sep-Nov	N/A	Moderate	2	No	**Included:** Targeted survey required as generic potential habitat and local records
Eastern Australian Underground Orchid (*Rhizanthella slateri*)	V	E	Sep-Nov	N/A	High	3	Yes	Excluded: Habitat is considered too disturbed and this species appears associated with sandstone and granitic habitats.

Common Name	NSW listing status	EPBC Listing status	Survey Season	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded/Targeted Survey
Scrub Turpentine (*Rhodamnia rubescens*)	CE	-	All year	N/A	High	3	Yes	**Included:** Targeted survey required as generic potential habitat
Magenta Lilly Pilly (*Syzygium paniculatum*)	E	V	Apr-June	N/A	High	2	No	**Included:** Targeted survey required as generic potential habitat
Zannichellia palustris	E	-	Oct-Jan	Waterbodies: yes Freshwater or slightly brackish estuarine areas (10%): yes	High	2	No	**Included:** Targeted survey required as generic potential habitat

2.5.3.1.3 Methods and effort

Targeted survey is required for the following species:

Table 13: Species Credit targeted flora survey species

Species	Species Credit	Potential habitat on site	Survey season	Survey methods
Trailing Woodruff (*Asperula asthenes*)	Known habitat	Dams and swamp forest	Oct-Dec	Habitat survey
Leafless Tongue Orchid (*Cryptostylis hunteriana*)	Known habitat	Dry sclerophyll forest	Nov-Feb	Habitat survey
Spider Orchid (*Dendrobium melaleucaphilum*)	Known habitat		Aug-Sept	Habitat survey during flowering season to confirm identification, but non-flowering plants can be detected.
Pale Yellow Doubletail (*Diuris flavescens*)	Known habitat	Dry sclerophyll forest	Sep-Oct	Habitat survey during flowering season (best around 1st week of October – verify with reference population)
Slaty Red Gum (*Eucalyptus glaucina*)	Known habitat	Dry sclerophyll forest	All year	Habitat survey
Eucalyptus seeana population in the Greater Taree local government area	Known habitat	Dry sclerophyll forest	All year	Habitat survey
Noah's False Chickweed *(Lindernia alsinoides)*	Known habitat	Dams and swamp forest	Nov-Feb	Habitat survey when flowering
Maundia triglochinoides	Known habitat	Dams and swamp forest	Nov-Mar	Habitat survey when flowering for ready identification, but experienced observer can identify outside flowering season.
Biconvex Paperbark *(Melaleuca biconvexa)*	Known habitat	swamp forest	All year	Habitat survey
Tall Knotweed (*Persicaria elatior*)	Known habitat	Dams and swamp forest	Dec-May	Habitat survey when flowering, but inspection of leaves, etc, for characteristic glands when non-flowering.
Scant Pomaderris *(Pomaderris queenslandica)*	Known habitat	Dry sclerophyll forest	All year	Habitat survey
Pterostylis chaetophora	Known habitat	Dry sclerophyll forest	Sep-Nov	Habitat survey when flowering
Scrub Turpentine *(Rhodamnia rubescens)*	Known habitat	Dry sclerophyll forest	All year	Habitat survey

Species	Species Credit	Potential habitat on site	Survey season	Survey methods
Magenta Lilly Pilly *(Syzygium paniculatum)*	Known habitat	Dry sclerophyll forest	Apr-Jun	Habitat survey when fruiting for confident identification from common species
Zannichellia palustris	Known habitat	Dams	Oct-Jan	Habitat survey as dies back off-season.

Cryptostylis hunteriana is a cryptic orchid and hence survey was undertaken once a month in Jan-March 2020 but focusing on the more open and grassy areas. A total of 3hrs was spent on targeted survey for this species over its flowering period.

Zannichellia palustris was surveyed by both hand sieving the shallows up to 50cm deep along the edge of the dams and drainage line, and scooping the deeper portions of the dams with a pool net to collect samples in January. A supplementary survey was undertaken in February and March following recent rain.

The two drainage lines in VZ 10 and 9 are degraded and generally artificial habitats, but a routine survey for Trailing Woodruff. This species can be difficult to discern from *Gallium* spp. when not flowering (hence preferred season is when flowering), however no potential plants were found despite ideal conditions. This species is thus considered absent.

The other species were surveyed in line with OEH (2016). The site was systematically searched by an ecologist walking parallel belt transects 5m wide depending on density of vegetation, systematically covering the potential habitat on site. An evergreen species survey occurred in May and June 2019 (pre-fire), with a total of 3hrs spent on this aspect of the survey (JBE 2018).

Seasonal survey of VZ 1 and VZ 2 will be required to be undertaken over the flowering seasons of *Pterostylis chaetophora* and the Pale Yellow Doubletail. *Pterostylis chaetophora* has 6 records in the locality, with the nearest being to the south on the northern edge of Khappinghat Nature Reserve (2011), and recently west on Bucketts Way and Burrell Creek (2018) (DPIE 2020a). The Pale Yellow Doubletail appears to have a restricted restriction west of the site from Buckett's Way near the MCC landfill to Tinonee, Burrell Creek, Killawarra and Wingham (DPIE 2020a). Several recent records of these two species are in the same location.

The likelihood of occurrence on site (particularly VZ 2 in Eriksson Lane) of these orchids is considered low given the disturbance history of the site (evident by weed levels in Eriksson Lane road reserve) and lack of close proximity records. For the purposes of this assessment for the rezoning and abiding the Precautionary Principle, they are assumed present until further survey or an expert report is obtained determining they are unlikely to occur.

2.5.3.1.4 Results

No threatened flora species was found onsite pre or post fire.

Spider Orchid surveys were undertaken in VZ 9, but only Robber Fern (*Pyrrosia confluens*) and Tongue Orchid (*Dendrobium linguiforme*) were found.

The only broadly similar plants to *Zannichellia palustris* found were a *Nitella* sp. algae and a Bladderwort (*Utricularia spp.).*

2.5.3.2 Fauna

Bionet (DPIE 2020a) and the literature record the following threatened species in the locality (excluding marine and estuarine species due to location inland):

Table 14: Bionet fauna records

Scientific Name	Common Name	BC Act	EPBC Act	Bionet records	BAMC predicted species?	Species or Ecosystem Credit	Included/Excluded from further assessment
Anseranas semipalmata	Magpie Goose	V	-	1	Yes	Ecosystem	Excluded: no suitable habitat.
Ephippiorhynchus asiaticus	Black-necked Stork	E1	-	15	No	Ecosystem	Excluded: no suitable habitat.
Botaurus poiciloptilus	Australasian Bittern	E	E	1	yes	Ecosystem	Excluded: no suitable habitat.
Circus assimilis	Spotted Harrier	V	-	1	yes	Ecosystem	**included**: generic potential habitat
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	M	5	No	Dual	**included**: default nest search required
Hieraaetus morphnoides	Little Eagle	V	-	2	Yes	Dual	**Included**: default nest search required
Burhinus grallarius	Bush Stone-curlew	E	-	1	Yes	Dual	**Included**: Potential habitat.
Pandion cristatus	Eastern Osprey	V	-	11	Yes	Dual	**included**: default nest search required
Numenius madagascariensis	Eastern Curlew	-	CE	1	No	Dual	Excluded: no suitable habitat, not mapped as an Important Area
Turnix maculosus	Red-backed Button-quail	V	-	2	Yes	Species	Excluded: habitat is degraded, has high fox predation risk, and very exposed**.**
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	8	Yes	Dual	**Included**: Potential foraging habitat (low value) only, no potential nest sites.
Glossopsitta pusilla	Little Lorikeet	V	-	1	Yes	Ecosystem	**Included**: Potential habitat.

Scientific Name	Common Name	BC Act	EPBC Act	Bionet records	BAMC predicted species?	Species or Ecosystem Credit	Included/Excluded from further assessment
Ninox connivens	Barking Owl	V	-	4	Yes	Dual	**Included:** Potential foraging habitat (low value) only, no potential nest sites.
Ninox strenua	Powerful Owl	V	-	7	Yes	Dual	**Included**: Potential foraging habitat (low value) only, no potential nest sites.
Tyto novaehollandiae	Masked Owl	V	-	1	Yes	Dual	**Included**: Potential foraging habitat (low value) only, no potential nest sites.
Tyto tenebricosa	Sooty Owl	V	-	2	No	Dual	Excluded: no suitable habitat.
Daphoenositta chrysoptera	Varied Sittella	V	-	2	Yes	Ecosystem	**Included**: Potential habitat.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	4	No	Ecosystem	**Included**: Potential habitat.
Dasyurus maculatus	Spotted-tailed Quoll	V	E	2	Yes	Ecosystem	Excluded: habitat is degraded, has high fox predation risk, and very exposed.
Phascogale tapoatafa	Brushtailed Phascogale	V	-	10	Yes	Species	**Included**: Potential habitat.
Planigale maculata	Common Planigale	V	-	1	Yes	Species	**Included**: Potential habitat.
Phascolarctos cinereus	Koala	V	V	272	Yes	Dual	**Included**: Potential habitat.
Petaurus australis	Yellow-bellied Glider	V		1	Yes	Ecosystem	**Included**: Potential habitat.
Petaurus norfolcensis	Squirrel Glider	V		4	Yes	Species	**Included**: Potential habitat.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	76	Yes	Dual	**Included**: Potential habitat.

Scientific Name	Common Name	BC Act	EPBC Act	Bionet records	BAMC predicted species?	Species or Ecosystem Credit	Included/Excluded from further assessment
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V		5	Yes	Ecosystem	**Included**: Potential foraging and roosting habitat.
Myotis macropus	Southern Myotis	V		3	Yes	Dual	**Included**: Potential foraging and roosting habitat.
Miniopterus australis	Little Bent-winged Bat	V		8	Yes	Dual	**Included**: Potential foraging habitat only.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V		8	Yes	Dual	**Included**: Potential foraging habitat only.

No additional species not predicted by the BAMC were added to the candidate species list for further assessment.

2.5.3.2.1 Potential occurrence assessment

The BAMC predicted the following species credit species (SCS) as potential occurrences on the site. These were reviewed for potential to occur in terms of habitat constraints, geographic limitations and the same criteria and reference information as for ecosystem credit species.

Table 15: Potentially occurring candidate species credit species – fauna

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
Rufous Bettong (*Aepyprymnus rufescens*)	V	-	North of Gloucester: Yes	High	2	No	Excluded: habitat is degraded, high risk of fox predation, major physical barriers	No
^{DC}Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	Breeding: ^{1}As per mapped areas – not mapped.	High	3	Yes	Excluded: Not in mapped area and extremely vagrant in sub-region. No history of sightings in locality and minimal true winter flowering species present.	No

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
Bush Stone-curlew (*Burhinus grallarius*)	E	-	Fallen/standing dead timber including logs.	High	2	No	**Included**: Targeted survey although no local records	Yes
DCCurlew Sandpiper (*Calidris ferruginea*)	E	CE	N/A	High	3	Yes	Excluded: No suitable habitat and too degraded.	No
Great Knot (*Calidris tenuirostris*)	V	CE	Within 5 km of the coast and tidal influenced water bodies: yes	High	3	No	Excluded: No suitable habitat and too degraded.	No
DCGlossy Black Cockatoo (*Calyptorhynchus lathami*)	E	V	Breeding: Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground: No.	High	2	No	Excluded: No suitable hollows verified by inspection	No
Eastern Pygmy-possum (*Cercartetus nanus*)	V	-	N/A	High	2	No	**Included**: Marginal potential habitat as limited preferred nectar sources and retained forest, and extreme edge effects	Yes
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	V	Cliffs: no Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels: No	Very high	3	No	Excluded: This species appears to be restricted to escarpments, particularly sandstone, and mining regions.	No
Wallum Froglet (*Crinia tinnula*)	V	-	N/A	Moderate	1.5	No	**Included:** marginal potential in VZ 10.	Yes

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	EP	-	N/A	Moderate	2	No	Excluded: Far south of known range and habitat degraded.	No
DCWhite-bellied Sea-Eagle (*Haliaeetus leucogaster*)	V	-	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines: yes	High	2	No	**Included:** No isolated trees which offer preferred nest sites – routine survey to demonstrate no nest present.	Yes
DCLittle Eagle (*Hieraaetus morphnoides*)	V	-	Breeding: Nest trees - live (occasionally dead) large old trees within vegetation: yes	Moderate	1.5	No	**Included**: Survey to confirm no nest.	Yes
Pale-headed Snake (*Hoplocephalus bitorquatus*)	V	-	N/A	High	2	No	**Included**: No local records, extremely degraded habitat with very poor linkages but generic potential habitat.	Yes
Stephens' Banded Snake (*Hoplocephalus stephensii*)	V	-	Hollow-bearing trees: yes Or within 500m of this habitat: yes Within 500m of arboreal/vine tangles/fallen/standing dead timber including logs: yes Or within 500m of this habitat: yes	High	2	No	**Included**: No local records, extremely degraded habitat with very poor linkages but generic potential habitat.	Yes
Swift Parrot (*Lathamus discolor*)	E	CE	Foraging: [1]As per mapped areas: no.	Moderate	3	Yes	Excluded: Not in mapped area.	No

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
DCBroad-billed Sandpiper (*Limicola falcinellus*)	V	-	Breeding: N/A	High	2	No	Excluded: Not suitable habitat.	No
Black-tailed Godwit (*Limosa limosa*)	V	-	Breeding: N/A	High	2	No	Excluded: Not suitable habitat.	No
Green and Golden Bell Frog (*Litoria aurea*)	E	V	Semi-permanent/ephemeral wet area: yes Within 1km of wet areas/swamps: yes Within 1km of swamps/waterbodies: yes Within 1km of waterbody: yes	High	2	No	**Included**: No local records, and Plague Minnow present in all habitats. Generic potential habitat.	Yes
Green-thighed Frog (*Litoria brevipalmata*)	V	-	N/A	Moderate	1.5	No	**Included**: Plague Minnow present in all habitats. Generic potential habitat.	Yes
DCSquare-tailed Kite (*Lophoictinia isura*)	V		Breeding: Nest trees	Moderate	1.5	No	**Included**: Survey to confirm no nest.	Yes
Parma Wallaby (*Macropus parma*)	V	-	N/A	High	2	No	Excluded: Habitat is extremely degraded, high risk of fox predation, major physical barriers and no local records.	No
DCLittle Bentwing Bat (*Miniopterus australis*)	V	-	Breeding: Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding.	Very high	3	Yes	Excluded: No suitable structures.	No

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
DCEastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*)	V	-	DCBreeding: Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding.	Very high	3	Yes	Excluded: No suitable structures.	No
Stuttering Frog (*Mixophyes balbus*)	E	V	N/A	Very high	3	Yes (southern populations)	Excluded: No suitable habitat.	No
Giant Barred Frog (*Mixophyes iteratus*)	E	E	Land within 50m of semi-permanent and semi-permanent drainages	Moderate	2	No	Excluded: No suitable habitat.	No
Southern Myotis (*Myotis macropus*)	V	-	Hollow-bearing trees: yes Within 200m of riparian zone; yes Bridges, caves or artificial structures within 200m of riparian zone/waterbodies: yes Includes rivers and creeks, lagoons, dams and other waterbodies on or within 200m of the site: yes	High	2	No	**Included**: Potential foraging habitat onsite and within 200m, and tree hollows	Yes
DCBarking Owl (*Ninox connivens*)	V	-	Breeding: Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground: no suitable trees	High	2	No	Excluded: No potential suitable breeding hollows	No
DCPowerful Owl (*Ninox strenua*)	V	-	Breeding: Living or dead trees with hollow greater than 20cm diameter	High	2	No	Excluded: No potential suitable breeding hollows	No

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
Eastern Osprey (*Pandion cristatus*)	V	-	Breeding: Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting): No nests, but within 100m of floodplain	Moderate	1.5	No	**Included**: Survey required to confirm no nests on site	Yes
Giant Dragonfly (*Petalura gigantea*)	E	-	Swamps: No Within 500m of swamps: yes	Very high	3	Yes	Excluded: This species is associated with true swamp to heath habitats which are absent from the site. Habitats to north are also highly degraded. No local records.	No
Squirrel Glider (*Petaurus norfolcensis*)	V	-	N/A	High	2	No	**Included**: Targeted survey required as potential habitat and local records	Yes
Brushtailed Rock-wallaby (*Petrogale penicillata*)	E	V	N/A	Very high	3	Yes	Excluded: No suitable habitat.	No
Brushtailed Phascogale (*Phascogale tapoatafa*)	V	-	Hollow-bearing trees	High	2	No	**Included**. Targeted survey required as potential habitat and local records	Yes
Koala (*Phascolarctos cinereus*)	V	V	Breeding: Areas identified via survey as important habitat defined by the density of Koalas and quality of habitat determined by on-site survey.	High	2	No	**Included**: Previously known from adjoining habitats.	Yes

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
Phascolarctos cinereus - endangered population Hawks Nest and Tea Gardens population	EP	V	N/A	High	2	No	Excluded: Located well outside range.	No
Common Planigale (*Planigale maculata*)	V	-	N/A	High	2	No	**Included** – generic potential	Yes
Long-nosed Potoroo (*Potorous tridactylus*)	V	V	Other: Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest): No suitable habitat.	High	2	No	Excluded. Site is extremely degraded for this species which has never been recorded in modified rural areas due to extreme vulnerability to predation by foxes.	No
DCGrey-headed Flying-fox (*Pteropus poliocephalus*)	V	V	Breeding: Breeding camps	High	2	No	Excluded: Not preferred type, and not a known site.	No
Red-backed Button-quail (*Turnix maculosus*)	V	-	N/A	High	2	No	Excluded: habitat is degraded, has high fox predation risk, and very exposed.	No
DCMasked Owl (Tyto novaehollandiae)	V	-	Breeding: Living or dead trees with hollows greater than 20cm diameter.	High	2	No	Excluded: No suitable breeding hollows present.	No
Mahony's Toadlet (*Uperoleia mahonyi*)	E	-	N/A	High	2	No	Excluded: well north of known range and no suitable habitat.	No

Common Name	BC Act	EPBC Act	Step 2: Habitat Constraints and Geographic Limitations criteria	Sensitivity to gain class	Biodiversity Risk Weighting	Candidate Sall	Included/Excluded from further assessment	Targeted survey required
Eastern Cave Bat (*Vespadelus troughtoni*)	V	-	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds."	Very high	3	Yes	Excluded: No suitable structures.	No
Terek Sandpiper (*Xenus cinereus*)	E	-	N/A	High	2	No	Excluded: no suitable habitat.	No

2.5.3.2.2 Species credit fauna species requiring survey

If a species credit species (SCS) is considered to have potential to occur, and it not assumed to occur for the purposes of the BAMC, targeted survey is required to verify its presence or absence (BAM Step 3).

The following table summarises survey method and season for the species identified to require survey to confirm presence/absence:

Table 16: Species Credit fauna species targeted survey

Species	Species Credit	Potential habitat on site	Survey season	Survey methods
White-bellied Sea-Eagle	Breeding	Dry sclerophyll forest	Jul-Dec	Diurnal nest location
Osprey	Breeding	Dry sclerophyll forest	Apr-Nov	Diurnal nest location
Bush Stone-curlew	Known habitat	Dry sclerophyll forest	Year round	Call playback (dusk) and diurnal survey to flush birds.
Little Eagle	Breeding	Dry sclerophyll forest	Aug-Oct	Nest survey in breeding season
Square-tailed Kite	Breeding	Dry sclerophyll forest	Sep-Jan	Nest survey in breeding season
Southern Myotis	Known habitat	Dams	Oct-Mar	Harp traps, mist nets, trip lines, call detection
Squirrel Glider	Foraging and breeding	Dry sclerophyll forest	All year	Camera traps, spotlighting, call detection
Brushtailed Phascogale	Known habitat	Dry sclerophyll forest	All year	PIR cameras and spotlighting
Eastern Pygmy-possum	Known habitat	Dry sclerophyll forest	Oct-Mar	PIR cameras, spotlighting Elliot A, pitfall traps.
Koala	Breeding	Dry sclerophyll forest	All year	Spot Assessment Technique, spotlighting, call playback and diurnal surveys.
Common Planigale	Known habitat	Dry sclerophyll forest	All year	Elliot A and pitfall trapping.
Wallum Froglet	Known habitat	dams	All year	Call detection
Green and Golden Bell Frog	Known habitat	dams	Nov-Mar	Diurnal surveys for basking frogs, call detection, torch surveys.
Green-thighed Frog	Known habitat	dams	Oct-Mar	Call detection, torch surveys.
Pale-headed Snake	Known habitat	Dry sclerophyll forest	Nov-Mar	Stag watching, PIR cameras and spotlighting.

Species	Species Credit	Potential habitat on site	Survey season	Survey methods
Stephens' Banded Snake	Known habitat	Dry sclerophyll forest	Oct-Mar	Stag watching, PIR cameras and spotlighting.

2.5.3.3 Targeted surveys

This is in line with Step 4 of the BAM.

2.5.3.3.1 Methods and effort

Targeted surveys for species credit species were undertaken at the site on the dates outlined in **Table 17**.

The location of targeted surveys are shown in **Figure 12.** Methods such as diurnal bird searches generally followed the route indicated by the spotlighting transect. As these methods as well as spotlighting were undertaken with numerous repeats, only one indicative route is shown to indicate comprehensive coverage of the site's habitats.

Table 17: Survey effort for fauna survey

Method	Habitat (ha)	Stratification units	Total effort	Target species
Arboreal Elliot A	~2ha	1 (<50ha)	7 PIR cameras set for 3 weeks (total effort of 126 trap nights)	Squirrel Glider, Brushtailed Phascogale, Eastern Pygmy Possum
Arboreal Elliot B	~2ha	1 (<50ha)		
Arboreal hair tubes	~2ha	1 (<50ha)		
Nest boxes	~2ha	N/A	Not used – marginal habitat and camera traps would detect if present.	Eastern Pygmy Possum
Area search	~4ha	1 (<50ha)	18hrs: 12 inspections over 6 weeks. Entire site surveyed. Additional surveys undertaken after main survey periods during post-fauna survey work eg. HBT inspection.	Ecosystem credit species, diurnal raptors, Bush-stone Curlew, Koala, Powerful Owl, Masked Owl, Barking Owl
Cage traps	Not used as no relevant Species Credit target species.			
Call playback/detection	~2ha	1 (<50ha)	4 nights in Feb-March	Powerful Owl, Masked Owl, Barking Owl, Bush-stone Curlew, Koala, Yellow-bellied Glider, Green-thighed Frog, Wallum Froglet, Green and Golden Bell Frog.
Call recording (Anabat)	~2ha	1 (<50ha)	2 Anabat units set for 4 weeks December-February	Southern Myotis and all other Ecosystem Credit microchiropteran bat species.
Harp trapping	~2ha	1 (<50ha)	Not undertaken as no suitable flyways for target species.	Southern Myotis, Eastern Cave Bat and all other Ecosystem Credit microchiropteran bat species.
Mist netting	Not used as Eastern Blossom Bat and Golden-tipped Bat not likely potential occurrences.			
Pitfall traps with drift net	~2ha	1 (<50ha)	Elliot A traps used as sparse habitat, Elliot trigger modified to Planigale body weight, and high density trapping.	Common Planigale, Eastern Pygmy Possum
Terrestrial camera traps	~2ha	1 (<50ha)	Not used – no Species Credit target species.	Ecosystem credit species, Rufous Bettong

Method	Habitat (ha)	Stratification units	Total effort	Target species
Sand plots	Not used as PIR cameras more effective.			
Search for scats and signs; turning over logs and raking leaf litter	~2ha	1 (<50ha)	4hrs on other species. 10hrs spent on Koala scat searches (2 dedicated surveys – 3 weeks apart).	Glossy Black Cockatoo, Powerful Owl, Masked Owl, Barking Owl, Koala, Pale-headed Snake, Stephen's Banded Snake, Three-toed Snake-toothed Skink
Spotlighting from vehicle	~2ha	1 (<50ha)	N/A	Powerful Owl, Masked Owl, Barking Owl, Koala, Yellow-bellied Glider, Greater Glider, Squirrel Glider, Brushtailed Phascogale, Spotted-tail Quoll, Ecosystem credit species, Pale-headed Snake, Stephen's Banded Snake
Spotlighting on foot	~2ha	1 (<50ha)	8hrs over 4 non-consecutive nights	
Stagwatching	~2ha	1 (<50ha)	8hrs over 4 non-consecutive nights	Glossy Black Cockatoo, Powerful Owl, Masked Owl, Barking Owl, Greater Glider, Squirrel Glider, Brushtailed Phascogale, Pale-headed Snake, Stephen's Banded Snake, Ecosystem credit species
Terrestrial Elliot A	~4ha	1 (<50ha)	40 traps/night over 4 nights (160 trap nights).	Common Planigale, Eastern Pygmy Possum, New Holland Mouse
Terrestrial Elliot B	Not used as no target species.			
Terrestrial hair tubes				
Watercourse search	-	1	1hr per night around two southern EECs and their dams on Lot 2, over 4 nights after heavy rainfall.	Ecosystem credit species, Green-thighed Frog, Green and Golden Bell Frog, Pale Headed Snake.
Wetland census (diurnal)	-	1	4hrs @ 1hr/day during and after the major rainfall events.	Ecosystem credit species, Green-thighed Frog, Green and Golden Bell Frog (non-breeding)
Wetland census (nocturnal)	-	1	1hr per night around two southern EECs and their dams on Lot 2, over 4 nights after heavy rainfall.	Ecosystem credit species, Green-thighed Frog, Green and Golden Bell Frog (non-breeding)

Weather conditions during the targeted surveys are outlined in **Table 18**.

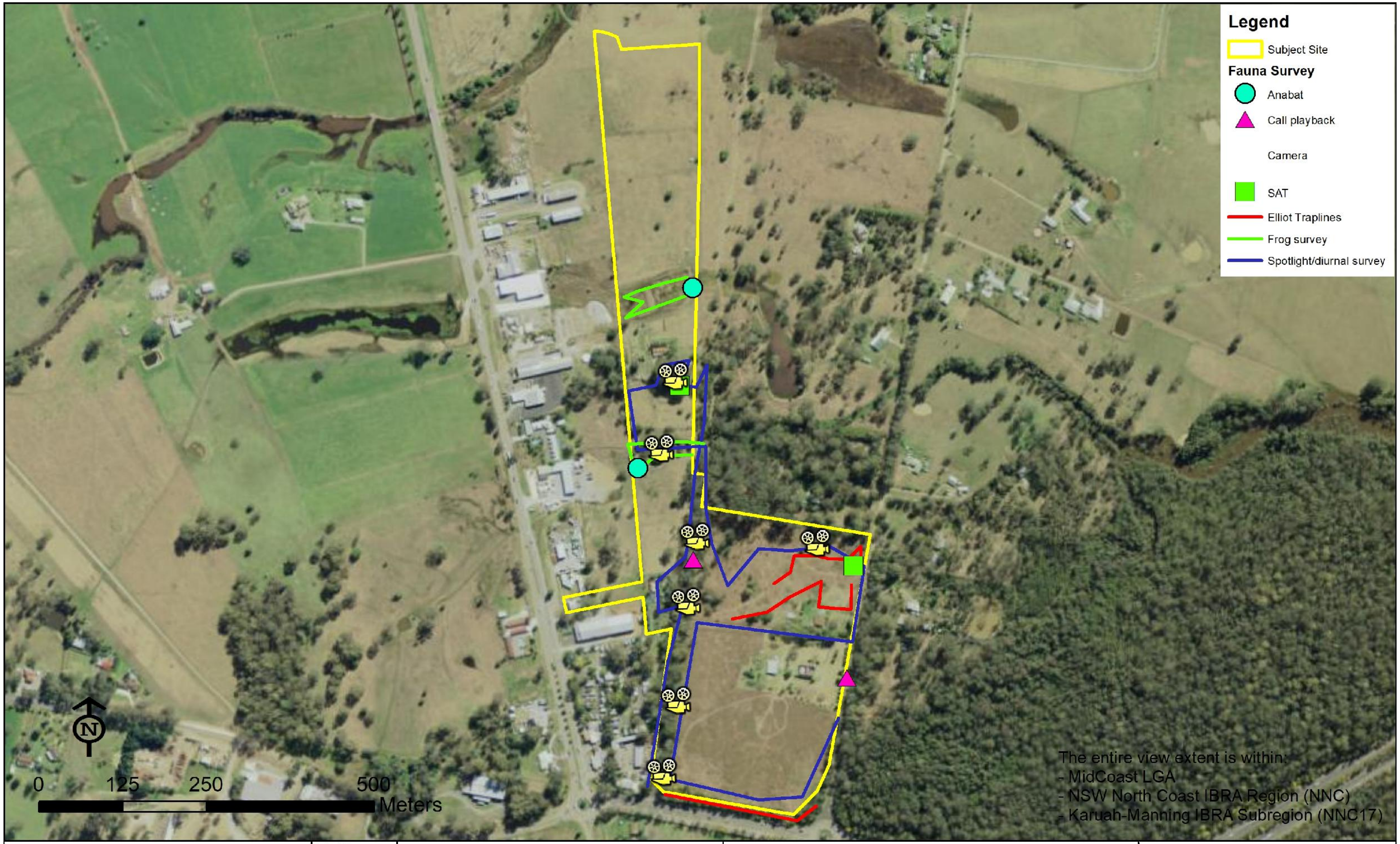
Table 18: Survey and weather conditions

(source: BoM 2020, Taree airport)

Date	Survey Methods	Min. temp. ^{0}C	Max. temp. ^{0}C	Rainfall (mm)
5/12/2019	Install Anabat at VZ 10	18.9	29.4	0
30/1/2020	Targeted threatened plant survey, large raptor nest survey, area search	21.6	33.6	0
5/2	area search, PIR camera installation, Nocturnal bird survey, spotlight, call playback, stagwatch for nesting birds, area search, SAT	17.5	0	0.2
10/2	Nocturnal bird survey, spotlight, call playback, stagwatch for nesting birds, area search, frog survey	19.3	27.7	36.0
11/2	Nocturnal bird survey, spotlight, call playback, area search, frog survey	18.1	29.0	13.8
12/2	Nocturnal bird survey, spotlight, call playback, stagwatch for nesting birds, frog survey,	20.2	28.1	2.2
13/2	Nocturnal bird survey, spotlight, call playback	20.9	26.9	35.4
15/2	Collect Anabat, area search	15.7	27.1	0
26/2	area search, spotlight, call playback, stagwatch for nesting birds, collect PIR cameras, collect Anabat	18.1	32.2	0
2/3	Elliot A trapping, area searches, spotlight, call playback, stagwatch, PIR camera retrieval	8.6	36.6	0
3/3	Elliot A trapping, area search, Koala scat search	22.5	25.5	0
4/3	Elliot A trapping, area search	19.6	26.1	6.2
5/3	Elliot A trapping, area search	20.9	24.7	0
6/3	Elliot A trapping, area search	21.3	32.5	8

Date	Survey Methods	Min. temp. ^{0}C	Max. temp. ^{0}C	Rainfall (mm)
12/3	Area search	15.1	24.6	1.4
13/2	Area search, HBT inspection	13.2	25.1	0.2
24/3	Area search	-	22.7	-

Figure 12: Targeted fauna surveys



This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Targeted Fauna Surveys

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

Scale: 1:7 000
Job Number: J2019-35
Revision: A

2.5.3.3.2 Survey results

Elliot A trapping recorded only a low diversity and abundance of small terrestrial mammals, reflecting the small size of the site and patchy cover. Only 2 Bush Rats (*Rattus fuscipes*) and 2 House Mouse (*Mus musculus**) were recorded. The House Mouse were found on Lot 2 DP573214. The Bush Rats were found on Lot 17.

Only common arboreals were detected by the cameras (Sugar Glider and Brushtail Possum), with no arboreals or threatened birds observed by spotlighting or stagwatching. Area searches failed to detect any roosting or nest attending owls.

No evidence of foraging by the Glossy Black Cockatoo was found, and the few trees had not produced cones for some time.

No Koala were observed and no scats were found, but 3 trees recorded scats in a previous survey (JBE 2018). This was unexpected given the site comprises some of the very limited area not burnt in the catastrophic 2019-2020 bushfire event.

No active sap incisions were noted, despite the Sugar Glider being present.

Only common species of birds were detected by the diurnal and nocturnal surveys. The latter was dominated by medium to large woodland birds. No response was made to nocturnal call playback of any species.

There are no large raptor nests on site. An Australian Raven nest was noted in a tree within the landscaping supplies yard, with the crows being present every site visit. This would be a significant deterrent to any raptor.

The only reptile recorded were common grass skinks.

Only the following common frogs were recorded in the dams despite ideal breeding conditions:

- Bleating Tree Frog (*Litoria dentata*)
- Dwarf Green Tree Frog (*L. fallax*).
- Peron’s Tree Frog (*L. peronii*)
- Striped Marsh Frog (*Limnodynastes peronii*).
- Common Eastern Froglet (*Crinia signifera*).

The microbat call detection survey was the most successful recording the following threatened species (see **Appendix 5** for report):

- Southern Myotis (definite)
- Little Bent-wing Bat (definite)
- Large Bent-wing Bat (probably – only short passes)
- East-coast Freetail Bat (definite)

The Greater Broad-nosed Bat (*Scoteanax rueppellii*) was also possibly recorded but its call cannot be distinguished from the common *Scotorepens orion*. The former has been recorded in very similar habitat by the consultant (eg. Berrigan 2000), hence it is considered a likely occurrence.

Similarly, the Eastern Cave Bat (*Vespadelus troughtoni*) call cannot be distinguished from the common *Vespadelus vulturnus* and *V. pumilus*. Given lack of mines, cliffs, sandstone escarpments, etc, in the locality which the Eastern Cave Bat is typically associated with, and the two common species are widely recorded in identical habitats to that on site, the Eastern Cave Bat is not considered likely to occur.

2.5.4 Final Species Credit species

The Koala and Southern Myotis are the only Species Credit species confirmed to occur on site to date, with two plants assumed present until targeted survey is undertaken, as follows:

Table 19: Final Species credit species

Name	Legal Status	Species presence	Dual or Species Credit	Biodiversity Risk Weighting
Southern Myotis	V-BCA	Known habitat	Species	2
Koala	V-BCA V-EPBCA	Known habitat	Dual	2
Pterostylis chaetophora	V-BCA	Assumed present	Species	2
Pale Yellow Doubletail (*Diuris flavescens*)	CE-BCA CE-EPBCA	Assumed present	Species	3

Species polygons for these species are shown in the following section, and derived as follows:

- Southern Myotis: 200m around the watercourses as per the guidelines (OEH 2018d).
- Koala: Entirety of VZ 7 as dominated almost entirely by primary preferred Koala food trees; drip line of scattered trees; and around collective dripline of other primary preferred Koala food trees (as listed in Callaghan et al 2003) in VZ 2.
- Orchids: Entirety of VZ 1 and VZ 2, which qualifies as generic potential habitat.

3 STAGE 2: IMPACT ASSESSMENT – BIODIVERSITY VALUES

This section assesses the proposed layout for impacts as per the BAM (OEH 2017) and the Stage 2 Operational Manual (DPIE 2019). As noted above, Lot 2 DP573214 is not proposed for development as part of the future DA.

3.1 Constraints and Layout Devisal

The primary engineering constraints influencing the layout design were:

- Services: Water and sewage mains have to be connected from Manning River Drive in the west along the Road 3 alignment, and follow the primary access (Road 2) to service future lots 1-5 and Lot 2 DP 863972. These both require crossing of Eriksson Lane but also limit the ability to curve roads.
- B-double access: Road alignment has to allow for B-double trucks to safely turn around corners within the estate.
- Pacific Highway access: The best access (from north and south highway traffic) for B-doubles to the future industrial estate is via Glenthorne Rd.
- Owner of Lot 2 DP573214 has expressed no interest in developing the land, and hence establishing infrastructure (such as Road 2) here servicing the industrial estate was considered by the proponent to be unfeasible.

The first layout concept is shown in **Figure 13**. This was refined to produce the final layout in Figure 3 after consideration of the VI (see overlay in **Figure 15**) and associated credit obligations, and other key habitat features eg. EECs, HBTs and KFTs, as follows:

- The BAMC identified the quantum of credits required, and the client considered a costs-benefits analysis considering road and services alignment and construction, cost of offsets, and lot layout.
- Review of MCC's preliminary comments on the layout in the application for a Planning Proposal, which recommended maximising avoidance of the Ericsson's Lane (see **Figure 14**).
- Modelling B-double truck turning circles and considering alignment of services.

The following sections further details both measures to avoid and minimise, and constraints on the maximum potential for avoidance.

Figure 13: Preliminary concept prior to BAM assessment

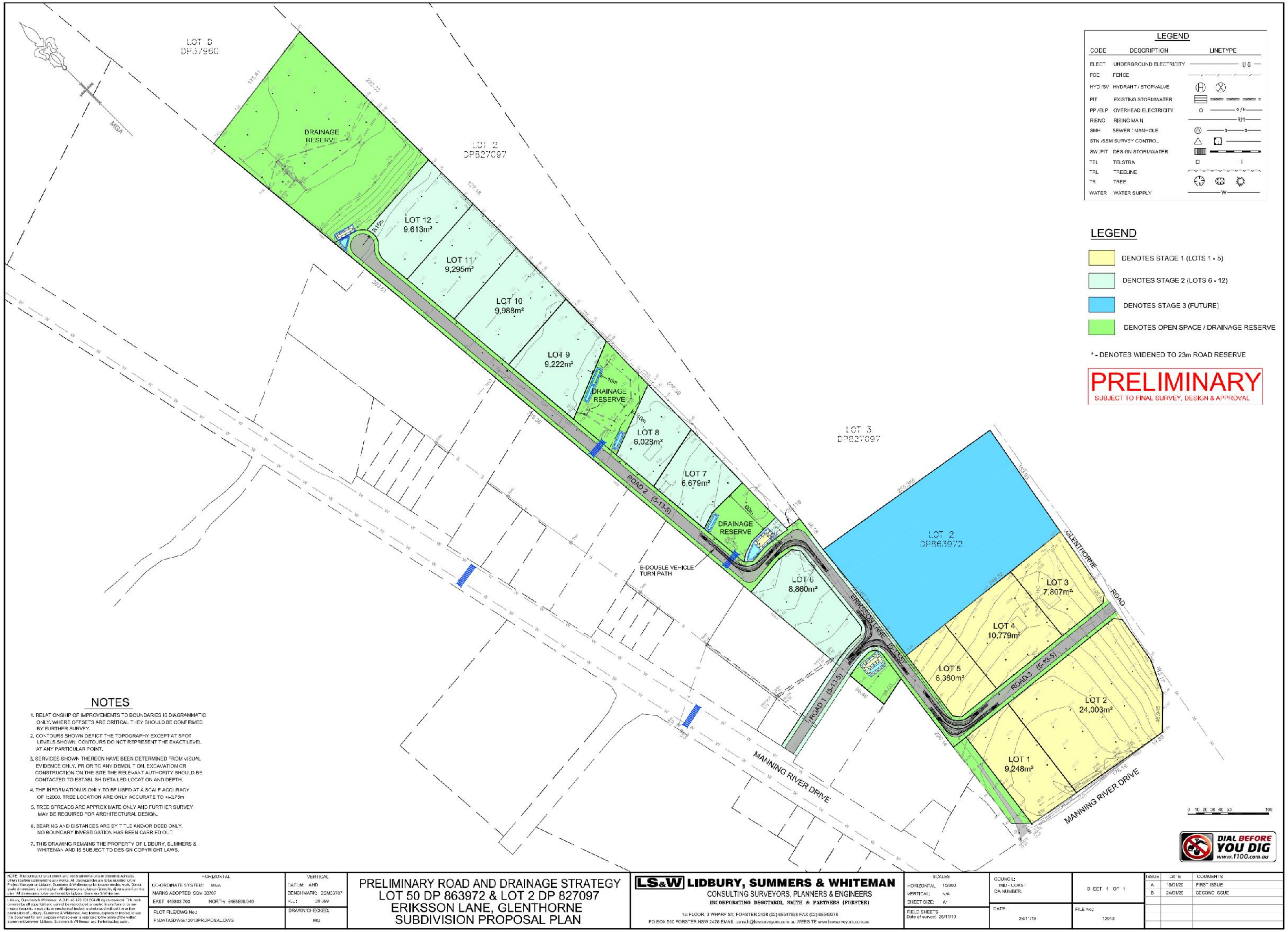


Figure 14: MCC's preliminary advice on draft concept pre-Planning Proposal

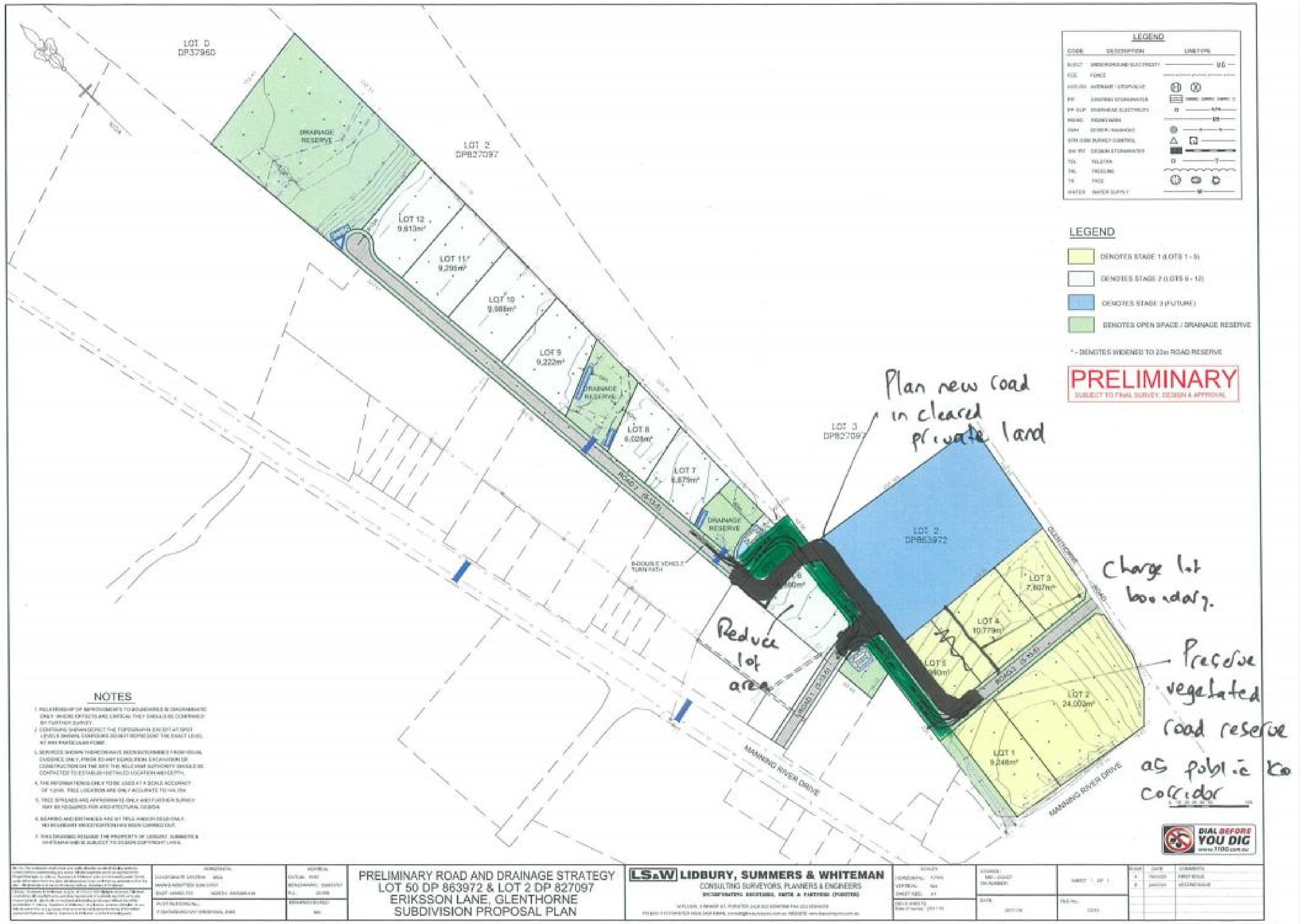
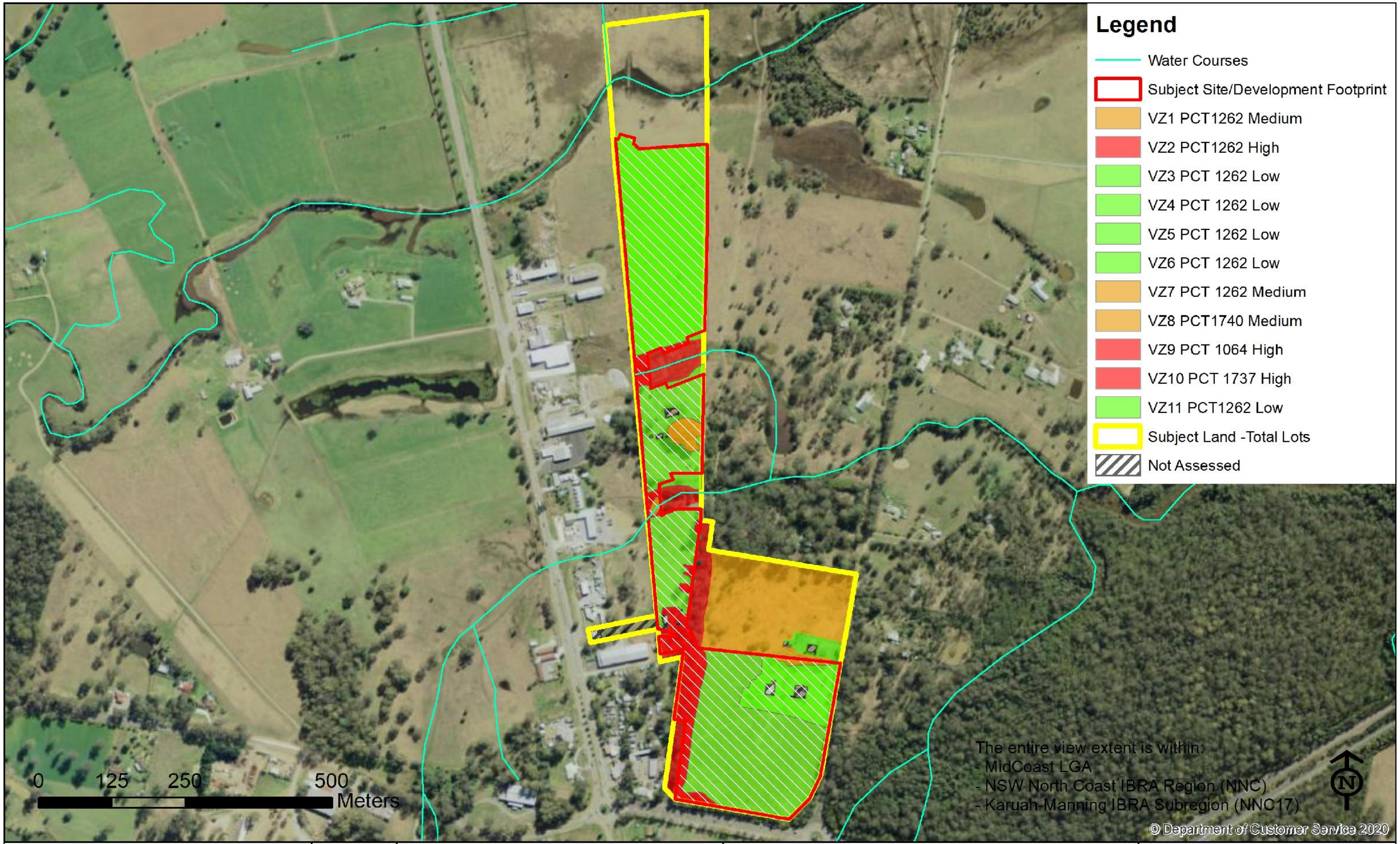


Figure 15: Final concept footprint and broad Vegetation Zone Vegetation Integrity classes



This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 5/06/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Vegetation Zones and Vegetation Integrity Final Concept

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

🟩 Low - Below min. VI
🟧 Medium VI > 20-60
🟥 High VI >60 or EEC

Scale: 1 :8,000
Job Number: J2019-35
Revision: A

3.2 Avoiding Impacts on Biodiversity and Prescribed Impacts

3.2.1 Locating a Project to Avoid and Minimise Impacts

The following table details where the rezoning and subdivision proposal has aimed to avoid and minimise impacts on biodiversity.

Table 20: Locating a project to avoid and minimise impacts on biodiversity

Approach	How avoided/minimised	Not avoided/minimised	Justification
Locating the proposal in areas where there are no biodiversity values	EECs are retained in drainage reserves, with infill planting in residual. Regenerating forest and groundcover in very good condition on Lot 2 DP573214 proposed to be retained as proposed E2 zone in Planning Proposal. Southern and northern end of Eriksson Lane retained, including most of the best potential orchid habitat and hollow-bearing trees. All existing pastoral areas used due to low VI for industrial subdivision footprint.	Middle third of Eriksson Lane to be developed into formal access to lots on Lot 2 DP827097. VZ 7 falls within an industrial lot.	Eriksson Lane is an RMS-owned road reserve and proponent has expressed an expectation of using this dedicated road reserve for road infrastructure. Engineering constraints also mean total avoidance is not possible. Relocating the primary access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints as well as alignment to Road 1 to access Manning River Drive; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. Retention of VZ 7 would create an island of habitat within an industrial estate that would need to be fenced off if unable to be used as a public park; would need ongoing maintenance of groundcover as well as managing risk of falling limbs (incurring a liability); and if posed a fire risk, may limit what kinds of development may occur adjacent. Furthermore, major engineering of landform of adjacent lots may adversely affect hydrological patterns which may place stress on these retained vegetation, impacting its long term viability. Lot 50, most of Lot 2 DP827097 and most if not all of Lot 2 DP573214 could currently be cleared and cultivated under current zoning under the *Local Land Services Act 2013*. Some trees could be logged for fence posts, boundary lines cleared, or if considered immature regrowth - cleared under exemptions of the *Local Land Services Act 2013* (subject to known threatened species habitat and EEC limitations). Rezoning of the majority of Lot 2 DP573214 to E2 allows for ongoing recruitment of KFTs to offset loss within development footprint. Buffers to EECs in drainage reserves could also be infill planted to buffer the EECs and increase KFT extent.

Approach	How avoided/minimised	Not avoided/minimised	Justification
Locating the proposal in areas where the native vegetation or threatened species habitat is in the poorest condition	Lot 50 is essentially a mixed pasture with some history of cultivation and maintained by slashing hence maximised development here. Lot 2 DP827097 is largely pasture with history of cultivation, and currently supporting cattle and maintained by slashing, hence maximised development here.	Middle third Eriksson Lane to be developed into formal access to lots on Lot 2 DP827097. This area contains a few of the site's least important hollow-bearing trees and some mature KFTs, but is also a dedicated road reserve. VZ 7 falls within an industrial lot, and is almost entirely primary preferred KFTs.	As above.
Locating the project in areas that avoid habitat for species and vegetation in high threat categories (e.g. an EEC or CEEC), indicated by the biodiversity risk weighting for a species	No CEEC is present on the site. Coastal Floodplain EECs retained in drainage reserves.	Not mapped as an Important Area of Habitat for Swift Parrot or Regent Honeyeater, but low chance of Swift Parrot foraging in Forest Red Gums during peak flowering season.	As above. Required VRZs to drainage reserves which contain EECs could be infill planted with KFTs to offset loss but also to widen the extent of EECs. These plantings will include Forest Red Gum and could include Swamp Mahogany which are characteristic of the *Swamp Sclerophyll Forest* EEC and both a Koala and Swift Parrot food tree. If majority of Lot 2 DP573214 zoned E2, current regrowth with numerous Forest Red Gums will be protected and on-going recruitment and regeneration secured. No CEEC species are known to occur on site. *Diuris flavescens* is subject to final orchid survey later in 2020 or an expert report, however habitat condition and lack of proximity suggests unlikely to be present within the development footprint; and best potential habitat is retained on Lot 2 DP573214.
Locating the proposal such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained	Lot 2 DP573214 retained "as is" in the DA as not part of proposed industrial estate by owners of other lots, with its regenerating Koala habitat retained. If majority of this lot is rezoned E2 as part of the rezoning, this regenerating habitat will be secured. EECs retained in drainage reserves retain connection	Middle third of Eriksson Lane to be removed. Southern and northern end retained with majority of HBTs and KFTs, but new road will pose a new potential vehicle strike risk to any terrestrial fauna (albeit limited risk given low speeds and poor habitat values to south limits diversity of species present and hence at risk). Shortest connection across the	The site does not play a key role in the local or wider landscape context as a corridor. As noted in 2.3.5, it lies at the northern fragmented tip of a very larger area of forest to the south largely within Kiwarrak State Forest-Khappinghat Nature Reserve; and is bound by major physical barriers ie. Pacific Highway to east, Manning River Drive to west and south, and cleared pastoral land to north and northwest. Koala use on site appears to be low intensity and infrequent, indicating it is not an occupied part of a home range and may be used by transient Koalas moving north from the large body of habitat south, or perhaps the remnant east on Lot 1. Movement west from the site for a Koala would be high risk due to the existing industrial estate and Manning River Drive, followed by limited patches of vegetation separated by cleared land with at most a scattered woodland providing connectivity to known habitat

Approach	How avoided/minimised	Not avoided/minimised	Justification
	east to other habitat via locating road on western boundary adjunct to the existing industrial estate and current terminus of their western connection.	new gap in Eriksson' Lane via Lot 102 to Lot 2 DP573214 and residual of road reserve. Gliding movement from Lot 1 DP1048115 to Eriksson Lane via Lot 55 DP863972 and Lot 17 DP836884 will be retained vi via Lot 102. Canopy gap in middle section of Eriksson Lane mitigated by retaining trees near stormwater drainage reserve, trees on Lot 102, and retaining northern end of Eriksson Lane. Can also still move through urban woodland on Lot 102 DP1118846, but would be difficult to cross Manning River Drive to west.	around Tinonee. However, Koalas have recently been observed crossing west of Manning River Drive (Tanya Cross, MCC, pers. comm.), hence while a hostile route, Koalas will attempt it (the major fire event may have been an unusual driver in this instance). Given high risk of vehicle strike, this is not ideal for population viability. It is currently possible for Koalas to move west from Lot 2 DP827097 to Lot 203 DP1202481 via several trees on the latter lot to a few Forest Red Gums on the other side of Manning River Drive, if they can get over the security fence on the boundary of Lot 203. The trees on Lot 203 however could be removed by future industrial development, hence this link is unlikely to remain long term. Another more marginal and circuitous link north from Lot 2 DP1045690 to VZ7 and a patch of trees in the rear of Lot 35 DP606484 is also possible, but would mean crossing around/over the roundabout and over pasture with a few trees for several hundred metres to reach the nearest clump of trees. Development of Lot 2 DP827097 will most likely remove these very tentative links, which given their high risk, is not considered a significant adverse change to current connectivity. Retaining the southern end of Eriksson Lane will retain potential for Koalas to move across Lot 102 and 9 to the west to cross Manning River Drive to reach several patches of trees on the northern side of Buckett's Way. This is currently the shortest route west for Koalas, other than walking along the edge of Manning River Drive. Lot 2 DP573214 retains connectivity with Lot 1 DP1048115 to the east of Glenthorne Rd which has potential to support a resident Koala due to its extent. Connectivity to the EECs from Lot 2 is also retained via the northern end of Eriksson Lane and remnant vegetation on adjoining lots to the north (although one has been largely cleared post-fire). Given no threatened gliders recorded and Eriksson Lane has no key linkage value to habitat south, the low value gliding link provided by Eriksson Lane is considered insignificant for these species in a local or landscape scale. The gap caused by the new road should be readily crossable given height of retained trees. Lot 50, most of Lot 2 DP 827097 and most if not all of Lot 2 DP 573214 could be cleared and cultivated under current zoning. Some trees could be logged for fence posts or cleared under exemptions of the *Local Land Services Act 2013*. Rezoning of the majority of Lot 2 DP573214 to E2 allows for ongoing recruitment of KFTs to offset loss within development footprint, and also strengthen canopy connectivity for fauna. Buffers to EECs in drainage reserves could be infill planted to buffer the EECs and increase KFT extent, but as do not link to any habitat west, no significance to connectivity.

3.2.2 Designing a Project to Avoid and Minimise Impacts on Biodiversity

The development has been designed in a way which avoids and minimises impacts as outlined below:

Table 21: Designing a proposal to avoid and minimise impacts on biodiversity

Approach	How avoided/minimised	Not avoided/minimised	Justification
Reducing the clearing footprint of the project	Lot 2 DP573214 retained "as is" in the DA as not part of proposed industrial estate by owners of other lots, with its regenerating Koala habitat retained. If majority of this lot is rezoned E2 as part of the rezoning, this regenerating habitat will be secured. EECs retained in drainage reserves which retain connection east to other habitat. Buffers to be replanted to widen the EEC. Southern and northern end of Eriksson Lane road reserve retained, with only middle section removed to minimum extent possible. Northern end of Lot 2 DP827097 which contains an EEC and Stitts Creek, retained as is.	Middle third of Eriksson Lane to be formed into main access road. VZ 7 contains a small patch of forest to be cleared. Western end of EECs removed for Road 2.	Eriksson Lane is an RMS-owned road reserve and proponent has expressed an expectation of using this dedicated road reserve for road infrastructure. Engineering constraints also mean total avoidance is not possible. Relocating primary access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot 2 DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. As noted above, retention of VZ 7 would create an island of habitat within an industrial estate that both poses management challenges, but there is uncertainty about changes to edaphics may see retained trees become non-viable long term. Lot 50, most of Lot 2 DP 827097 and most if not all of Lot 2 DP 573214 could be cleared and cultivated under current zoning. Some trees could be logged for fence posts or cleared under exemptions of the *Local Land Services Act 2013*. Rezoning of the majority of Lot 2 DP573214 to E2 allows for ongoing recruitment of KFTs to offset loss within development footprint. Drainage reserves could be infill planted to buffer the EECs and increase KFT and forest extent.

Approach	How avoided/minimised	Not avoided/minimised	Justification
Locating ancillary facilities in areas where there are no biodiversity values	Majority of development footprint on land below minimum VI for offsets. Road 3 (primary access for B-double trucks) from highway aligned to minimise habitat loss from Eriksson Lane subject to other hard constraints, seeing two thirds of the VZ retained including majority of HBTs and KFTs. No proposal to create driveways to Manning River Drive via Lot 17 DP836884. Access to Manning River Drive from Lot 2 DP827097 through existing industrial estate. Stormwater basins to be located in areas of pasture. Access road on Lot 2 DP827097 runs along western boundary to use disturbed edge of EECs adjacent to existing industrial area to minimise fragmentation of EECs and maintain current connectivity downstream, and minimise road kill risk of wetland fauna crossing road. Services expected to follow road footprint.	Middle third of Eriksson Lane to be formed to main access road. Some stormwater infrastructure located in buffer to EECs (VRZ requirements may change these nominal locations).	Eriksson Lane is an RMS-owned road reserve and proponent has expressed an expectation of using this dedicated road reserve for road infrastructure. Engineering constraints also mean total avoidance is not possible. Relocating main road access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot 2 DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. Lot 50, most of Lot 2 DP 827097 and most if not all of Lot 2 DP 573214 could be cleared and cultivated under current zoning. The EECs could potentially also be modified further eg. removing the current earth crossings would significantly change the current hydrological regime (dry out) allowing pasture to replace wetland plants.
Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the poorest condition (i.e. areas that have a lower Vegetation Integrity score)	As above.	As above.	As above.

Approach	How avoided/minimised	Not avoided/minimised	Justification
Locating ancillary facilities in areas that avoid habitat for species and vegetation in high threat status categories (e.g. an EEC or CEEC)	No CEECs. EECs retained in drainage reserves with VRZs to be established which will buffer from edge effects.	Some stormwater infrastructure currently largely located in buffer or edge of EECs.	Engineering constraints limit suitable locations for stormwater infrastructure. Final location of stormwater infrastructure will need to consider VRZs ie. wider vegetated buffer should be established. VRZs to be infill planted including EECs will be subject to Vegetation Management Plan (VMP) to manage current weeds.
Providing structures to enable species and genetic material to move across barriers or hostile gaps	EECs retain direct connection east via locating road on western boundary adjunct to existing industrial estate.	Removal of central part of Eriksson Lane's road reserve vegetation and creation of road poses a new barrier and mortality risk to any Koala using the residual habitat in Eriksson Lane, or trying to cross to or from the urban woodland on Lot 102 DP1118846 and Lot 9 DP836884.	While containing most of the site's hollows, Eriksson Lane is not a key interlink or corridor at a local or site scale for any threatened gliders. Hence overpasses not required, and the gap is crossable by gliders. The alignment of the road also severely limits speed, reducing collision risk. Site does not bisect habitat of a large Koala population and create a major risk of multiple fatalities from vehicle strike or pose a barrier to genetic heterogeneity, hence major measures such as underpasses or overpasses not required. Connectivity via southern retained end of Eriksson Lane to Lot 2 DP 573214 and northern end of Eriksson Lane if deemed required for Koalas could incorporate signage, lighting and speed control measures to minimise risk of vehicle strike. No threatened frogs recorded, and EECs do not connect west, hence underpasses and exclusion fencing not required. Lot 2 DP573214 has very good current connectivity to Lot 1 DP1048115, broken only by Glenthorne Rd. If required, Koala warning signage and speed control measures can be implemented at the entry to Glenthorne Rd. Connectivity west to Manning River Drive via Lots 203, 202 and 35 not viable long term, hence no measures proposed to retain or encourage this link for Koalas. Linkage across Lots 102 and 9 in the south currently provided by canopy connectivity from southern end of Eriksson Lane.

Approach	How avoided/minimised	Not avoided/minimised	Justification
Making provision for the demarcation, ecological restoration, rehabilitation and/or ongoing maintenance of retained native vegetation habitat on the development site.	Majority of Lot 2 DP573214 not proposed to be rezoned industrial, preferred to be zoned E2 and allowed to regenerate. Residual of drainage reserves can be infill planted, and weeds managed under VMP to improve condition under DA consent for industrial estate. Subject to RMS approval, residual of Eriksson Lane can be infill planted, and weeds managed under VMP to improve condition under DA consent for industrial estate.	Removal of middle part Eriksson Lane's road reserve vegetation which contains some of the site's hollows and mature KFTs.	Eriksson Lane is an RMS-owned road reserve and proponent has expressed an expectation of using this dedicated road reserve for road infrastructure. Engineering constraints also mean total avoidance is not possible. Relocating main road access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot 2 DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. Lot 50, most of Lot 2 DP 827097 and most if not all of Lot 2 DP573214 could be cleared and cultivated under current zoning. The EECs could potentially also be modified further eg. removing the current earth crossings would significantly change the current hydrological regime. Northernmost drainage reserve on Lot 2 DP827097 could also be allowed to regenerate or actively restored under a VMP. This area contains a *Freshwater Wetland on Coastal Floodplains* derived from historical clearing of either *Swamp Sclerophyll Forest or Swamp Oak Forest on Coastal Floodplains.* Downstream is the latter EEC, and hence regenerating this area could expand its local occurrence, but will be bound by on-going pastoral activities to north, east and west.

Approach	How avoided/minimised	Not avoided/minimised	Justification
Efforts to avoid and minimise impacts through design must be documented and justified.	Initial constraints assessment (JBE 2018) identified the EECs, presence of Koala scats and location of primary preferred KFTs, localised concentration of hollows in Eriksson Lane road reserve, and regeneration potential of Lot 2 DP573214, and hence its suitability to be zoned E2. Preliminary design of Road 3 altered subject to hard constraints (services, B–double access to highway, and separate land ownership) and to minimise loss of higher VI vegetation to minimise offset requirements. Proposed layout retains EECs in drainage reserves; retains majority of HBT and KFTs in Eriksson Lane, and retains regenerating area of Lot 2 DP573214. Glenthorne Rd used as primary access off Manning River Drive instead of cutting across Lot 17.	Removal of middle part of Eriksson Lane’s road reserve vegetation which contains some HBTs and KFTs. VZ 7 falls within an industrial lot.	Eriksson Lane is an RMS-owned road reserve and proponent has expressed an expectation of using this dedicated road reserve for road infrastructure. Engineering constraints also mean total avoidance is not possible. Relocating main road access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot 2 DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. Retention of VZ 7 poses challenges for management and uncertainty over long term viability. Lot 50, most of Lot 2 DP 827097 and most if not all of Lot 2 DP 573214 could be cleared and cultivated under current zoning. Logs could be taken for fence posts from VZ 7. The EECs could potentially also be modified further eg. removing the current earth crossings would significantly change the current hydrological regime.

3.2.3 Prescribed biodiversity impacts

The future development concept is assessed for prescribed biodiversity impacts as follows:

Table 22: Prescribed biodiversity impacts

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities affected
Impacts of development on the habitat of threatened species or ecological communities associated with: • karst, caves, crevices, cliffs and other geological features of significance, or • rocks, or • human made structures, or • non-native vegetation	No rocks, karst, caves, abandoned buildings, mines, etc on site. No non-native vegetation providing habitat for any threatened species. Elliot A trapping only recorded House Mouse and Bush Rats using lantana patches.	N/A
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	The site does not play a key role in the local or wider landscape context as a corridor. As noted in 2.3.5, it lies at the northern fragmented tip of a very larger area of forest to the south largely within Kiwarrak State Forest-Khappinghat Nature Reserve; and is bound by major physical barriers ie. Pacific Highway to east, Manning River Drive to west and south, and cleared pastoral land to north and northwest. Koala use on site appears to be low intensity and infrequent, indicating it is not an occupied part of a home range and may be used by transient Koalas moving north from the large body of habitat south, or perhaps the remnant east on Lot 1. Movement west from the site for a Koala would be high risk due to the existing industrial estate and Manning River Drive, followed by limited patches of vegetation separated by cleared land with at most a scattered woodland providing connectivity to known habitat around Tinonee. However, Koalas have recently been observed crossing west of Manning River Drive (Tanya Cross, MCC, pers. comm.). It is currently possible for Koalas to move west from Lot 2 DP827097 to Lot 203 DP1202481 via several trees on the latter lot to a few Forest Red Gums on the other side of Manning River Drive, if they can get over the security fence on the boundary of Lot 203. The trees on Lot 203 however could be removed by future industrial development. Another more marginal and circuitous link north from Lot 2 DP1045690 to VZ7 and a patch of trees in the rear of Lot 35 DP606484 is also possible, but would mean crossing around/over the roundabout on Manning River Drive and over pasture with a few trees for several hundred metres	Koala, Southern Myotis, East-Coast Freetail Bat, Little Bent-wing Bat and common hollow-obligates. Some marginal potential habitat of 2 threatened orchids which require seasonal survey. *Freshwater Wetlands* and *Swamp Sclerophyll Forest on Coastal Floodplains* EECs on site; and *Subtropical Floodplain Forest on Coastal Floodplains* to east. *Freshwater Wetlands* and *Swamp Oak Floodplain Forest on Coastal Floodplains* EECs in northern end of Lot 2 DP827097 outside development footprint.

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities affected
	to reach the nearest clump of trees in the southwest near Buckett's Way. Development of Lot 2 DP827097 will most likely remove these very tentative links, which given their high risk, is not considered a significant adverse change to current connectivity. Retaining the southern end of Eriksson Lane will retain potential for Koalas to move across Lot 102 and 9 to the west to cross Manning River Drive to reach several patches of trees on the northern side of Buckett's Way. This is currently the shortest route west for Koalas, other than walking along the edge of Manning River Drive. Lot 2 DP573214 retains connectivity with Lot 1 DP1048115 to the east which has potential to support a resident Koala, broken only by Glenthorne Rd. If required, Koala warning signage and speed control measures can be implemented. Connectivity to the EECs via Lot 2 is also retained via remnant vegetation on adjoining lots to the north (although one has been largely cleared post-fire). Given no threatened gliders recorded and Eriksson Lane has no key linkage value to habitat south, the fragmentation of the low value gliding link provided by Eriksson Lane is considered insignificant. The gap will be crossable where Road 3 passes through Eriksson Lane. Connectivity to retained end of Eriksson Lane to Lot 2 DP573214 and northern end of Eriksson Lane if deemed required for Koalas could incorporate signage, lighting and speed control measures. No threatened frogs recorded, and EECs do not connect west (other than a degraded area within the adjacent industrial estate), and road located on western boundary adjunct to existing industrial estate, maximising connectivity to similar habitats and EECs downstream. No change to current connectivity in EEC in northern end of Lot 2 DP827097 which is outside development footprint.	

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities affected
Impacts of development on movement of threatened species that maintains their lifecycle	Koala appears only use site infrequently and low intensity, as evidenced by failure to detect even when majority of local habitat was burnt and site offered refuge value. Does not thus appear to support key lifecycle stages such as breeding. At most, may be used as support habitat by dispersing animals. Proposal will see loss of a handful of KFTs in Eriksson Lane and VZ 7; keeping regenerating habitat on Lot 2 DP573214 and majority of mature KFTs in Eriksson Lane. The latter will be accessible from Lot 1 DP1048115 to the east where the nearest likely Koala home range is. Impacts on other marginal local links to the west for Koala discussed above. Southern Myotis has no known geographical barrier, flying over cleared land to use dams and along major rivers. Foraging habitat will be retained in drainage reserves. Most of site hollows lost, but some retained in adjacent private lands. No impact on movement. East-coast Freetail Bat and Little Bent-wings similarly have no known geographical barrier, flying over cleared land, and recorded foraging in urban areas. No threatened frogs or plants recorded yet (or likely, but precautionary assumed present or this assessment pending final survey) in wetland habitats, and flow patterns maintained as well as direct connectivity to habitat downstream, hence no significant adverse changes expected on species characteristic of the EECs.	Koala affected most adversely. Low impacts on EECs. Nil impact on microchiropteran bats given mobility.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)	EECs retained within drainage reserves, and stormwater directed via a treatment chain to these areas, so increased dryness is not a risk. Major earthworks and creation of impermeable surfaces will however increase water shedding, hence flooding frequency and extent may increase. This could also lead to some scouring of the channels, creating some more pools. This would benefit the Southern Myotis given the very heavy detritus load in VZ 9 due to self-mulching habitat of Cumbungi, but adequate structures would be needed to minimise erosion and sedimentation at discharge points. Industrial estates have businesses which use chemicals that can enter the stormwater system and impact downstream aquatic ecosystems catastrophically eg. via a major fuel spillage. The high load of weeds in the EECs indicates such impacts has occurred already from the adjoining industrial estate eg. nutrient enrichment. Some chemicals can impact aquatic fauna directly eg. frogs via endocrine disruptors. Stormwater treatment chain will need to be effective in mitigating this risk in addition to statutory controls applying to commercial industry eg. installing oil and grease traps, and effective measures for emergency control of spills. Stormwater changes expected to be minimal relative to *Freshwater Wetland* EEC in northern drainage reserve on Lot 2 DP 827097 given lies at northernmost extremity of the estate hence increased stormwater inputs will be minor and includes Stitt's Creek.	Southern Myotis. *Freshwater Wetlands* and *Swamp Sclerophyll Forest on Coastal Floodplains* EECs on site; and *Subtropical Floodplain Forest on Coastal Floodplains* to east. *Freshwater Wetlands* and *Swamp Oak Floodplain Forest on Coastal Floodplains* EECs in northern end of Lot 2 DP827097 outside development footprint.

Prescribed biodiversity impact	Description in relation to the development site	Threatened species or ecological communities affected
Impacts of vehicle strikes on threatened species or on animals that are part of a TEC.	Minimal for aquatic species in EECs as road has aligned on western boundary to adjoin existing industrial estate to minimise this risk for the EECs. Increased risk if Koalas or any other fauna that continue to use Eriksson Lane for connectivity but maximum speed limited by engineering design. Potential risk of Koalas using any planted habitat in drainage reserves wandering into the industrial estate, but given no resident population, risk is very low. Southern Myotis unlikely to be impacted via ability to avoid or behavioural avoidance. Maximum speed on roads will be 50kph. Where road crosses Eriksson Lane, road resign will reduce to slower speed, reducing risk.	*Freshwater Wetlands* and *Swamp Sclerophyll Forest on Coastal Floodplains* EECs on site; and *Subtropical Floodplain Forest on Coastal Floodplains* to east. Koala. Southern Myotis

3.2.4 Locating a project to avoid and minimise prescribed biodiversity impacts

The following table evaluates if the development has been located in a way which avoids and minimises prescribed biodiversity impacts:

Table 23: Locating a project to avoid and minimise prescribed biodiversity impacts

Approach	How avoided/minimised	Not avoided/minimised	Justification
Locating the envelope of surface works to avoid direct impacts on the habitat features	Lot 2 DP573214 retained as is, with its regenerating Koala habitat. EECs retained in drainage reserves which retain connection east to other habitat. Southern and northern end of Eriksson Lane road reserve retained.	Middle part of Eriksson Lane to be formed to main access road. VZ 7 to be cleared. Western end of drainage lines impacted by Road 2, removing one dam.	Eriksson Lane is an RMS-owned road and proponent has expectation of using this dedicated road reserve. Total avoidance is thus not possible. Relocating main road access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot 2 DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. Retention of VZ 7 would create an island of habitat within an industrial estate that would need to be fenced off if unable to be used as a public park; would need ongoing maintenance of groundcover as well as managing risk of falling limbs (incurring a liability); and if posed a fire risk, may limit what kinds of development may occur adjacent. Furthermore, major

Approach	How avoided/minimised	Not avoided/minimised	Justification
			engineering of landform of adjacent lots may adversely affect hydrological patterns which may place stress on these retained vegetation, impacting its long term viability. Lot 50, most of Lot 2 DP827097 and most if not all of Lot 2 DP573214 could be cleared and cultivated under current zoning. Some trees could be logged for fence posts or cleared under exemptions of the *Local Land Services Act 2013*. If Lot 2 DP573214 is zoned E2, this will secure on-going regeneration of forest dominated by KFTs to offset loss. Drainage reserves could also be infill planted to buffer the EECs and increase KFT and forest extent.
Locating the envelope of sub-surface works, both in the horizontal and vertical plane, to avoid and minimise operations beneath the habitat features, e.g. locating long wall panels away from geological features of significance or water dependent plant communities and their supporting aquifers	Not very relevant as not a mining operation and no basement parking provided. Some filling will be required in some areas to raise above 1:100 ARI, where others will need topsoil stripping to get to firmer soil horizon to support foundations.	VZ 7 not retained, but if retained, sub-soil excavation adjacent could possibly lead to adverse changes to groundwater patterns with unpredictable impacts on trees.	Major engineering of landform of adjacent lots may adversely affect hydrological patterns which may place stress on the retained vegetation, impacting its long term viability, plus posing risks to life and property by falling limbs and trees. Further investigation may be required to confirm this risk if Consent Authority considers retention of VZ 7.
Locating the project to avoid severing or interfering with corridors connecting different areas of habitat, migratory flight paths to important habitat or preferred local movement pathways	Rezoning Lot 2 DP573214 to E2 retains connectivity with Lot 1 DP1048115 to the east which has potential to support a resident Koala, broken only by Glenthorne Rd. If required, Koala warning signage and speed control measures can be implemented. Connectivity to the EECs via Lot 2 is also retained via remnant vegetation on adjoining lots to the north (although one has been largely cleared post-fire).	Most of Eriksson Lane to be formed to main access road. VZ 7 to be cleared.	Site has no role in migratory flights for birds such as waders or forest birds as is not a major wetland, estuary, beach, foreshore, etc; or a significant hill or range. The site does not play a key role in the local or wider landscape context as a corridor. It lies at the northern fragmented tip of a very large and regionally significant body of forested habitat in Kiwarrak State Forest-Khappinghat Nature Reserve, and is bound by major physical barriers ie. Manning River Drive, the Pacific Highway and cleared pasture to the north and west, and ultimately the Manning River. Koala use appears to be low intensity and infrequent. Movement west is high risk, and Koalas moving north from large extent of habitat south have to pass over Manning River

Approach	How avoided/minimised	Not avoided/minimised	Justification
	Aside from increased traffic along first 250m of Glenthorne Rd, current tenuous link from Lot 1 DP1048115 to southern end of Eriksson Lane retained. Main road located on western side of EECs to avoid further fragmentation (apart from EEC in VZ 9 which extends in a more degrade form west in the existing industrial estate) from downstream occurrences. Southern end of Eriksson Lane retains link to habitat in Lots 102 and 9, and shortest potential link west to Buckett's Way.		Drive: not ideal for long term recovery of the population. Urban woodland which provides tentative link west is not secured, with likely future industrial development on Lots 202, 35 and 203. Given no threatened gliders recorded and Eriksson Lane has no key linkage value to habitat south, the loss of the low value gliding link provided by Eriksson Lane is considered insignificant. Connectivity to southern retained end of Eriksson Lane to Lot 2 DP573214 if deemed required for Koalas could incorporate signage, lighting and speed control measures. No threatened frogs recorded, and EECs do not connect west, and road located on western boundary adjunct to existing industrial estate, maximising connectivity to similar habitats and EECs downstream. No change to current connectivity in EEC in northern end of Lot 2 DP827097 which is outside development footprint.
Optimising project layout to minimise interactions with threatened and protected species and ecological communities, e.g. designing turbine layout to allow buffers around features that attract and support aerial species, such as forest edges, riparian corridors and wetlands, ridgetops and gullies	Proposal is not a wind farm. Lot 2 DP573214 retained and preferred to be rezoned to E2. EECs retained in drainage reserve with some buffers which can be infill planted.	Middle part Eriksson Lane to be formed to main access road. This will remove a few of the site's HBTs and mature KFTs, but overwhelming majority retained. VZ 7 to be cleared (dominated by KFTs).	Eriksson Lane is an RMS-owned road and proponent has expectation of using this dedicated road reserve. Total avoidance is thus not possible. Relocating main road access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot 2 DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. Retention of VZ 7 would create an island of habitat within an industrial estate that would need to be fenced off if unable to be used as a public park; would need ongoing maintenance of groundcover as well as managing risk of falling limbs (incurring a liability); and if posed a fire risk, may limit what kinds of development may occur adjacent. Furthermore, major engineering of landform of adjacent lots may adversely affect hydrological patterns which may place stress on these retained

Approach	How avoided/minimised	Not avoided/minimised	Justification
			vegetation, impacting its long term viability. Lot 50, most of Lot 2 DP827097 and most if not all of Lot 2 DP573214 could be cleared and cultivated under current zoning. Some trees could be logged for fence posts or cleared under exemptions of the *Local Land Services Act 2013*. If Lot 2 DP573214 is zoned E2, this will secure on-going regeneration of forest dominated by KFTs to offset loss. Drainage reserves could also be infill planted to buffer the EECs and increase KFT and forest extent.
Locating the project to avoid direct impacts on water bodies	Two dams in VZ 9 retained with drainage reserve, as is Stitt's Creek in the far northern end of Lot 2.	End of dam (possibly entire dam) in VZ 7 may be impacted by western alignment of access road.	Dam is dominated by exotic vegetation and an artificial structure. Not used by any threatened frogs. Small size limits value to Southern Myotis.

3.2.5 Designing a project to avoid and minimise prescribed biodiversity impacts

The following table evaluates if the development has been designed in a way which avoids and minimises prescribed biodiversity impacts.

Table 24: Designing a project to avoid and minimise prescribed biodiversity impacts

Approach	How avoided/minimised	Not avoided/minimised	Justification
Engineering solutions, e.g. proven techniques to minimise fracturing of bedrock underlying features of geological significance, water dependent communities and their supporting aquifers; proven engineering solutions to restore connectivity and favoured movement pathways	N/A	N/A	N/A

Approach	How avoided/minimised	Not avoided/minimised	Justification
Design of project elements to minimise interactions with threatened and protected species and ecological communities	Lot 2 DP 573214 retained and preferred to be rezoned to E2 to allow regeneration to continue and establish more habitat, including Koala habitat. Road 3 design minimises clearing of Eriksson Lane subject to engineering constraints. EECs retained in drainage reserve which will need to be accommodate VRZs as per WM Act. Main road alignment on Lot 2 DP827097 on western boundary to minimise EEC fragmentation and road kill risk.	Middle part of Eriksson Lane to be formed to main access road. This will remove a few of the site's HBTs and mature KFTs. VZ 7 to be cleared (dominated by KFTs). Main road alignment will still cross two EECs.	Eriksson Lane is an RMS-owned road and proponent has expectation of using this dedicated road reserve. Relocating primary access to Lot 2 DP827097 over western boundary of Lot 50 and Lot 2 DP573214 proposed by MCC was considered uneconomical by the proponent, but also conflicted with the sewage, water main and B-double access constraints; and increased biodiversity impacts on Lot 2 DP573214 which is proposed to be predominantly zoned E2. The owner of Lot 2 DP573214 has also expressed no interest in developing the land, hence may reject a road on this property. Retention of VZ 7 raises issues of public safety and long term viability of the trees. Lot 50, most of Lot 2 DP827097 and most if not all of Lot 2 DP573214 could be cleared and cultivated under current zoning. Some trees could be logged for fence posts or cleared under exemptions of the *Local Land Services Act 2013*. If Lot 2 DP573214 is zoned E2, this will secure on-going regeneration of forest dominated by KFTs to offset loss. Drainage reserves could also be infill planted to buffer the EECs and increase KFT and forest extent.

Approach	How avoided/minimised	Not avoided/minimised	Justification
Design of the project to maintain environmental processes critical to the formation and persistence of habitat features not associated with native vegetation	EECs retained within drainage reserves. No diversion of water away from these EECs.	New stormwater pipes will direct flow into EECS – risk of scouring with associated downstream erosion and sedimentation.	No drying of the Coastal Floodplain EECS will occur as water not diverted away. Fire is already a rare ecological process – no longer a key hollow formation factor. Standard engineering measures can abate scouring at pipe discharge point.
Design of the project to maintain hydrological processes that sustain threatened species and TECs	EECs retained within drainage reserves. No diversion of water away from these EECs. Northern *Freshwater Wetland* EEC habitat avoided by development as not included in footprint. No likely lowering of watertable in EECs as no pumping of groundwater and no diversion away from drainage lines or floodplains.	Stormwater devices located on edge of drainage reserves possibly in EEC habitat will need to consider VRZs. Changes to hydrological regime may have positive and negative effects ie. more frequent flooding but higher intensity flows as rapid shedding from catchment.	Current pollution control legislation to mitigate risk of dumping chemicals into stormwater and to capture chemicals on premises for proper disposal minimises risk of a catastrophic spill. Stormwater chain to meet best practice requirements as per statutory controls. Standard erosion and sedimentation controls to be implemented during construction.
Design of the project to avoid and minimise downstream impacts on rivers, wetlands and estuaries by control of the quality of water released from the site.	As above. Stormwater chain to meet best practice requirements as per statutory controls. Standard erosion and sedimentation controls to be implemented during construction. Northern *Freshwater Wetland* EEC which contains Stitt's Creek avoided by development as not included in footprint.	Conversion to industrial estate expanding existing industrial estate increases risk of a catastrophic chemical spill impacting downstream aquatic ecosystems.	As above

3.3 Impacts on EECs

The majority of the site's Coastal Floodplain EECs which fall within the proposed industrial subdivision are retained within drainage reserves. As part of the DA consent, these will be subject to VMPs to improve their condition via removal of weeds, and buffered by infill planting of existing pasture within the residual of the reserves and VRZs required under the *Water Management Act 2000*.

Habitat loss of the EECs totaling 0.27ha will occur for the footprint of Road 2 and possibly the edge of stormwater infrastructure. This road has been strategically located on the western end of the drainage lines in which the EECs occur due to engineering constraints, but also minimises fragmentation of the EECs, and impacts the most weed infested portions.

Stormwater runoff will be directed into these EECs, adding to current loads up the upstream existing industrial area and drainage from Manning River Way and site loads from grazing cattle, but will travel through a treatment train to mitigate the incremental and cumulative nutrient inflow. Standard erosion and sediment controls during construction will also be required under the Development Consent to mitigate this threat during construction.

The habitat of the EECs is not likely to be subject to increased drying, but the larger area of paved surfaces may develop some higher velocity inputs at discharge points. Appropriate design controls will be implemented to minimise scouring.

3.4 Serious and Irreversible Impacts (SAII)

The Pale Yellow Doubletail and the Swift Parrot are listed as SAII species. Neither has been detected on site to date, but targeted survey is required for the orchid during its flowering season in potential habitat in VZ 1 and 2 to confirm that it is absent as expected given condition of the habitat and disturbance history, and lack of close proximity records.

The site does not contain habitat currently mapped as Important Habitat for the Swift Parrot (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap), hence the SaII threshold trigger is not activated, and only the Pale Yellow Doubletail needs to be assessed under the SaII criteria as detailed below.

Table 25: Candidate Serious and Irreversible Impacts entities

Species / Community	Principle	Direct impact individuals / area (ha)	Threshold for SaII Assessment
Swift Parrot	1 - a species, population or ecological community that is a candidate entity because it is in a rapid rate of decline.	About 0.4ha containing potential food trees	Mapped important areas
Pale Yellow Doubletail (*Diuris flavescens)*	2 - species or ecological communities with very small population size. 3 - species or area of ecological community with very limited geographic distribution.	Loss of 1.24ha of marginal potential habitat in Eriksson Lane	N/A

Table 26: Determining whether impacts are serious and irreversible

Determining whether impacts are serious and irreversible	Assessment
Principle 1	
Does the proposal impact on a species, population or ecological community that is a candidate entity because it is in a rapid rate of decline?	Yes – *Diuris flavescens* if it is found to be present by future seasonal surveys. This appears a low risk however given only 1.24ha of disturbed marginal genetic potential habitat is impacted.
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible	No threshold is listed for this species, hence any impact is considered serious and irreversible. If the plant is not found, the impact will not be serious and irreversible.
Principle 2	
Does the proposal impact on a species that is a candidate entity because it has been identified as having a very small population size?	Yes – *Diuris flavescens* if it is found to be present by future seasonal surveys. This appears a low risk however given only 1.24ha of disturbed marginal genetic potential habitat is impacted
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible	Targeted survey or an expert report required to confirm presence or absence of species required. Potential habitat nominated to be removed occurs in Eriksson Lane road reserve. The best potential habitat is proposed to be retained and rezoned to E2.
Principle 3	
Does the proposal impact on the habitat of a species or an area of an ecological community that is a candidate entity because it has a very limited geographic distribution?	Yes – *Diuris flavescens* if it is found to be present by future seasonal surveys. This appears a low risk however given only 1.24ha of disturbed marginal genetic potential habitat is impacted
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.	No threshold listed, hence any impact is considered likely to be serious and irreversible, if the plant is found on site. This appears a low risk however given only 1.24ha of disturbed marginal genetic potential habitat is impacted
Principle 4	
Does the proposal impact on a species, a component of species habitat or an ecological community that is a candidate entity because it is irreplaceable?	No
If yes, is the impact in excess of any threshold identified and therefore likely to be serious and irreversible? Note: where candidate entities have no listed threshold, any impact is considered likely to be serious and irreversible.	N/A

The following table evaluates the significant of the proposal's impacts on the candidate SaII species:

Table 27: Evaluation of impact significance on a candidate SaII species

Impact Assessment Provision	Assessment
(a) the action and measures taken to avoid the direct and indirect impact on the potential entity for a SaII	If detected within the footprint by future surveys, the nominated layout will need to be reconfigured. The majority of potential habitat occurs on Lot 2 DP573214 which is nominated to be rezoned E2. The potential habitat impacted is the comparatively more highly degraded by weed invasion, pastoralism and regular lawn mowing.
(b) the size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification	Targeted survey is required to confirm the plant is present or an expert report. There is limited potential habitat on site, most of which is proposed to be retained and zoned E2, with the majority of marginal generic potential habitat in Eriksson Lane also retained.
(c) the extent to which the impact exceeds any threshold for the potential entity that is specified in the Guidance to assist a decision-maker to determine a serious and irreversible impact	All losses of known populations will be considered serious and irreversible. If the plant is shown to be absent, no threshold will be exceeded. This appears likely given only 1.24ha of disturbed marginal generic potential habitat is impacted.
(d) the likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population, including but not limited to: (i) an estimate of the change in habitat available to the local population as a result of the proposed development (ii) the proposed loss, modification, destruction or isolation of the available habitat used by the local population, and (iii) modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.	Targeted survey is required to confirm the plant is present, or an expert report. There is limited potential habitat on site, most of which is proposed to be retained and zoned E2. Only 1.24ha of disturbed marginal generic potential habitat is impacted. If present, a local population is likely to be restricted to the site habitat, especially given potential habitat on Lot 3 to the north was largely cleared recently after the 2019-2020 bushfire event. Approximately 1.24ha (including the gravel track comprising Erickson's Lane) of disturbed generic potential habitat is proposed to be removed. The affected habitat will be cleared and filled for the primary access road to the northwest industrial area. Edge effects on habitat on Lot 2 DP573214 could be a risk (eg. weed invasion, diversion of stormwater) if unmitigated, but this area is currently threatened by invasion of exotic grasses. Recovery of understorey and canopy on Lot 2 would suppress exotic grasses. If present on Lot 2, this area would best be managed under a VMP to mitigate threats.
(e) the likely impact on the ecology of the local population. At a minimum, address the following: (i) for fauna: – breeding – foraging – roosting, and – dispersal or movement pathways (ii) for flora, address how the proposal is likely to affect the ecology and biology of any residual plant population that will remain post development including where information is available:	Edge effects such as diversion of stormwater into the residual habitat on Lot 2 DP573214 could support weed invasion, especially from the new road edge, but such effects will be limited given the relatively gentle slope and existing edge effects status. Exotic grasses and lantana are however currently invading Lot 2 from Glenthorne Rd and Lot 50 frontages, modifying potential habitat, and this is the key threat to the potential habitat here irrespective of the development proposal. Cessation of any natural disturbance such as fire may also adversely impact this species which appears to prefer a periodic disturbance regime (eg. fire or slashing) to trigger flowering. A management plan for Lot 2 would be needed if this plant was found to be present to establish an appropriate fire regime, if part of this lot was to be subject to future development. Pollinators are less likely to be affected directly given current limited connectivity to other habitat which is not highly degraded (ie Lot 1 to the east); and barriers posed by degraded habitat in other directions.

Impact Assessment Provision	Assessment
– pollination cycle – seedbanks – recruitment, and – interactions with other species (e.g. pollinators, host species, mycorrhizal associations)	
(f) a description of the extent to which the local population will become fragmented or isolated as a result of the proposed development	The species is a cryptic orchid with very poor dispersal potential of its pollen and seed. A potential site population would be expected to be currently be largely isolated from other habitat west by pasture/rural and industrial land uses. Development of potential habitat in Eriksson Lane would be an incremental addition to this isolation, but given existing barriers, would not be likely to directly result in isolation above the current status.
(g) the relationship of the local population to other population/populations of the species. This must include consideration of the interaction and importance of the local population to other population/populations for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	The species is a cryptic orchid with very poor dispersal potential of its pollen and seed by insect pollinators. A potential site population would currently be largely isolated from other habitat west by pasture/rural and industrial land uses, with very low potential for dispersal of pollen given distance to nearest populations and available vectors.
(h) the extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	Remaining potential habitat on Lot 2 DP573214 adjacent to the east of the road development and in the marginal potential habitat retained in Eriksson Lane, would be subject to an increase current edge effect risks eg. dust during construction, changes to stormwater runoff patterns, etc. This can be mitigated by a management plan including weed and dust management and appropriate design of stormwater diversion. The northern end of Eriksson Lane could also be subject to a VMP to control weeds to reduce this risk as well.
(i) an estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	The plant is only known from a number of small populations in the locality to the west and northwest including near the Council waste processing centre, under overhead powerline easements, edges of paddocks, and a cemetery dominated by exotic groundcovers and routinely mown (DotEE 2014, DPIE 2020a, 2020c). None are considered adequately reserved.
(j) the measure/s proposed to contribute to the recovery of the species in the IBRA subregion.	Under the Saving Our Species (DPIE 2020c) program, the species is a Site Managed species. Management activities include broad-scale weed control, managing commercial activities, and managing disturbances (eg. slashing and herbicide spraying). If detected as present, this species would best be managed as per the SOS program under a VMP with on-going management provisions.

3.5 Direct impacts

The direct impacts of the development on:

- native vegetation are outlined in **Table 28**
- threatened species and threatened species habitat is outlined in **Table 29**.
- prescribed biodiversity impacts is outlined in Section 3.2.1

Direct impacts including the final project footprint (construction and operation) are shown in **Figure 16**.

Table 28: Direct impacts to native vegetation

VZ	PCT ID	PCT Name	EEC	Direct impact (ha)
1	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	0.09
2	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	1.15
3	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	4.46
4	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	4.75
5	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	1.17
6	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	1.46
7	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	0.24
8	1740	PCT 1740: Tall Spike Rush freshwater wetland	Yes	0.04
9	1064	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Yes	0.07
10	1737	PCT 1737: Typha rushland	Yes	0.16
11	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	1.28

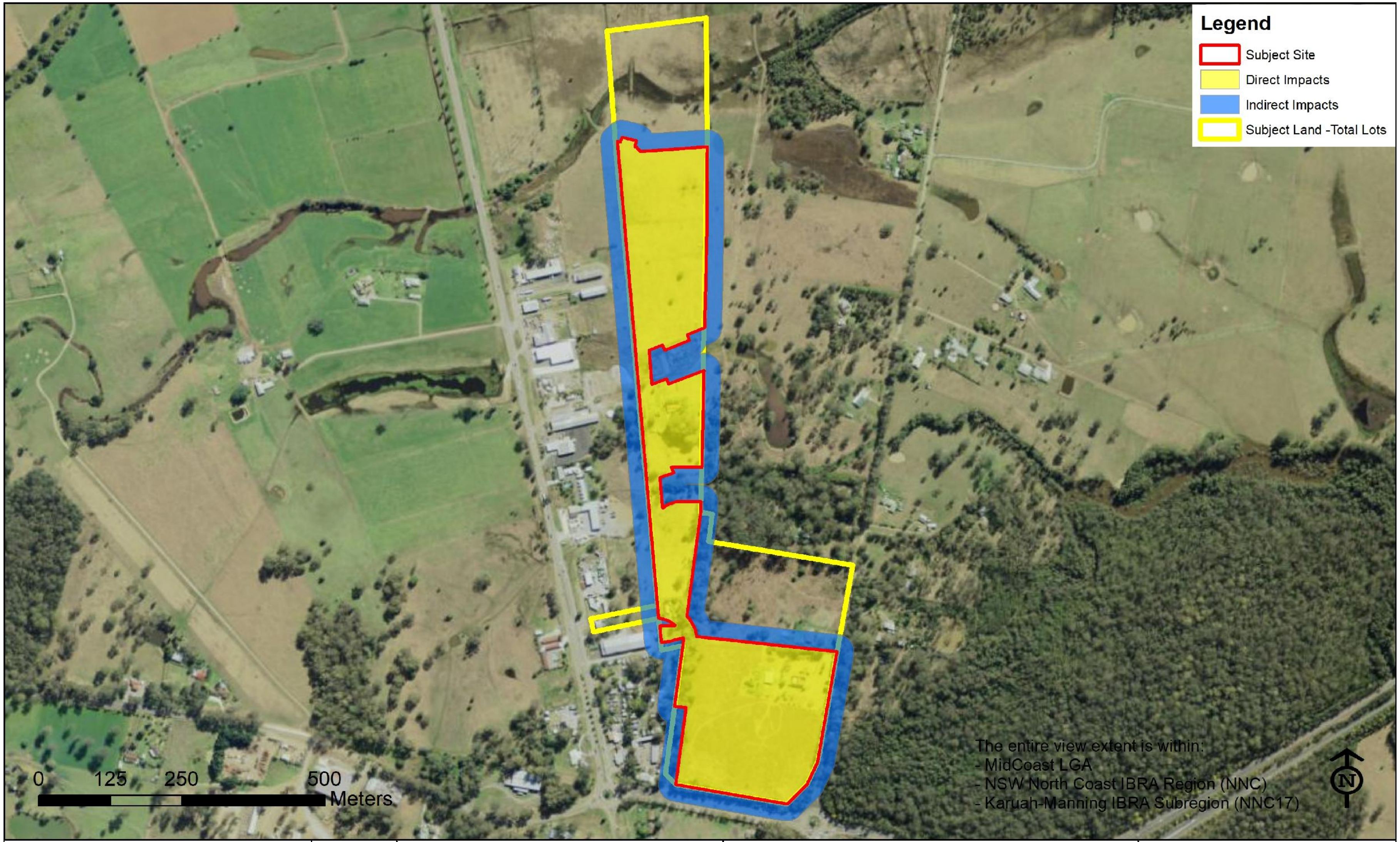
Table 29: Direct impacts on threatened species and threatened species habitat

Name	Legal Status	Species presence	Direct impact number of individuals / habitat (ha)	Biodiversity Risk Weighting
Southern Myotis	V-BCA V-EPBCA	Known habitat	6.08ha	2
Koala	V-BCA	Known habitat	0.72	2
Pterostylis chaetophora	V-BCA	Assumed present	1.24	2
Pale Yellow Doubletail (*Diuris flavescens*)	CE-BCA CE-EPBCA	Assumed present	1.24	3

3.6 Indirect impacts

Potential indirect impacts associated with the development and the current development concept are outlined below. Nominal indirect impact zones are shown in **Figure 16**.

Figure 16: Indirect and direct impact zones



This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 4/06/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Direct & Indirect Impacts
Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne
Client: Glenthorne Industries

JBEnviro

Scale: 1 :6,800
Job Number: J2019-35
Revision: A

Table 30: Indirect impacts

Indirect impact	Probability and/or consequence of impact if not mitigated	Extent/Entities Impacted	Frequency	Duration	Timing
Sedimentation and contaminated and/or nutrient rich run-off	Could lead to shallowing of waterbodies and smothering of vegetation and benthos. Shallowing may allow weeds to establish. High risk if ineffectually mitigated as major earthworks in proximity to watercourses, but these have been previously impacted by adjacent construction leading to shallowing of the watercourses, plus VZ 9 has been converted to two small dams via earthen crossings.	EECs within drainage lines encapsulated within the footprint on Lot 2 DP827097, and downstream.	After each rainfall event	After each rainfall event during construction	Construction in short term
Contaminated and/or nutrient rich run-off	Very low probability of a major event given statutory constraints on water quality controls, however potential for long term catastrophic impacts in major events (eg. chemical or fuel spill) given industrial landuses proposed. Stormwater in an industrial estate will be expected to have an elevated level of nutrients and contaminants than other landuses due to chemical storage and usage, high traffic loads, etc. This will flush into the stormwater system, most likely having low level impacts on the aquatic ecosystem (eg. algae growth, loss of sensitive fauna and flora, weed growth) given current level of degradation from upstream runoff and cattle grazing. This impact is currently evident in the EECs in the southern end of Lot 2 adjacent to the existing industrial estate.	EECs within drainage lines encapsulated within the footprint on Lot 2 DP827097 and downstream.	Very rare – perhaps one off for major events. After each rainfall events for low level contaminants.	Short to long term, depending on chemical, volumes, etc, for major events Perpetuity for low concentration emissions.	Operation phase
Noise, dust or light spill	Noise currently elevated as edge effect due to location on edge of existing industrial estate and rural land uses, plus close to highway and adjacent to Manning River Drive. Will incrementally increase on site with the development, mostly diurnal with limited nocturnal noise. Not expected to impact fauna given current noise levels, not near a breeding area of threatened frogs or migratory or wetland birds. Currently some light spill from industrial estate and Manning River Drive. Expect to increase. Will impact residual of Eriksson Lane, regenerating habitat on Lot 2	Adjacent forest edges of Lot 1, 2, 17 and 55. May penetrate more open habitats >100m. Impact on hollow-obligate species if light directed at hollows.	Construction phase Operation phase	Construction phase – day time Operation phase – day and early night	Construction in short term, and long term during Operation

Indirect impact	Probability and/or consequence of impact if not mitigated	Extent/Entities Impacted	Frequency	Duration	Timing
	DP573214, and edge of Lot 1 DP1048115. Expected to significantly increase with the new estate from signage, street and security lighting.				
Inadvertent impacts on adjacent habitat or vegetation	Risk of dumping building wastes, parking of plant or storage of construction materials during construction phase, impacting root zones of any retained trees on edge of Eriksson Lane, drainage reserves or damage to regenerating vegetation on Lot 2 DP573214. Consent condition, specifications in CEMP and compliance enforcement by MCC Ordinance Officers however reduces risk.	Boundary of development envelope to EECs and Lot 2.	Unpredictable	Temporary – obligated to manage to avoid this.	Construction
Transport of weeds and pathogens from the site to adjacent vegetation	Low risk of greenwaste dumping in retained habitat could lead to establishment of new weeds. Risk is low as lawns and landscaping within the estate will be limited. Current gravel road on Eriksson Lane can be closed and rehabilitated, leaving only a footpath/cycleway to minimise risk of dumping.	Boundary of development envelope to EECs and Lot 2; and residual of Eriksson Lane	Unpredictable	Temporary – obligated to manage	Construction Operation
Vehicle strike	Increased traffic on Glenthorne Rd, Manning River Drive and crossing of Eriksson Lane will increase risk, but current existing threat on the first two roads, hence only incremental increase where already a threat. Eriksson Lane is not a key linkage at local scale, so probability of a Koala moving north along it is low at best hence low risk. Mitigable by signage and speed control measures if deemed required. Increased traffic volume on Glenthorne Rd offset by short length to access road and roundabout at southern end.	Glenthorne Rd, Manning River Drive, Eriksson Lane	When roads used but most risk at night when fauna most active	Permanent after construction	Operation

Indirect impact	Probability and/or consequence of impact if not mitigated	Extent/Entities Impacted	Frequency	Duration	Timing
Rubbish dumping	Low risk of greenwaste and other rubbish dumping in residual habitats in drainage reserves and Lot 2 could lead to establishment of new weeds; and dumping of debris may include contaminants, chemicals (eg. paint) and plastics (non-biodegradable). Current gravel road on Eriksson Lane can be closed and rehabilitated, leaving only a footpath/cycleway to minimise risk of dumping. Risk is low as highly visible to passer-by and community reporting.	Boundary of development envelope to EECs and Lot 2; and residual of Eriksson Lane	Rare and erratic.	Temporary – can be readily remediated	Construction Operation
Wood collection	Retained habitat on Lot 2 DP573214 is expected to be protected plus no residential component. Current gravel road on Eriksson Lane can be closed, leaving only a footpath/cycleway to minimise risk of firewood collection.	Lot 2 DP573214 and residual of Eriksson Lane	Winter annually	On-going	Operation
Bush rock removal and disturbance	N/A. None present	N/A.	N/A.	N/A.	N/A.
Increase in predatory species populations	Foxes highly likely to be present given preference of agricultural lands, and feral cats likely with existing industrial estate and on peri-urban fringe. Expanding estate may exclude foxes but cats could still occur from adjoining residences. Plague Minnow already present in dams.	Residual habitats on site and adjacent habitats where feral cats could disperse to.	Ongoing	Permanent	Operation
Increase in pest animal populations	Feral rodents already present and will remain using industrial estate. Indian Mynas also observed and expected to remain and compete with native species for hollows.	Residual habitats on site and adjacent habitats.	Ongoing	Permanent	Operation

Indirect impact	Probability and/or consequence of impact if not mitigated	Extent/Entities Impacted	Frequency	Duration	Timing
Increased risk of fire	Possible risk of industrial residents perceiving fire risk in adjacent remnant forest on Lot 1 and lighting fires given risk uncontrolled fire would pose. Establishing a petroleum based industry close to Lot 1 may raise fire management as a concern, but at most, should only stimulate proactive fuel reduction by the respective landowner, or the RFS can issue a notice to control. Implementing a bushfire management plan if Lot 2 is regenerated would also mitigate threat perception on this lot. The drainage reserves are a low threat due to moisture levels.	Residual habitat on Lot 2, residual of Eriksson Lane and adjacent on Lot 1	Ongoing	Permanent	Operation
Disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds, frogs	Southern Myotis foraging in EECs as small part of local range – which includes large dam to east. Some temporary changes to habitat during construction expected to have minimal impact on activity. Small potential for light spillage to affect behaviour – recorded foraging in metropolitan watercourses suggests a level of tolerance. No threatened frogs present. No shorebird or significant wetland habitat for waders. Loss of proportion of site's KFTs	VZ 8 and 9. Southern Myotis Koala.	Construction Operation	Permanent	Operation
Increased risk of starvation, exposure and loss of shade or shelter	Low risk – loss of about 7 hollow-bearing trees (including termitaria) on site which contain only small, under-developed (eg. broken leader) or termitaria hollows. Majority including all medium and large hollows retained. Loss of proportion of site's KFTs not likely to have measurable impact on Koala given low activity level, but still a net reduction in carrying capacity unless Lot 2 allowed to continue regeneration via E2 zoning, and drainage reserves infill planted.	Site and study area	Single event during construction	Permanent	Construction

3.7 Minimising Impacts

Measures proposed to minimise impacts at the development site before, during and after construction, based on the current layout, are outlined below:

Table 31: Measures proposed to minimise impacts from the current layout

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Rezone of majority of Lot 2 DP573214 to E2. Offset planting of KFTs within VRZ/EEC buffers within drainage reserves in VZ 8 and 9. Southern end of Eriksson Lane converted to pedestrian access only, with infill planting of KFTs and weed removal in northern and southern end, and conversion to public reserve. Retain trees in southern of Lot 2 DP827097 where possible around drainage reserve for connectivity. All replanting and weed management under VMP.	High – unavoidable loss of proportion of KFTs in development footprint. Ongoing weed development in residual road reserve.	Nil Low	Rezone of majority of Lot 2 DP573214 to E2. Residual of Eriksson Land converted to public reserve. Design construction in drainage reserve to minimise loss of existing trees. Development consent to require offset plantings and regeneration to be undertaken under a VMP, and lands secured.	No net loss of Koala habitat.	Planning Proposal consent DA Consent	Proponent MCC
Relocate suitable sections of fallen hollow-bearing trees to edges of EECs to offer refuge for fauna.	High - hollow-bearing trees to be felled will be destroyed.	Nil	Development consent to require ecologist to identify suitable sections of hollow-bearing trees to be salvaged and direct relocation to secure habitat areas.	Augmentation of habitat integrity in EECs.	DA approval where hollow-bearing trees to be felled.	Proponent MCC
Removal of existing western crossing in EEC within VZ 9 to allow natural recolonisation by wetland species to offset loss of EEC for western edge for road.	High – unavoidable loss of western edge for new road.	Nil	Development consent to require removal of this crossing and allow it to be recolonised by aquatic plants.	Almost no net loss of this EEC in VZ 9.	Subdivision DA approval.	Proponent MCC

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Timing clearing works to avoid critical life cycle events such as breeding or nursing.	High – loss of HBTs.	Low	Clearing outside breeding season of hollow-obligate bats, birds and mammals; and using 2 phase clearing protocol (remove non-habitat first, and remove hollows >24hrs later).	Avoid impacts on breeding.	Spring-summer for bats.	Proponent
Instigating clearing protocol including pre-clearing surveys and staged clearing, and the presence of a trained ecologist or licensed wildlife handler during clearing events	High – Koala recorded plus common hollow-obligate mammal and birds expected eg. Lorikeets and possums.	Low	Consent condition requiring the measure.	Minimal if any fauna injury or mortality	Prior to and during clearing.	Proponent MCC Ecologist.
Clearing protocols that identify vegetation to be retained, prevent inadvertent damage and reduce soil disturbance	Moderate – risk of impacts on retained KFTs and HBTs, and EECs	Low	Consent condition requiring the measure in future DA.	EECs, KFTs and HBTs protected during construction.	DA consent and construction phase.	Proponent MCC
Sediment barriers and sedimentation ponds to control sediment and the quality of water released from the site into the receiving environment during construction	High – risk of impacts on EECs	Low	Consent condition requiring the measure.	Erosion controlled during construction.	DA consent and construction phase.	Proponent MCC
External artificial lighting to be located and use designs to minimise light spillage on adjacent vegetation.	High – development adjacent to Lot 1 will establish a new impact here. Developments adjacent to EECs will also expand the impact here.	Low	DAs for future industrial developments to demonstrate environmental lighting provisions.	Light spillage minimised.	DA consent and operation phase.	Proponent MCC

Measure	Risk before mitigation	Risk after mitigation	Action	Outcome	Timing	Responsibility
Protection of retained trees in Eriksson Lane as per AS4970-2009 *Protection of Trees on Development Sites.*	High – excavation to boundary could impact roots	Low	Arborist assessment of trees to advise setbacks.	Minimal if any necessary tree removal.	Pre-DA to finalise development proposal. DA consent to secure conditions.	Proponent MCC
Temporary exclusion fencing to protect significant environmental features such as EECs during construction.	High – risk of impacts riparian zone.	Very low	Consent condition requiring the measure in future DA.	EEC protected during construction.	DA consent and construction phase.	Proponent MCC
Hygiene protocols to prevent the spread of weeds or pathogens between infected areas and uninfected areas	Low – risk of introduction of frog and plant diseases.	Very low	Consent condition in DA for hygiene measures ie. washdown of construction machinery before entering site.	No disease introduced during major earthmoving works.	DA consent and construction phase.	MCC
Staff training and site briefing to communicate environmental features to be protected and measures to be implemented.	High – risk of impacts on EECs.	Very low	Consent condition requiring include toolbox talks to ensure all workers aware of issues.	No impacts during construction.	DA consent and construction phase.	Proponent MCC
Scour mitigation measures at discharge points into drainage lines.	High if high velocity water directed into the watercourses.	Very low	Consent condition requiring appropriate siting and engineering measures.	Scouring minimised.	DA consent and construction phase.	Proponent MCC

3.8 Impact summary

Following implementation of the BAM and the BAMC, the following impacts have been determined.

3.8.1 Serious and Irreversible Impacts (SAII)

The Pale Yellow Doubletail has at best a low potential to occur within VZ 1 and 2. Only 1.24ha of degraded habitat is impacted by the proposed industrial subversion, mainly where Road 2 passes through Eriksson Lane. This section is currently highly disturbed by use as a rear access to the existing industrial estate by the proponent, and to existing residence on site, with the remaining verge highly weed infested.

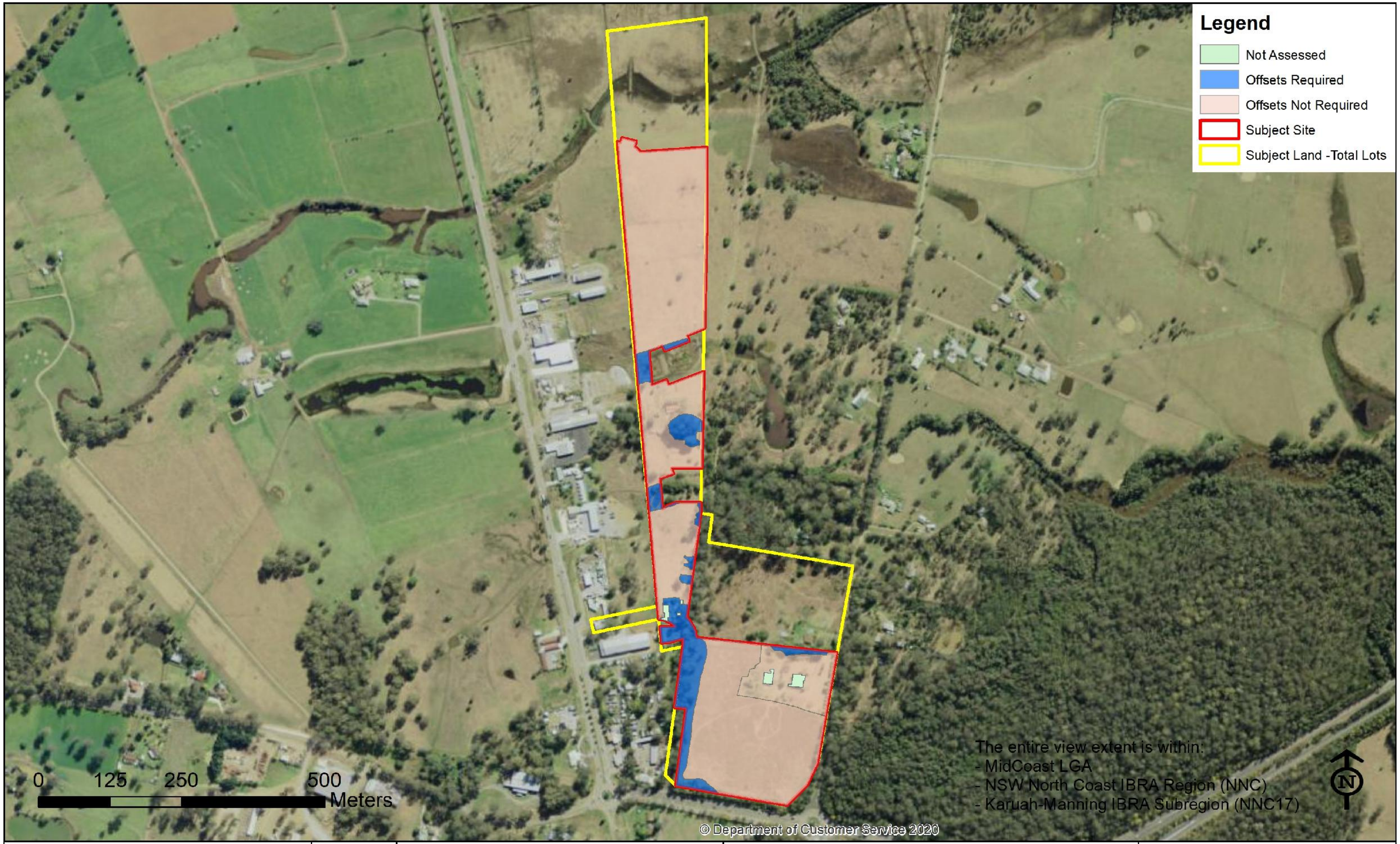
The remainder is in the adjacent paddock on Lot 2 maintained by lawn mowing by the adjacent resident, or grazed by cattle and dominated by improved pasture; and the western margins of Lot 50 directly adjacent to Eriksson Lane where native groundcovers still dominate.

A targeted survey in the flowering season later this year is required to confirm this species is absent from the development footprint and most likely the site.

3.8.2 Impacts requiring offsets

Impacts requiring offset for native vegetation loss are shown below in **Figure 17:**

Figure 17: Areas requiring or not requiring assessment or offsets within the development footprint



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Drawn By: MB
Date: 4/06/2020
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Figure Name: Direct & Indirect Impacts

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

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Revision: A

Table 32: Impacts to native vegetation that require offsets

Vegetation Zone	PCT ID	PCT Name	Vegetation Class	Vegetation Formation	Direct impact (ha)	Candidate SaII
VZ 1	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	0.09	No
VZ 2	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	1.15	No
VZ 7	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	0.24	No
VZ 8	1740	PCT 1740: Tall Spike Rush freshwater wetland	Coastal Freshwater Lagoons	Freshwater Wetlands	0.04	No
VZ 9	1064	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Coastal Swamp Forests	Forested Wetlands	0.07	No
VZ 10	1737	PCT 1737: Typha rushland	Coastal Freshwater Lagoons	Freshwater Wetlands	0.16	No

Table 33: Impacts on threatened species and threatened species habitat that require offsets

Species	Species presence	Legal Status	Direct impact (number of individuals / habitat (ha)	Candidate SaII
Koala	Known habitat	V-BCA V-EPBCA	0.72	No
Southern Myotis	Known habitat	V-BCA	6.08	No
Pterostylis chaetophora	Assumed present	V-BCA	1.24	No
Pale Yellow Doubletail (*Diuris flavescens*)	Assumed present	CE-BCA CE-EPBCA	1.24	Yes

3.8.3 Impacts not requiring offsets

The impacts of the development not requiring offset are outlined in **Table 34** and shown in **Figure 17**.

Table 34: Impacts to native vegetation that do not require offsets

Vegetation Zone	PCT ID	PCT Name	Vegetation Formation	Vegetation Class	Direct impact (ha)	Rationale
VZ 3	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	4.46	Below Vegetation Integrity threshold
VZ 4	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	4.75	Below Vegetation Integrity threshold
VZ 5	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	1.17	Below Vegetation Integrity threshold

Vegetation Zone	PCT ID	PCT Name	Vegetation Formation	Vegetation Class	Direct impact (ha)	Rationale
VZ 6	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	1.46	Below Vegetation Integrity threshold
VZ 11	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Northern Hinterland Wet Sclerophyll Forests	Wet sclerophyll forest (Grassy sub-formation)	1.28	Below Vegetation Integrity threshold

3.8.4 Areas not requiring assessment

The western end of Road 2 on Lot 203 falls over an existing industrial development, and the footprint of existing dwellings and sheds were not assessed.

All other areas on the site are considered vegetated with native vegetation and were assessed.

3.8.5 Change in vegetation integrity

The change in vegetation integrity as a result of the development is outlined in the following table.

Table 35: Change in vegetation integrity

Vegetation Zone	PCT ID	Condition	Area (ha) impacted	Area (ha) retained	Current vegetation integrity score	Future vegetation integrity score in footprint	Change in vegetation integrity
1	1262	Moderate	0.09	3.57	38.9	0	-38.9
2	1262	Moderate-high	1.15	0.83	65.5	0	-65.5
3	1262	Low	4.46	0	16.6	0	-16.6
4	1262	Low	4.75	0.05	0.5	0	-0.5
5	1262	Low	1.17	0.08	0.6	0	-0.6
6	1262	Low	1.46	0.21	2.2	0	-2.2
7	1262	Moderate	0.24	0	52.8	0	-52.8
8	1740	Moderate	0.04	0	36.5	0	-36.5
9	1064	Moderate	0.07	0.24	38.5	0	-38.5
10	1737	Moderate	0.16	0.51	59.8	0	-59.8
11	1262	Low	1.28	0.27	0.9	0	-0.9

3.9 Credit summary

The number of ecosystem credits required for the development are detailed in **Table 36**. The number of species credits required for the development are outlined in **Table 37,** with species polygons shown following. A biodiversity credit summary report is included in **Appendix 3**.

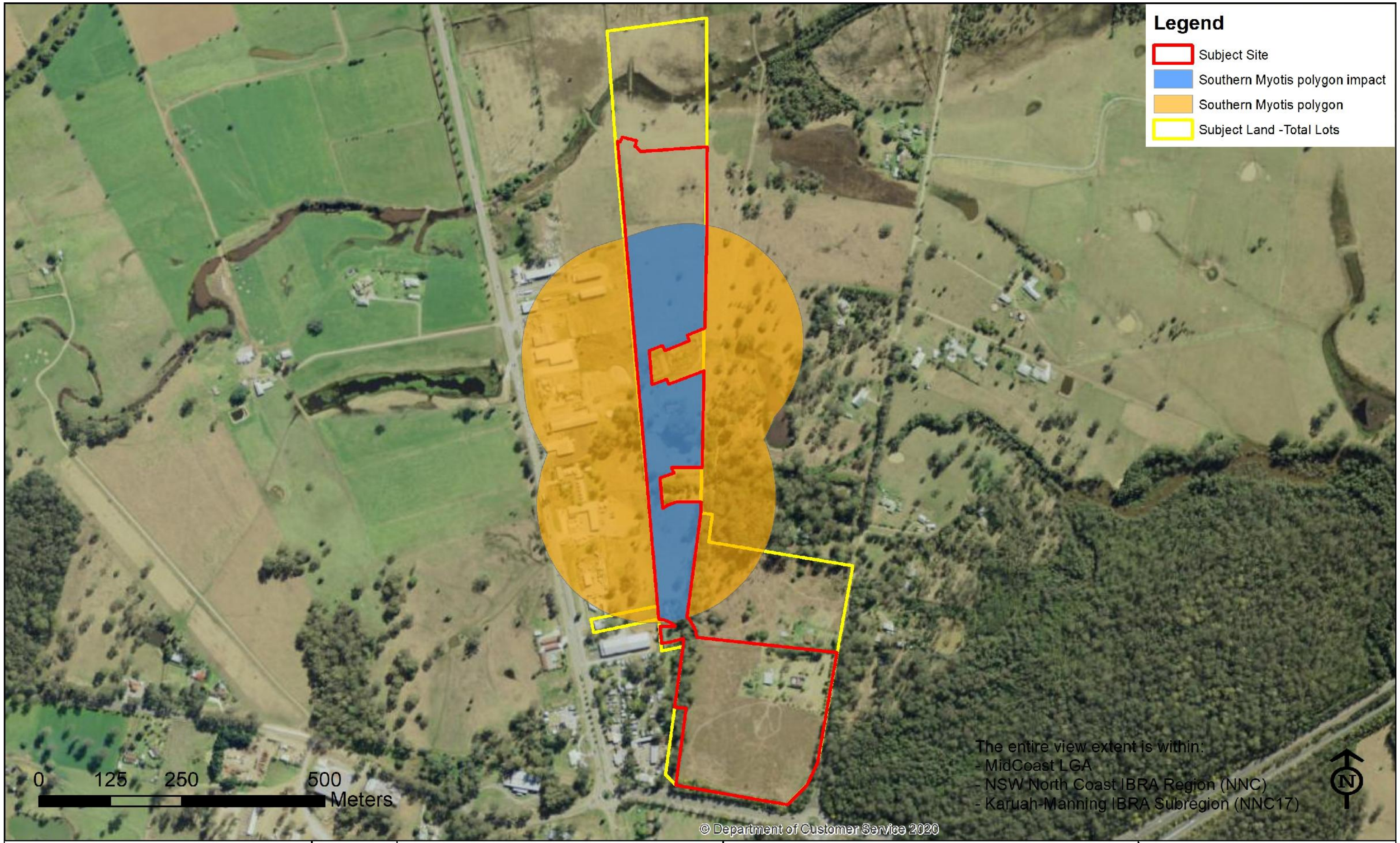
Table 36: Ecosystem credits required

VZ	PCT ID	PCT Name	Candidate SAII	VI	Direct impact (ha)	Biodiversity Risk Weighting	Credits required
1	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	38.9	0.09	1.5	1
2	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	65.5	1.15	1.5	28
7	1262	PCT 1262: Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	52.8	0.24	1.5	5
8	1740	PCT 1740: Tall Spike Rush freshwater wetland	No	36.5	0.04	1.75	1
9	1064	PCT 1064: Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	No	38.5	0.07	2	1
10	1737	PCT 1737: Typha rushland	No	59.8	0.16	1.75	4
						Total:	**40**

Table 37: Species credit summary

Name	Legal Status	Candidate Sall	Direct impact (number of individuals / habitat (ha)	Biodiversity Risk Weighting	Species Credit	Credits required
Southern Myotis (*Myotis macropus*)	V-BCA	No	6.08	2	Known habitat	22
Koala (*Phascolarctos cinereus*)	V-BCA V-EPBCA	No	0.72	2	Breeding habitat	21
Pterostylis chaetophora	V-BCA	No	1.24	2	Known habitat	40
Pale Yellow Doubletail (*Diuris flavescens*)	CE-BCA CE-EPBCA	**Yes**	1.24	3	Known habitat	60
					Total:	**143**

Figure 18: Southern Myotis species credit polygon and development footprint



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Drawn By: MB
Date: 4/06/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Southern Myotis Species Polygon
Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne
Client: Glenthorne Industries

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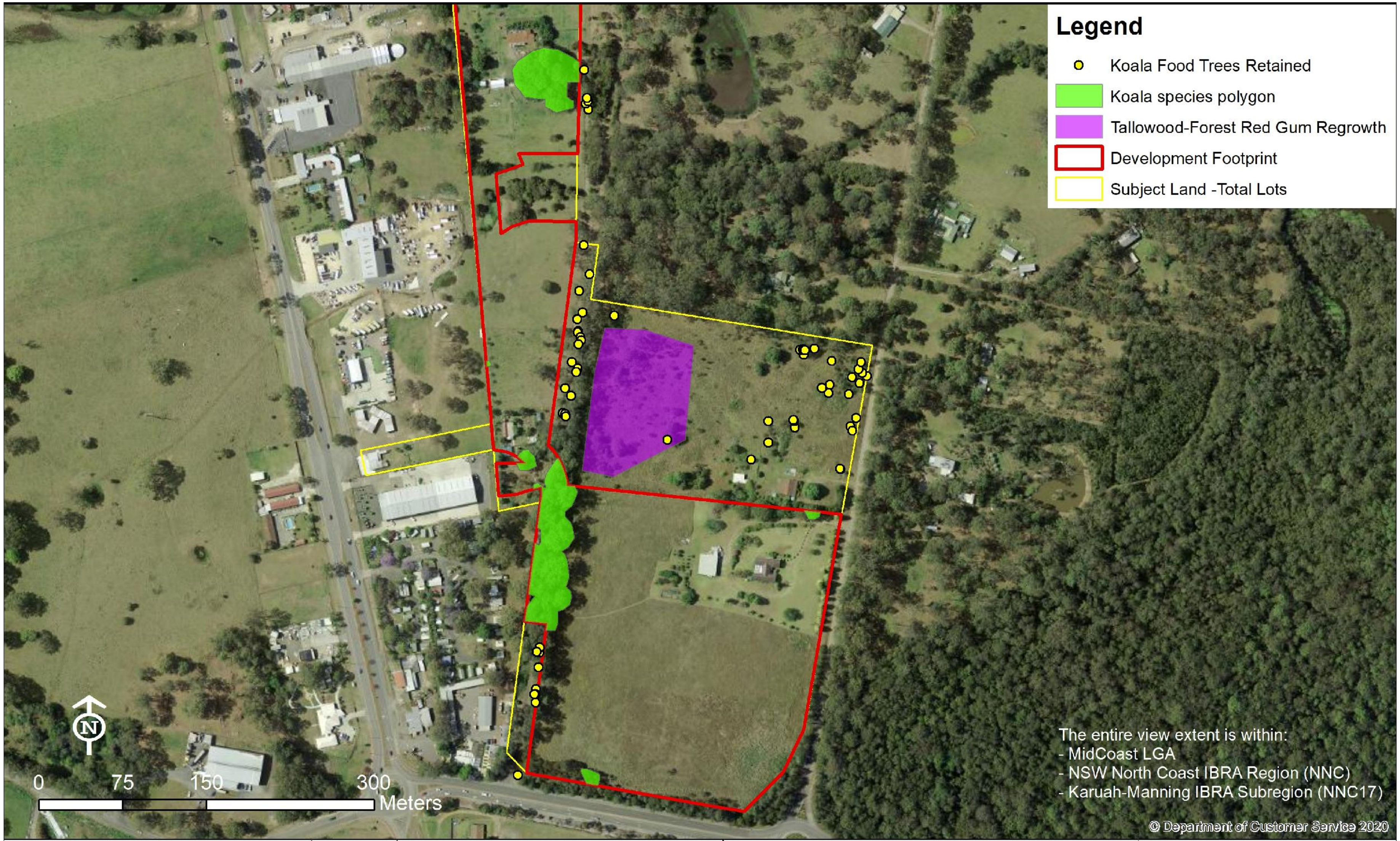
Figure 19: Koala species credit polygon and development footprint



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Drawn By: MB
Date: 5/08/2020
Map Projection: MGAz56
Map Datum: GDA94
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Figure Name: Koala Species Polygon Map

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

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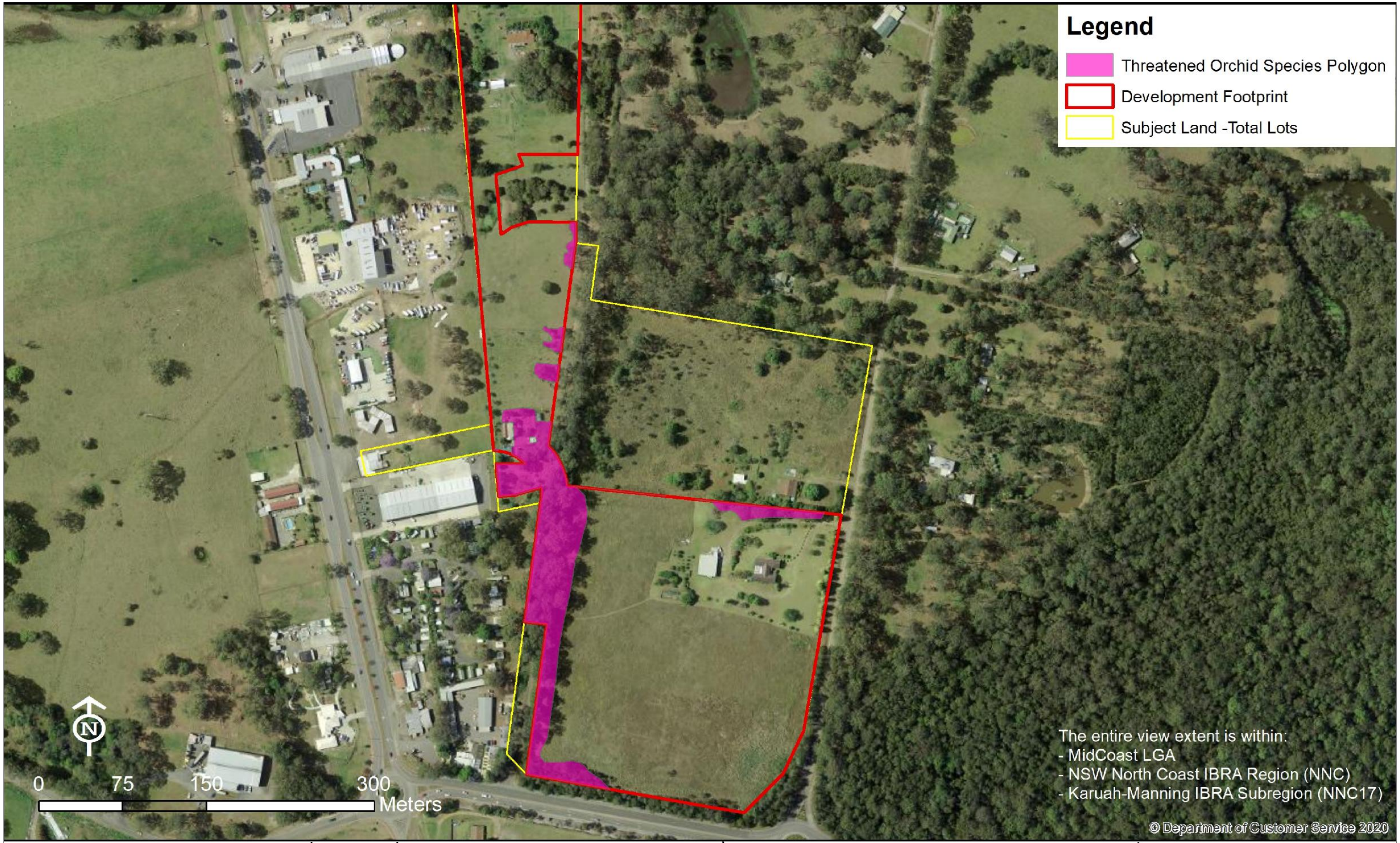
Figure 20: Threatened orchid species credit polygon and development footprint



The entire view extent is within:
- MidCoast LGA
- NSW North Coast IBRA Region (NNC)
- Karuah-Manning IBRA Subregion (NNC17)

Project Manager: JB
Drawn By: MB
Date: 5/06/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Pterostylis chaetophora , Rough Doubletail and Pale Yellow Doubletail Species Polygon Map

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

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4 EPBC ACT – MNES ASSESSMENT

4.1 General Assessment Overview

The provisions of the EPBC Act require determination of whether the proposal has, will or is likely to have a significant impact on a "*matter of national environmental significance*". These matters are listed and addressed as follows:

1. World Heritage Properties: The site/study area is not listed as a World Heritage area nor does the proposal affect any such area.

2. Ramsar Wetlands of International Significance: No Ramsar wetland occurs on or adjacent to the site, nor does the proposal affect a Ramsar Wetland.

3. EPBC Act listed Threatened Species and Communities: The Koala (Vulnerable), Grey-headed Flying Fox (Vulnerable), Swift Parrot (Critically Endangered) and White-throated Needletail (Vulnerable) are known or considered potential occurrences in the study area. These were assessed and not considered likely to be significantly impacted. *Diuris flavescens* have a remote probability of occurrence in VZ 1 and 2. If present within the development footprint, removal of any of these plants would be considered a significant impact and trigger referral.

4. Migratory Species Protected under International Agreements: No migratory species is likely to be significantly affected by the proposal, as detailed in section 4.2.3.

5. Nuclear Actions: The proposal is not a nuclear action.

6. The Commonwealth Marine Environment (CME): Listed as relevant to the site though is not within the CME nor does it affect such.

7. The Great Barrier Reef Marine Park: The proposal does not affect the Great Barrier Reef Marine Park.

8. National Heritage: The site does not contain an item of National Heritage.

9. **A water resource, in relation to coal seam gas development and large coal mining development**: The proposal is not a mining development.

The proposal thus is not considered to require referral to the Department of Environment and Energy (DotEE) for approval under the EPBC Act.

4.2 EECs

As detailed in section 2.4.3, no EECs listed under the Act occur on site.

The nearest is a patch of *Coastal Swamp Oak Forest of New South Wales and South East Queensland* downstream on Stitts Creek.

4.3 Threatened Species

4.3.1 Threatened Flora

No EPBC Act listed flora species were found on the site, however targeted survey in the flowering seasons is required to confirm absence of the following species in the disturbed potential habitat on site:

- *D. flavescens* in VZ 1 and 2.

Preliminary assessment is provided based on assumed presence.

4.3.1.1 *D. flavescens* (CE)

For the purposes of assessment, the '*population*' is defined as any plants within the locality that form an interbreeding aggregate. Any population of *D. flavescens* must be considered vital to the recovery of the species given its rarity.

a. Lead to a long-term decrease in the size of an important population (Vulnerable) or population (Critically/Endangered) of a species, or:

The proposal may result in the loss/modification of 1.24ha of forest which offers some generic potential habitat due to the vegetation type and condition, and that it occurs within the locality of known records. Targeted survey for this species is required to confirm presence/absence, but the disturbance and condition of the site habitat and lack of close proximity records suggests they are unlikely to occur.

If present, the loss of known habitat would contribute to a decrease in the size of the population, which is confined to a few records. Hence all populations are important for the long term recovery of the species and must be retained.

If absent, the distance from known habitat predicates the plants are not likely to colonise the site, hence the loss of marginal habitat would not lead to a long term decrease of the population.

b. Reduce the area of occupancy of an important population (Vulnerable) or population (Critically/Endangered), or:

If the orchid is found to be present within VZ 1 or 2, then known or potential habitat will be removed. If not, only generic potential habitat may be removed.

c. Fragment an existing important population (Vulnerable) or population (Critically/Endangered) into two or more populations, or:

D. flavescens has very limited dispersal ability. Keith *et al* (1997) provides a 'rule of thumb' for genetic discontinuity between populations of >1 km apart. The nearest records are >1km from the site, hence any population potentially on site is already likely to be isolated from the nearest known population.

d. Adversely affect habitat critical to the survival of a species, or:

"*Critical habitat*" refers to areas critical to the survival of a species or ecological community may include areas that are necessary for/to:

- Activities such as foraging, breeding, roosting or dispersal.
- Succession.

- Maintain genetic diversity and long term evolutionary development, or
- Reintroduction of populations or recovery of the species/community.

If the species was detected onsite, the known habitat would be considered critical to the survival of the species given its conservation status.

e. Disrupt the breeding cycle of an important population (Vulnerable) or population (Critically/Endangered) or:

If present, loss of known habitat would impact the breeding cycle via loss of plants. Impacts on pollination vectors is unlikely given current limitations.

f. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or:

If present, the loss, modification or isolation of known habitat would contribute to the threatening processes responsible for decline of the species.

Given the species is Critically Endangered, this would be a significant impact unless the population was determined to be non-viable in the long term regardless of whether the development proceeds or not.

g. Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable and/or Critically/Endangered species, becoming established in the Vulnerable and/or Critically/Endangered species' habitat, or:

Invasive species are currently present in the potential habitat of these plants, with no controls likely to occur unless under a VMP or similar as a mitigation measure for an approved development.

In the absence of management, invasive grasses and weeds are expected to increase (including on Lot 2 DP573214, further degrading the potential to support the orchid, if present.

If Lot 2 is rezoned, the potential habitat will be secured, but a VMP to manage existing exotic grass invasion is unlikely as the current owner has expressed no interest in developing the site. A future owner could be conditioned to implement a VMP as part of consent for development in the southeast corner which is suitable for industrial development.

Rehabilitation of the residual of Eriksson Lane could be conditioned under development consent to improve the potential habitat here.

h. Introduce disease that may cause a species to decline; or

No disease that affects either of the subject species is likely to be introduced as a direct result of the proposal as none are known to be affected by such.

i. Interferes substantially with the recovery of the species.

Ideally, the goal in threatened species recovery is to increase the number and extent of the threatened species, so that it is not in risk of becoming extinct.

At present, the subject species is not known to occur on site, subject to future survey in the flowering season or an expert report verifying it is unlikely to occur. Likelihood is low given distance from known records, isolation from known habitat, previous disturbance history and edge effects. However if present, the rarity of these species prioritises retention of known habitat. Hence removal of such would interfere substantially with their recovery.

4.3.1.2 Conclusion

Survey for these species in their flowering season is required to confirm absence and hence whether referral is required.

4.3.2 Threatened Fauna

The Koala is the only EPBC Act species confirmed to use habitat on site. The Grey-headed Flying Fox and White-throated Needletail are likely to use habitat on site seasonally as a very small part of their range. The Swift Parrot has a remote chance of opportunistically using flowering Forest Red Gum on site during its migration from breeding habitat in Tasmania.

4.3.2.1 Koala

The habitat on site has been assessed using the Koala habitat assessment tool from the EPBC Act Referral Guidelines (DotE 2014). To qualify as critical habitat, it must score 5 or more. This is shown in the following table:

Table 38: Critical Koala Habitat assessment

Attribute	Score	Reason	
Koala occurrence	2	Desktop	Recorded within <1km of the site on Bionet Atlas
		On-ground	Recorded on-site.
Vegetation structure and composition	2	Desktop	On-line vegetation mapping of site shows the site's forest is classed as high quality Koala habitat
		On-ground	Site proven to contain high quality Koala habitat
Habitat connectivity	1	Site is part of a contiguous landscape >500ha, but is located at the northern end where fragmentation limits its role	
Key existing threats	1	Desktop	OEH Bionet has records of Koala road kill in local area.
		On-ground	No evidence of Koala road kill found during survey. Site is adjacent to residential and industrial areas where dogs found.
Recovery value	1	The following factors indicate that the habitat on the property is not important for achieving the interim recovery objectives for the Koala: • Low Koala activity recorded – not breeding habitat or a key refuge. • Koala activity in the study area, but site habitat is only very small portion of habitat within metapopulation's range. • Site is not a key part of a local corridor	
Total	7	Site qualifies as critical habitat	

As per the Koala habitat assessment tool, the site qualifies as critical habitat. An assessment has been undertaken to determine if the proposal will adversely affect this habitat and/or interfere substantially with the recovery of the Koala and require referral to the Minister.

The following table derived from the Koala Referral Guidelines (DotE 2014a) assesses whether the proposal is likely to adversely affect habitat critical to the survival of the Koala.

Table 39: Critical habitat assessment

Factor	Y/N	Reason
Does impact area contain habitat critical to the survival of the Koala	Y	Site scores 7 as per the Koala habitat assessment tool.
Do the areas proposed to be cleared contain known Koala food trees	Y	Yes – approx. 0.72ha of Tallowwoods and Forest Red Gum occur in development envelope plus secondary and tertiary browse species. Some of these will be removed, but many will be retained on Lot 2 DP 573214 and within the residual of Eriksson Lane.
Are you proposing to clear<2ha of habitat containing known Koala food trees in an area with a habitat score of ≤5	N	Proposal will remove/modify approximately 0.72ha of habitat containing primary preferred Koala food trees in an area that scores 7.
Are you proposing to clear >20ha of habitat containing known Koala food trees in an area with a habitat score of ≥8	N	Proposal will remove/modify approximately 0.72ha of habitat containing primary preferred Koala food trees in an area that scores 7.
Outcome	Impact unlikely to be significant	

The Guidelines also require consideration of whether the proposed action may interfere with the recovery of the Koala, as follows:

Table 40: Impact on recovery assessment

Threat	Likely to increase Y/N	Reason
Increasing Koala fatalities in habitat critical to the survival of the Koala due to dog attacks to a level that is likely to result in multiple, ongoing mortalities.	N	Dogs currently present in adjacent rural-residential areas. Industrial estate do not normally have dogs, unless used for security in which case would be within a secured area.
Increasing Koala fatalities in habitat critical to the survival of the Koala due to vehicle-strikes to a level that is likely to result in multiple, ongoing mortalities.	N	Given current low activity levels, and what appears to be a low density population in the study area, and given existing major threats posed by Manning River Drive and the Pacific Highway, it is very unlikely that the development will lead to “multiple, ongoing mortalities” as no major body of habitat is bisected.
Facilitating the introduction or spread of disease or pathogens for example *Chlamydia* or *Phytophthora cinnamomi*, to habitat critical to the survival of the Koala, that are likely to significantly reduce the reproductive output of Koalas or reduce the carrying capacity of the habitat.	N	*Phytophthora cinnamomi* introduction can be mitigated if required via appropriate controls. Site is not a high activity area and does not appear to support a resident Koala, hence risk of inducing nutritional stress and risking Chlamydia development is low.

Threat	Likely to increase Y/N	Reason
Creating a barrier to movement to, between or within habitat critical to the survival of the Koala that is likely to result in a long-term reduction in genetic fitness or access to habitat critical to the survival of the Koala.	N	Site is located at northern, fragmented end of a very large area of habitat which contains the population to which the threshold applies. It does not form a key local or landscape link due to cleared land north and west, the Pacific Highway east, and Manning River Drive west and south, and contains insufficient habitat to support a resident Koala let along a population. The proposal will incrementally reduce the marginal connectivity west north-south, but has no impact on the current most viable north-south link where the Manning River Drive is narrowest.
Changing hydrology which degrades habitat critical to the survival of the Koala to the extent that the carrying capacity of the habitat is reduced in the long-term.	N	N. Site habitat is largely above the floodplain and not dependent on groundwater. Retention of VZ 7 appears unlikely to be practical if adjacent land surfaces are lowered and watertable changes put stress on remaining trees, hence it is assumed to be removed. Regardless, the site forms a minute fraction of the local habitat used by the important population, and is not even big enough to solely support a resident individual or a population.
Outcome	Referral **not required** as impact unlikely to be significant as: • Measures generally at least meet the low criteria for mitigation. • No resident site Koala population impacted. • No significant change to current major mortality or landscape connectivity threats.	

4.3.2.2 Grey-Headed Flying Fox (V), Swift Parrot (CE) and White-throated Needletail (V)

For the purposes of assessment, the "*important population*" of Grey-Headed Flying Foxes is defined as that population of the species likely to depend on colonial roosts in the locality or within foraging range of the site.

The White-throated Needletail breeds in Asia, spending a non-breeding migration mainly in eastern Australia with vagrants in the west. The population is thus the group of birds visiting the locality during their non-breeding seasons.

The Swift Parrot is a migratory species that only breeds in Tasmania, where its primary threat (loss of nesting habitat) is contributing to its decline, in addition to loss of non-breeding foraging habitat on the mainland (particularly box-gum woodland). The population is thus the group of birds visiting the locality during their non-breeding seasons.

a. Lead to a long-term decrease in the size of an important population (Vulnerable) or population (Endangered) of a species, or:

Grey-headed Flying Fox:

The proposal may result in the loss/modification of about 1.48ha of forest plus some scattered trees which contains nectar and fruit producing which may be used as a minute fraction the important population's seasonal range. The site and study area also does not contain a known or likely camp.

Hence, the proposal will thus not lead to a long-term decrease in the size of an important population.

White-throated Needletail:

This non-breeding aerial insectivorous migrant will not be impacted detectably by the development given the relatively minor impact on prey habitat and potential roosting habitat relative to the scale of habitat used by this international migrant.

Swift Parrot:

This species ranges from its breeding habitat in Tasmania every winter to forage over habitat in south-east Australia. Some localities receive reliable annual visits (eg. upper Hunter, box-gum woodland in Victoria and NSW), while others are recorded as opportunistic sightings of small groups of birds where local flowering patterns facilitate transient foraging during this time.

The site contains about 0.3ha of Forest Reds Gums which offer generic potential foraging habitat if this bird were to be present at the time of flowering. Competition with other honeyeaters including the larger common lorikeets and aggressive Noisy Miner may limit potential to occur, as well as lack of large stands of other suitable habitat nearby to attract the bird to the area.

Given the site is not breeding habitat; that it is not within an area visited annually; and it a very small area relative to its seasonal range: the loss of about 0.4ha is not likely to lead to a long-term decrease in the size of an important population. The remainder is to proposed to be rezoned E2 and expanded to increase the number of Forest Red Gums over about 3.5ha.

b. Reduce the area of occupancy of an important population (Vulnerable) or population (Endangered), or:

For the Grey-Headed Flying Fox, the proposal will not result in the loss of any roosting habitat, as the site is not known or suitable to be a roost site. Foraging habitat of this species is measured in terms of hundreds of thousands of hectares, hence the loss of about 1.48ha of forested habitat plus scattered trees on site is insignificant relative to the area of occupancy.

The White-throated Needletail is a non-breeding migrant, ranging extensively across Australia, and can be observed foraging over natural to highly modified habitats eg. residential areas. The loss/modification of about 14.9ha of mostly very marginal habitat including 1.48ha of good generic prey habitat and potential roosts is clearly inconsequential to this species area of occupancy.

The Swift Parrot is a non-breeding migrant that ranges from Victoria to southeast Qld during non-breeding. The loss of 0.3ha of potential foraging habitat thus has no potential to reduce the area of occupancy. Infill planting of Lot 2 (as well as VRZs) is expected to see a net increase in potential habitat for this species.

c. Fragment an existing important population (Vulnerable) or population (Endangered) into two or more populations, or:

The Grey Headed Flying Fox is highly mobile and known to be capable of crossing human-modified habitat. The proposal will offer no barrier to movement. Thus it will not fragment an existing important population.

The White-throated Needletail is a non-breeding migrant, ranging extensively across Australia and eastern Australia respectively. The proposal will offer no barrier to movement. Thus it will not fragment an existing population.

The Swift Parrot is a non-breeding migrant that ranges from Victoria to southeast Qld during non-breeding. The proposal will offer no barrier to movement. Thus it will not fragment an existing important population.

d. Adversely affect habitat critical to the survival of a species, or:

"*Critical habitat*" refers to areas critical to the survival of a species or ecological community may include areas that are necessary for/to:

- Activities such as foraging, breeding, roosting or dispersal.
- Succession.
- Maintain genetic diversity and long term evolutionary development, or
- Reintroduction of populations or recovery of the species/community.

The vegetation on the study site is not considered potential roosting habitat for the Grey-Headed Flying Fox. It contains <3ha of foraging habitat, which forms a small fraction of such habitat in the locality. Most of the habitat would be used in the later stages of breeding due to flowering in summer-autumn, with limited potential resources available in winter-spring which is the critical period (DPIE 2020b).

Thus while the site has value as foraging habitat, it is not considered critical habitat for the survival of the important population.

The White-throated Needletail is a non-breeding migrant, ranging extensively across Australia. Hence the study area is not breeding habitat which is critical to the species survival; and the loss/modification of about 14.9ha of mostly marginal non-breeding habitat and 1.48ha of potential roosting habitat is clearly not critical given the extent remaining in the study area and in the locality.

The site is not critical to the Swift Parrot as its breeding habitat, or a key non-breeding foraging area.

e. Disrupt the breeding cycle of an important population (Vulnerable) or population (Endangered or:

The proposal is unlikely to disrupt the breeding cycle of an important population/population given that:

- The site does not represent potential breeding habitat for the Grey-Headed Flying Fox, with extensive habitat more likely to support breeding in the surrounding locality which includes conservation reserves as well as State Forest;
- The Swift Parrot breeds in Tasmania.
- The extent of potential foraging habitat to be removed comprises a miniscule fraction of its local extent for these large range species.
- The subject species have large to very large ranges that far exceed the site and study area, hence they meet most of their lifecycle requirements beyond the study area.
- The potential for these species to occur within the study area will be retained post-development; and
- Alternative potential habitat in the locality is extensive.

f. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or:

As detailed previously, the site and the degree of vegetation/habitat loss is not significant enough to affect the local population of the subject species to the point it could cause a decline of the species due to their ecological requirements.

g. Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable and/or Endangered species, becoming established in the Vulnerable and/or Endangered species' habitat, or:

No new species that affects any of the subject species is likely to be introduced as a direct result of the proposed works.

h. Introduce disease that may cause a species to decline; or

No disease that affects either of the subject species is likely to be introduced as a direct result.

i. Interferes substantially with the recovery of the species.

Ideally, the goal in threatened species recovery is to increase the number and extent of the threatened species, so that it is not in risk of becoming extinct. As detailed previously, the proposal will result in the modification of a relatively minute area of potential habitat that is not significant enough to interfere with the recovery of either of the subject species.

4.3.2.3 Conclusion

The proposal will not have a significant impact on the Grey Headed Flying Fox, Swift Parrot, or White-throated Needletail.

4.3.3 Migratory Species

No EPBC Act listed migratory species was recorded on the site. However several species (eg. Rainbow Bee-eater, White-throated Needletail, Fork-tailed Swift) are considered potential occurrences using the site as a minute fraction of their range.

a. Substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or;

First, the site is not considered likely to constitute an *important area of habitat* on the basis of the following:

- A number of species are considered potential occurrences, mostly as vagrants or seasonal foragers utilising the general area of part of their large seasonally nomadic range. The value of this habitat is as a fraction of a significant extent of similar habitat not only in the LGA, but the North Coast Bioregion. The study area and site are not known breeding habitat for any of these species. The study area is not considered capable of supporting an ecologically significant proportion of any of these species (for some at most only a small group or transient individuals).
- While some migratory species occurring in the locality may be at the limits of their range, no such species were recorded in the study area. Additionally, similar habitat is known to occur both north and south of the locality.
- If the site were located at the limits of a species whose abundance and range is declining, it would not be considered significant as such habitat is locally abundant in the

area, and habitat with greater capability occurs within 10km eg Conservation Areas, Nature Reserves, State Forests, etc.

In regards to point (**a**): The proposal does not affect important habitat, and while the proposal will most likely see a small reduction in the potential habitat for migratory species on the site, the area and locality contains an abundance of alternative habitat which is available to those species.

b. Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species, or;

In regards to point (**b**): An invasive species is one that may become established in the habitat, and harm the migratory species by direct competition, modification of habitat, or predation.

Foxes and cats currently on site and will occur post-development. Their abundance is not expected to change as a result of the proposal.

No other invasive species is likely to be introduced by the proposal that is capable of being harmful to the subject species.

c. Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

In regards to point (**c**): No disruption on the lifecycle of any migratory bird is likely as:

- Potential habitat to be affected is either only marginally suitable, and/or locally abundant.
- No nesting/breeding habitat is affected.
- Key habitat areas are not impacted.

In view of the above, no migratory bird is considered likely to be significantly affected by the proposal.

5 KOALA HABITAT PROTECTION SEPP 2019 – KOALA ASSESSMENT REPORT

State Environmental Planning Policy (*Koala Habitat Protection*) 2019 replaced SEPP 44 – *Koala Habitat Protection* from March 1 2020.

The draft Koala *Habitat Protection Guideline* (DPIE 2020) outlines the following assessment process for Development Applications that impact Koala habitat where no approved Koala Plan of Management (KPoM) is in place.

5.1 Application of the SEPP

5.1.1 SEPP Mapping

The Koala Development Application Map (KDAM) maps all tree cover on the site as highly suitable Koala habitat (see **Figure 21**). At the site scale, only VZ 1, 2 and 7 actually contain Koala food trees; and paddock trees north of the second drainage line on Lot 2 DP DP827097 are non-browse or exotic species.

Figure 21: Koala Development Application Map

5.1.2 Assessment Tier

The following table determines if the proposal must be assessed under Tier 1 or 2:

Table 41: KHP SEPP Tier determination

Factor	Y/N	Reason
Indirect impacts that will not result in clearing of native vegetation within Koala habitat	Indeterminable	Regenerating forest on Lot 2 DP573214 preferred to be retained via E2 zoning to protect this area, but if remains RU1, could be cleared under LLS Act. Tree retention in residual of Erickson's Lane could be secured if converted to public reserve. Some tree loss may also occur if TPZs cannot be accommodated.
The development is below the Biodiversity Offsets Scheme threshold under the BC Act	N	Development requires a BDAR due to exceeding area threshold.
There is no native vegetation removal	N	Current proposal also will see loss of a third of remnant forest in Eriksson Lane, and a 0.24ha patch on Lot 2 DP DP827097 in VZ 7. Other areas proposed to be totally removed have VI<20. Partial removal of two wetland/swamp forest PCTs for road.
The development footprint will not impede movement between Koala habitat	Partially met	Proposal will see a third of existing habitat along Eriksson Lane eventually removed. Retaining the regrowth forest on Lot 2 DP573214, will retain linkage to other habitat east where a resident Koala may occur. Linkage west is very tenuous and constrained by the existing industrial area including security fencing and then Manning River Drive and about 400m of pasture; and trees in the existing urban woodland here are not protected (undeveloped industrial land). The development will largely remove the more marginal potential western links, retaining linkage in the southwest via habitat linked to the southern end of Eriksson Lane to Lot 102 and 9. Linkage south is limited by Manning River Drive which is subject to high traffic volumes, peaking diurnally however with less constraint late at night. Connectivity via an existing forested road reserve (Lot 17) adjoining Lot 50 in the south retains this linkage from Eriksson Lane to the larger body of habitat east on Lot 1 which may support a resident Koala/Koala aggregate.
Adequate mitigation measures are implemented as necessary	Partially met	Controls on dogs, vehicles, pools, bushfire, disease and disturbance can be implemented as relevant.
Outcome	Proposal will exceed no or low direct impact on Koalas or their habitat: Tier 2 assessment required.	

5.2 Koala habitat values

Principle 1: Understand Koala habitat values

5.2.1 Criteria 1

The site is established as Core Koala Habitat if it occurs on the Koala Development Application Map (KDAM) or by undertaking a site area survey undertaken in accordance with the methods outlined in Appendix C of this Guideline.

The site is mapped on the KDAM, and hence meets the criteria.

A standard Koala survey was employed to test the KDAM as per Part A and Part B of Appendix C.

5.2.2 Part A

5.2.2.1 Methodology

A comprehensive Koala survey was undertaken using the following methods:

- Scat searches under all Tallowwoods and Forest Red Gum, with application of the SAT in two locations where the statistical assumptions of the method could be met.
- 8 hours over 2 nights of spotlighting spread over the late breeding season.
- 8 sessions over 4 nights of call playback and active listening (just after peak breeding season).
- 19 hours of dedicated diurnal searches for Koalas plus survey during other survey activities.

5.2.2.2 Results

No Koalas were observed during any diurnal or spotlighting survey and no response was made to call playback.

Despite the site being some of the limited unburnt habitat in the locality, no Koala scats were found by this survey, hence the SAT score was 0. However Koala scats were found under 3 trees in an earlier survey (JBE 2018).

5.2.2.3 Conclusion

Under Part A, detection of Koala scats is sufficient to qualify the site as Core Koala Habitat.

Assessment under Part B is thus not required, however VZs 1, 2 and 7 would readily qualify as high quality Koala habitat; and there are historical and recent records of Koalas within 2.5km. A nearby resident advised seeing a Koala crossing Manning River Drive south of the site in February 2020.

Figure 22 maps the Core Koala Habitat on site, determined by location of scats found by JBE (2018) and the SEPP criteria.

5.2.3 Criteria 2

Further analysis is undertaken in order to understand the broader values of the core Koala habitat, including information about the Koala population using the habitat and any specific ecological functions the habitat might serve.

5.2.3.1 Local records and generational persistence

Figure 23 shows Koala records within the wider locality, with the 2.5km radius around the site shown for landscape context. Koala records occur in habitat south, east, southeast, southwest, and west, with some scattered single records northeast.

Most of these fall within remnant forest ranging from several hectares to falling within State Forest. Some of these records have low accuracy (10km from community survey), but date back >30 years, indicating generational persistence of a Koala population.

5.2.3.2 Landscape and local connectivity

In the landscape context, the site lies at the northern extremity of habitat which has at least tenuous connectivity to the key Koala metapopulation reservoir to the south which comprises conservation reserves and State Forests (most of which was catastrophically burnt out in the 2019-2020 fire event). This metapopulation is separated from Koala records in Taree by the Manning River, and hence would be a separate genome.

Landscape movements of genetic material (and thus Koalas) would appear to primarily be east-west and southwest given the pattern of the major landscape remnant comprising Kiwarrak State, Talawahl Nature Reserve Forest to Khappinghat Nature Reserve, and the cleared floodplains of the Manning.

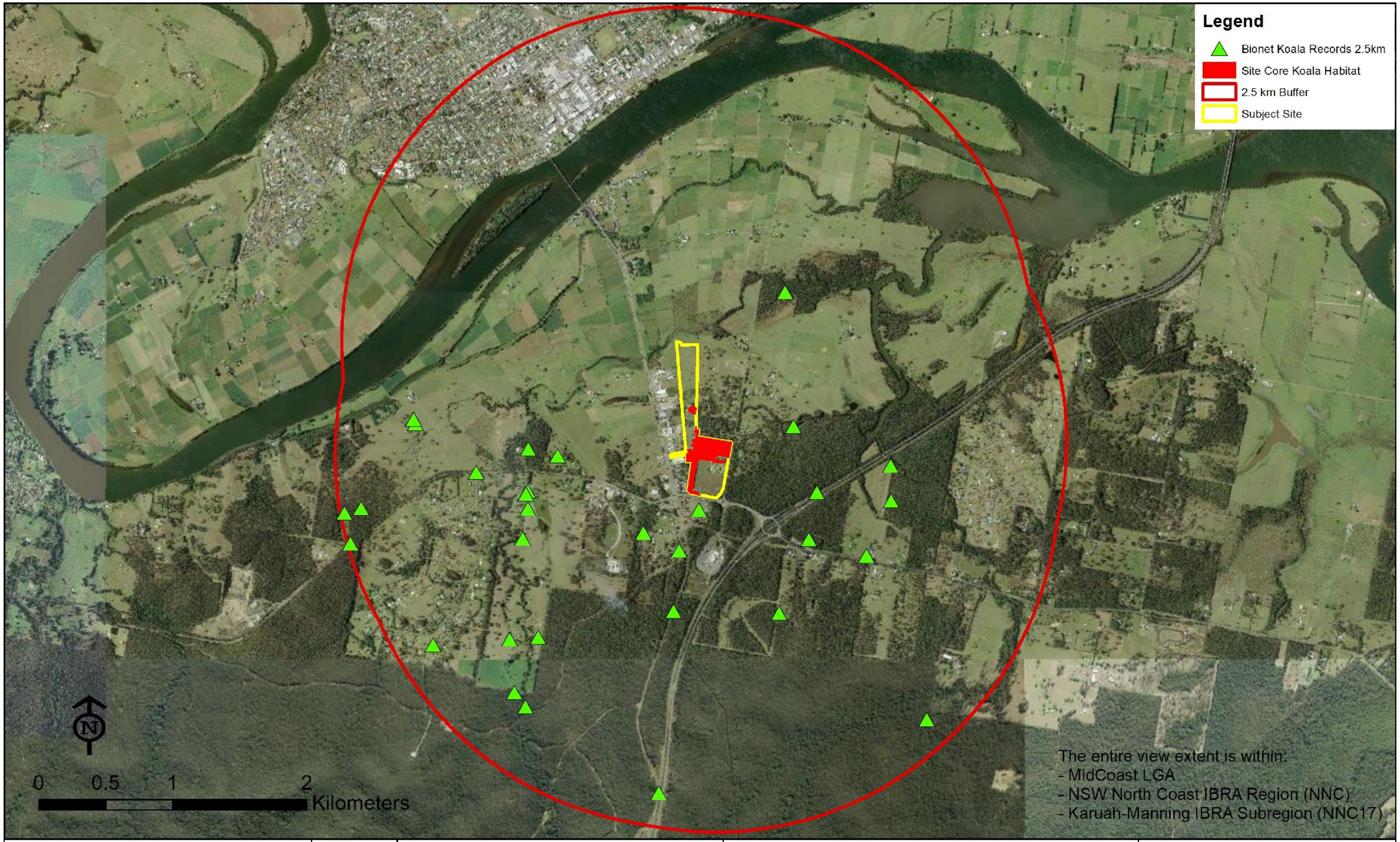
The site is not a key local corridor or link at a local or landscape scale, as evident in Figure 14 which shows it does not provide a key link north due to historical clearing for pasture (for dairy farms), or west due to the existing industrial area and Manning River Drive and then cleared pastures posing an effective physical barrier.

A recent report of Koalas crossing Manning River Drive west of the site suggests Koalas moving west could either skirt around the southern side of the existing industrial area using trees in the adjacent manufactured housing estate and landscape supplies (most of which are Tallowwood); or move from VZ 7 west to another small clump containing food trees on Lot 35, and then cross vacant industrial lots, Manning River Drive and pasture to reach habitat along the Buckett’s Way within 400m west. Both options however are very high risk due to predator and dog attack exposure, and vehicle strike risk.

5.2.3.3 Koala ecology role in local and landscape context

At the local scale, the site adjoins a remnant of around 60ha of mixed forest types (most of which contains KFTs listed in the SEPP) to the east on Lot 1, which may have sufficient capability to support at least 1 Koala in a home range. This habitat and the site is however constrained by the major physical barrier and mortality threat of the Pacific Highway in the east; and Manning River Drive to the south and west. Vehicle strikes are recorded on the database, but lack of exclusion fencing does not prevent Koalas crossing these barriers, with a local resident report a sighting south of the site preceding the survey. MCC (Tanya Cross, Matt Bell, pers. comm.) also advised of recent sightings of Koalas crossing Manning River Drive to the west towards known habitat in Taree South.

Figure 22: Site Core Koala Habitat and Koala records within 2.5km



This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB
Drawn By: MB
Date: 15/03/2020
Map Projection: MGAz56
Map Datum: GDA94
Page: 1 of 1

Figure Name: Site Koala Habitat & Koala Records within 2.5km

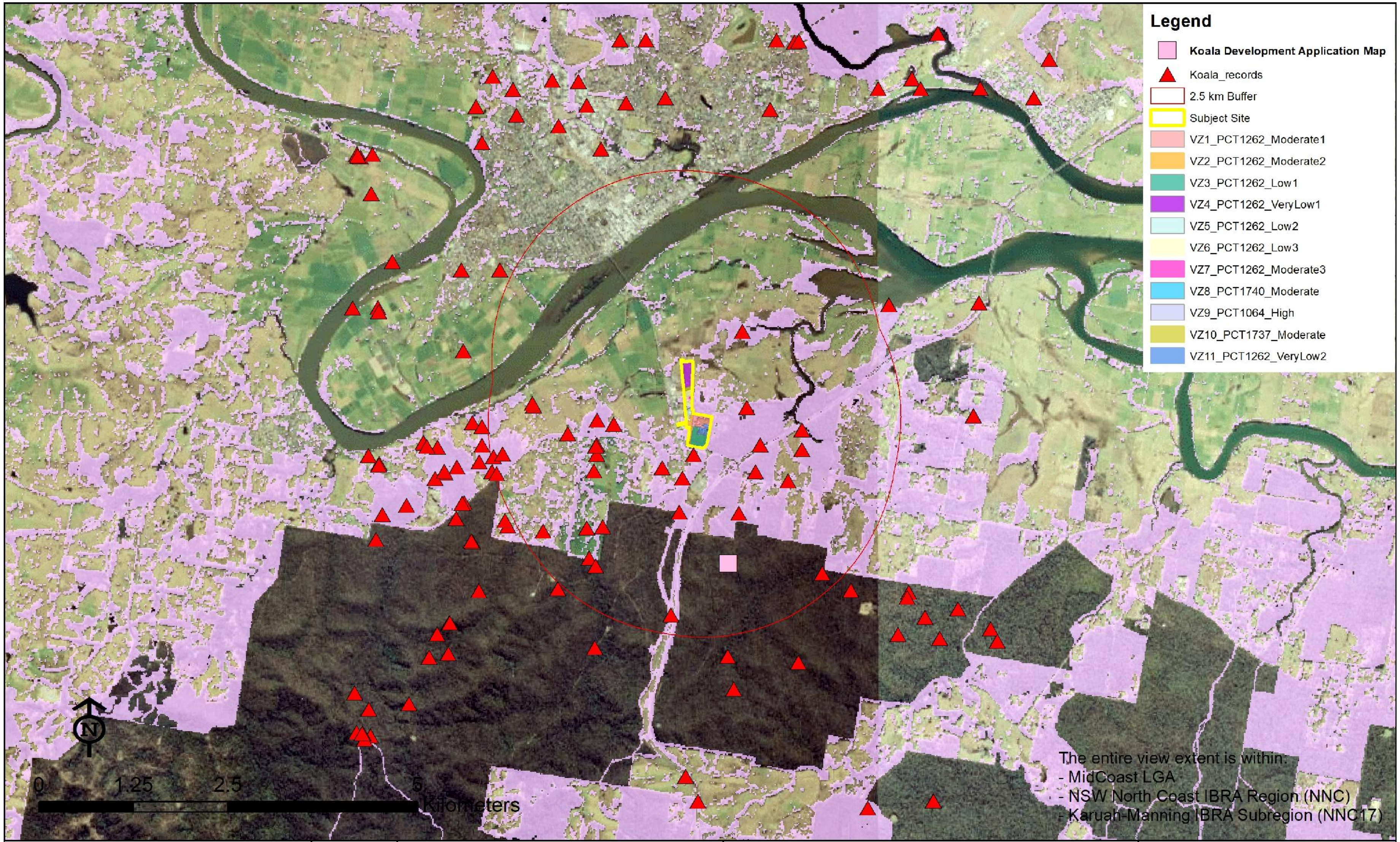
Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

Scale: 1: 35 000
Job Number: J2019-35
Revision: A

Figure 23: Site and other Koala Habitat and Koala records within 2.5km and 10km radius



The entire view extent is within:
- MidCoast LGA
- NSW North Coast IBRA Region (NNC)
- Karuah-Manning IBRA Subregion (NNC17)

This mapping should be considered indicative only and all derivations (eg of areas of EECs and vegetation communities) are at best approximations and subject to errors including individual interpretation and reliance on information provided to JB Enviro which may not have been independently verified. All information is intended to be indicative only and no reliance for extrapolation, mapping, etc should be placed upon this map without independent validation of the information by the user. JB Enviro takes no responsibility for any subsequent errors, losses, etc that may arise from use of this data without independent verification.

Project Manager: JB

Drawn By: MB

Date: 15/03/2020

Map Projection: MGAz56

Map Datum: GDA94

Page: 1 of 1

Figure Name: Site and other Koala Habitat & Koala records within 10km

Site: Lot50_DP863972, Lot2_DP573214a, Lot20_DP836884 Lot2_DP827097, Lot16_DP836884 Eriksson Lane, Glenthorne

Client: Glenthorne Industries

JBEnviro

Scale: 1: 62 000

Job Number: J2019-35

Revision: A

At the site scale, the site habitat is predominantly comprised of the strip of remnant mature forest retained in the Erikson Lane road reserve; regrowth on Lot 2 DP573214; the patch of Tallowwood and Forest Red Gum on Lot 2 DP827097; and some scattered trees in the southern end of Lot 2 DP827097. Tallowwood and Forest Red Gum (primary preferred species) on site are shown in Figure 16. Other species listed in Appendix A of the Guidelines on site are: Forest Oak, Pink Bloodwood, White Mahogany, Thick-leaved Mahogany, Blackbutt, Sydney Blue Gum, and Grey Ironbark.

At present, the site and a small part of the habitat east is some of the only unburnt vegetation within the range of the Kiwarrak-Khappinghat metapopulation. It was expected to be acting as a refuge, however no Koalas were observed on site despite the current extraordinary situation. This may reflect its lack of value for other site limitations, or the local aggregate may have been catastrophically impacted by the fire event and reduced to very low numbers, and hence not encountered by the survey.

5.3 Measures to avoid impacts to Koalas

Principle 2: Avoid intensifying land use in Koala habitat areas through appropriate landscape planning and site selection.

Principle 3: Encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas.

5.3.1 Criteria 3

Site selection takes into account Koala habitat values.

Refer to Figure 19.

The current Planning Proposal and DA concept will see retention of over 4.4ha of VZs containing or having the ability to regenerate Koala habitat as follows:

- VZ 1 on Lot 2 DP573214 is comprised of regenerating Tallowwood and Forest Red Gum.
- The southern and northern end of Erikson's Lane will be retained which includes many of the site's Forest Red Gum and Tallowwood plus other browse species eg. Sydney Blue Gum and Thick-leaved Mahogany.
- A few trees in the southern end of Lot 2 DP827097 fall within a proposed drainage reserve should be selectively retained.

The current concept will remove approximately 0.72ha of primary preferred KFTs as follows:

- A handful of Tallowwoods and other species in Eriksson lane for the access road from Lot 50 to Lot 2 DP827097.
- VZ 7 on Lot 2 DP827097 which is almost entirely Tallowwood and Forest Red Gum.
- Scattered trees in the southern end of Lot 2 DP827097, and possibly one on the northeast boundary and mid-western boundary of Lot 50 will also be removed.

If Glenthorne Rd is widened in the future, a number of Tallowwoods and Forest Red Gum plus other browse species along the road reserve here will also be removed.

5.3.2 Criteria 4, 5 and 6

Development avoids the direct loss of Koala habitat within the site area and avoids fragmentation.

Koala habitat is excluded from the development footprint.

Development avoids direct impacts to Koala habitat within the site area

Eriksson Lane is an existing road reserve owned by the NSW Roads and Maritime Services (Stuart Murray, Site R&D, pers. comm.) and hence the proponent has an expectation of using this road reserve in part for the primary access, as Glenthorne Rd provides direct left and right turn access for the majority of traffic; is the practical access for B-doubles from the Pacific Highway; and linkage is needed between the two stages of the proposed industrial estate to Glenthorne Rd for B-doubles.

Access to services and turning angles for B-doubles also limited the ability to minimise loss of trees within Eriksson Lane. However the re-aligned route impacts some of the most disturbed area of the reserve currently used as an access, and only a handful of KFTs need to be removed.

In addition to the KFTs lost in the crossing of Eriksson Lane, VZ 7 is dominated by KFTs and a few scattered KFTs fall with the desired industrial footprint eg. on western side of Lot 50 and Lot 2 DP827097.

The rezoning proposal recommends retaining the habitat on Lot 2 DP573214 which is generally young regrowth 5-15 years old, and contains a cluster of Tallowwood and Forest Red Gum regrowth that may develop into a stand identical to VZ 7. Lot 2 is directly opposite the approximately 60ha remnant to the east mostly on Lot 1, separated only by Glenthorne Rd which is currently gravel. This habitat is currently interconnected, separated only by Glenthorne Rd.

Habitat on Lot 55 DP863972 and Lot 17 DP836884 will remain, retaining a currently tenuous link from the forest east of the site to the southern end of the Eriksson Lane road reserve which will contains food trees, and the urban woodland on Lot 102 DP1118846 and Lot 9 DP836884 which contain food trees including Tallowwood. Access to these trees west from Eriksson Lane is limited by a sheet metal fence, but some trees currently stand in close proximity allowing inter-canopy crossing.

A band of trees will remain in the southern drainage reserve on Lot 2 DP827097, but this will be a small island bound by the main access road north and east, and existing development south and west. Koalas could access this via crossing Manning River Drive to the south, and move north via urban woodland on adjoining lots to the west and cross the road at its narrowest point diagonally opposite Lot 2 DP573214.

5.3.3 Criteria 7

Where some loss of habitat cannot be avoided (and providing it is consistent with all other criteria set out here), development is designed in a way that retains higher value areas across the site and avoids fragmentation of habitat within the site area and more broadly within the region.

As noted above, about a third of the forest within Eriksson Lane will be removed plus VZ 7, and 3 scattered trees in the paddocks.

All habitat with Lot 2 DP573214 will be retained and allowed to continue regeneration, subject to the landowner’s management regime and zoning. This would centralize habitat in a protected area long term, in a position where it has very good connectivity to remaining habitat north and east.

The other habitat retained is most of the current mature food trees on site in the southern and northern end of the Eriksson Lane road reserve.

The required VRZs in the two drainage reserves in VZ 9 and 10 can also be planted out with KFTs to establish forested buffer zones (see section 3.4). Both of these areas will have direct connection east with adjoining habitat on private land subject to development/clearing controls, and their interfaces with the industrial zone can be fenced to exclude dogs.

5.3.4 Criteria 8

Development is undertaken in a way that maintains the potential function of the Koala habitat.

As detailed in section 5.2, the site habitat is not a key corridor at the regional or landscape scale, and does not provide a key interlink role as the local corridor scale. It lies at the northern and increasingly fragmented fringe of a large area of habitat to the south, with major barriers posed by the Pacific Highway and Manning River Way.

Evidence collected by a comprehensive survey suggests it is not an area of major activity, with visitation being infrequent, and does not support breeding animals. Its role thus appears likely to be support habitat for sub-dominant and/or transient individuals moving across occupied home ranges.

The loss of 1.48ha (including 0.72ha of primary preferred KFTs) of ‘highly suitable Koala habitat’ while incrementally contributing to the primary threatening process to the species (DECC 2008), is not likely to have short term impacts on the local Koala aggregate capable of placing a local population at risk of extinction.

Options for connectivity north-south will be reduced, but the narrowest gap between habitat is currently between the roundabout and the Pacific Highway, and this gap is not to be widened. Eriksson Lane currently lies opposite developed land with few trees to the south in Purfleet, hence has less value in the larger landscape context.

Eriksson Lane could still be used by Koalas moving north from source habitat to the south, as they can still enter the southern end of Eriksson Lane which is to be closed to traffic, however they will then need to cross the main access road to access retained habitat on Lot 2 DP573214 and northern end of Eriksson Lane. This would pose a risk of vehicle strike, but the proposed road design here will limit speed and lighting, passive traffic speed control measures, artificial lighting, and strategic plantings could mitigate this threat.

The retention and protection of the majority of Lot 2 DP573214 via rezoning as E2 with its regeneration potential plus the residual of Eriksson Lane and infill planting of the drainage reserves in VZ 9 and 10 would no net loss of habitat, and these areas would be readily accessible by the Koala from the east. This could maintain the current carrying capacity of the site and adjoining habitat east which essentially constitutes all of the habitat north and west of Manning River Drive accessible from source habitat to the south.

5.4 Analysis of potential impacts

Principle 4: Implement best practice measures for the management of identified risks to koalas.

5.4.1 Criteria 9

All relevant indirect impacts to Koalas and Koala habitat associated with the development are identified.

Indirect impacts on the Koala are assessed in the following table:

Table 42: Evaluation of indirect impacts on the Koala

Indirect Impact	Relevant?	Significance
Dog attack	Y – in part	This major mortality threat is a very low risk as the proposal is for non-residential use of the land. There is a small chance that a commercial business may employ dogs for security, in which case they will be confined to the subject lot and not allowed to roam Koala habitat. Security fencing around the perimeter of the industrial estate and lack of food trees within the subdivision as landscaping would reduce the risk of this impact to negligible via excluding Koalas from dogs.
Vehicle strike	Y	This major mortality threat (DECC 2008) currently has very high risk along Manning River Drive to the south of the site (mitigated slightly by the roundabout reducing maximum speed) and the Pacific Highway. The proposal will incrementally increase the current risk by: • Incrementally and cumulative increase in traffic volume on Manning River Drive via increasing local traffic and off the highway. This road has periodically very high current traffic levels and appears to be at least zoned 60km/hr. • Seeing increased traffic volume on the first 250m of Glenthorne Rd due to upgrading to a sealed road and increased traffic volume. Strike risk should be low given only a short section is subject to upgrade and increased volume, and traffic needs to give way at each end, but appropriate measures will need to be implemented eg. signage. • Creating the new road across Lot 50, utilising the central part of Eriksson Lane and exiting west to Manning River Drive. This will pose a new strike threat to any Koalas moving along the remainder of Eriksson Lane or attempting to access or move through the limited habitat in Lot 2 DP827097 and the adjacent manufactured housing estate. As noted above, this can be mitigated. • Creating a new road along the western side of Lot 2 DP827097, which will limit access to a few food trees at the rear of the industrial estate. Current security fencing is a barrier to these trees. This threat could be mitigated in some areas by strategic Koala fencing to funnel movement away from crossing the first 250m of Glenthorne Lane (but will pose a barrier to use of Lot 17 and 55); and utilising measures mentioned above in Eriksson Lane.
Drowning in pools	N	As the land will be used for industrial not residential purposes, outdoor pools are not expected to be constructed, negating this risk.

Indirect Impact	Relevant?	Significance
Increased risk of fire	Y	This is an existing risk that will remain post-development on Lot 2 DP573214, as allowing on-going regeneration will increase the bushfire risk (and its perception) by future landowners. This area will need to be managed in perpetuity to mitigate fuel load and risk of increased fire. Potential planting out of the two main drainage reserves centre on existing drainage lines will have similar management issues. Lot 1 to the east may be perceived by businesses with vulnerable assets as a threat. Arson is unlikely given very high visibility. The RFS may be lobbied to issue a control order to the owner of Lot 1 to undertake fuel reduction This Lot is zoned rural and hence can be logged under the LLS Act which may have varying influences on fire eg. temporary reduce risk but increase medium and long term risk.
Damage to retained trees	Y	Trees retained in the southern end of Eriksson Lane may have root zones which extend into Lot 50, which could be impacted by earthmoving. These will need to be assessed as per AS 4970-2009 *Protection of trees on development sites*.
Introduction or spread of disease – food trees	Y	Phytophora is a key threat to Eucalyptus, and could be introduced by contaminated fill, plant/machinery, landscaping plantings, and contaminated footwear. The risk is highest during construction due to the amount of earthmoving and plant used (which could be sourced from contaminated sites). Incorporating standard hygiene for plant, and certifying and using VENM standard fill is the best practice to mitigate this risk.
Introduction or spread of disease – Koala pathogens	Y	Chlamydia is the key disease in Koalas, with a few others also prevalent. As no Koalas were observed, an indication of current disease status cannot be determined but the disease is generally prevalent across coastal Koala populations (DECC 2008). Loss of habitat inducing behavioural and physiological stress can increase risk of disease occurring. As the site does not appear to be an area of major activity and hence does not contain home range trees, it appears unlikely that any local Koala will be subject to such stress. Hence disease incidence is not expected to increase.
Anthropogenic impacts eg. light spillage, direct human contact, noise.	Y	Conversion of the central part of Eriksson Lane to a primary access for a 24hr industrial estate which may include a service station development will increase noise, light and human presence impacts on the site's remaining habitat and adjacent habitat. Traffic, noise and lighting will significantly increase on the section of Glenthorne Rd fronting the site. Due to the Pacific Highway, Manning River Drive, the adjacent highway service centre and industrial estate, such impacts have already largely manifested and hence fauna would be expected to have adapted to an extent. The Koala has a demonstrated adaptability where it has occupied peri urban and residential areas over time, and is recorded using habitat fringing industrial estate in Port Macquarie and Taree (eg. Naturecall 2015, Wilkes and Snowden 1998, DPIE 2020). Given the above, and that the site does not appear to be permanently occupied, these impacts are not expected to impact current Koala usage of the site or study area.

Indirect Impact	Relevant?	Significance
Behavioural and physical barriers to movement.	Y	Fences can prevent access to food trees, and major new roads or complete changes to habitat arrangements in the landscape can have behavioural impacts on Koalas eg. predator risk perception. The main change is the loss of the middle part of the habitat in Eriksson Lane which offers a north-south link if a Koala were to cross from Purfleet or from the west (a low likelihood given gap width between contiguous habitat, and roading). It may be warranted to fence the western side of the northern boundary of Eriksson Lane to exclude Koalas from wandering into the industrial area on Lot 2 DP827097, however this would negate Koala access to the few trees southeast in the residual of Lot 2 and in the adjoining industrial area. The alternative is to implement measures to reduce vehicle strike risk at the crossing point. Fencing around the industrial estate is expected around many lots for security. This will not enclose any habitat.
Risk of injury during clearing	Y	Koalas may potentially be present on-site during clearing or enter the site during such work. This poses the risk of Koala mortality or injury. A spotter will need to undertake pre-clearing surveys and monitor clearing.

5.5 Plan to Manage and Protect Koalas and Their Habitat

Principle 5: Use compensatory measures only where they can be shown to better promote the aim of the SEPP.

Principle 6: Use adaptive management strategies to monitor, evaluate and deliver appropriate planning outcomes for Koalas.

5.5.1 Criteria 10

The following table lists management measures to manage indirect impacts which are to be employed in the final concept and future DAs as relevant:

Table 43: Measures to manage indirect impacts

Indirect Impact	Construction or Operation Phase	Significance
Dog attack	Both	Construction: • Dogs not to be allowed on site during construction. Operation: • Dogs to be restricted to fenced enclosures. Fences which enclose dogs and industrial lots to be of a design that excludes Koalas.

Indirect Impact	Construction or Operation Phase	Significance
Vehicle strike	Operation	• Glenthorne Rd to be zoned 50km/hr with traffic calming measures as required. • Final design to consider fencing off west side of retained habitat in northern Eriksson Lane to prevent Koalas moving across the estate. • Appropriate lighting and traffic calming devices at point where Koala may cross Road 3 where it bisects Eriksson Lane. • Koala warning signs where any road crosses Koala habitat. • Koala exclusion zone on north, south and western side of two drainage line drainage reserves.
Drowning in pools	N/A	No outdoor pools expected to be constructed.
Increased risk of fire	Operation	• Drainage reserves to have a bushfire management plan to manage fuel loads. Survey for Koalas on site before ignition. • Plan to include emergency contacts for RFS, Koala carers and vets. • Asset Protection Zones established where required within the industrial estate outside of Core Koala Habitat. • In event of uncontrolled fire, burnt area to be inspected for Koalas when safe to detect any injured Koalas in need of care.
Damage to retained trees	Construction	• Trees in Eriksson Lane to be retained will be subject to physical protection of root zones as per AS 4970-2009 *Protection of trees on development sites*.
Introduction or spread of disease – food trees	Construction	• Standard hygiene for earthmoving plant eg. washdown at previous site before transport, with written certification recorded in Construction and Environmental Management Plan. • VENM standard fill certified as sourced from site free of Phytophora.
Introduction or spread of disease – Koala pathogens	Construction	• Construction and Environmental Management Plan (CEMP) to include induction on reporting Koalas with signs of wet bottom or behaving oddly eg. sitting at base of tree, weeping eyes, etc.
Anthropogenic impacts eg. light spillage, direct human contact, noise.	Operation	• Artificial lighting design to best practice environmental light pollution standards.
Behavioural and physical barriers to movement.	Both	• No fencing to enclose Koala habitat at any time.

Indirect Impact	Construction or Operation Phase	Significance
Risk of injury during clearing	Construction	• Koala spotter (ecologist) to be undertake pre-clearing survey each day of clearing. Adjacent habitat to be inspected where accessible for nearby Koalas. • If a Koala is detected, a minimum buffer of 50m is recommended to minimise any stress. The Koala is to be monitored while works continue outside this buffer as the animal may move to the ground and attempt to relocate. • Any injured Koala to be subject to emergency vet treatment with post-treatment care by a qualified carer. • Any Koalas showing signs of sickness to be reported for capture and treatment by a certified Koala treatment organisation eg, the Koala Hospital. • Any rehabilitated Koala to be released in the nearest suitable habitat to capture location.

5.5.2 Criteria 11 and 12

Compensatory measures are only used once it has been demonstrated that options to avoid, minimise and manage impacts to koala habitat have been exhausted.

Where there is any direct loss of habitat or compromise in the potential function of a koala habitat area (and providing it is consistent with all other criteria outlined here), suitable compensatory measures are provided.

Assuming loss of Core Koala Habitat within VZ 7, central part of Eriksson Lane and scattered trees, offset habitat will be required.

Lot 2 DP573214 is ideal for infill planting to offset loss of primary preferred Koala food trees given it contains regenerating trees dominated by these species and needs limited weed management, and has very good connectivity to other habitat to the west. It and the adjoining private land also provide a linkage to the two drainage line reserves, which can also be infilled with forest vegetation which both contains KFTs, but will act as filtration buffers to the EECs they contain. However, the owner of Lot 2 has expressed no intention to develop the land and it is not part of the DA. Hence other than rezoning the majority of the Lot to E2 to allow passive regeneration and requiring a future landowner proposed to develop the southeast to implement a VMP to manage weeds in theE2 zone, no infill planting is likely to be permitted here.

If use of Lot 2 as an offset site is not an option, and infill planting of the drainage reserves and rehabilitation of the residual of Eriksson Lane is not deemed sufficient by the consent authority, the offset should be met via:

- Securing Koala Species Credits from an offset site secured under the BC Act that lies within a 2.5km radius of the site. The nominal radius correlates with that used by the SEPP to identify a local Koala population; or.
- Securing an existing cleared site within a 2.5km radius that meets the following criteria, and revegetating a minimum of 2x the area cleared on site with a fully structured native vegetation community dominated by KFTs, replacing KFTs at a minimum ratio of 1:1 and planting at no greater density than 1 tree/25m^2:
  - Is connected to other potential Koala habitat on at least 3 sides
  - Infills a gap within a larger area of intact potential or Core Koala Habitat.

  - Joins isolated fragments of Koala habitat with a local or regional corridor.
  - Is secured in perpetuity under an effective planning mechanism (not a S88b instrument).

5.5.3 Criteria 13

Development Application includes a monitoring, adaptive management and reporting component against the key outcomes.

The DA consent for the industrial subdivision is recommended to require the proponent to:

- Quantify exact extent of KFTs and habitat to be removed.
- Qualify how habitat loss will be offset eg. plantings on Lot 2 or in the drainage reserves, or offsite offsets.
- Incorporate the identified measures into development design and construction phase to address indirect impacts.
- Provide relevant plans for any offset that relies on plantings (eg. VMP) which includes monitoring, adaptive management, reporting and contingency mechanisms.

REFERENCES

Australasian Bat Society (2020. Australian Bat Society website. www.abs.org.au

Callaghan, J., Curran, T., Thompson, J, and Floyd, R. (2003). Draft *Greater Taree Comprehensive Koala Plan of Management.* Unpublished report prepared for GTCC. Australian Koala Foundation, Brisbane.

Dept. of Planning, Infrastructure and Environmental (2020a). Guideline for applying the Biodiversity Assessment Method at severely burnt sites: Biodiversity Development Assessment Report/Biodiversity Certification Assessment Report. DPIE, Sydney.

DPIE (2020b). Bionet /Atlas of Wildlife (http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx)

DPIE (2020c). Threatened Biodiversity Data Collection. www.threatenedspecies.environment.nsw.gov.au

DPIE (2020d). Pale Yellow Doubletail (*Diuris flavescens*) SOS strategy. https://www.environment.nsw.gov.au/savingourspeciesapp/ViewFile.aspx?ReportProjectID=81&ReportProfileID=10238

DPIE (2019). Biodiversity Assessment Method Operation Method – Stage 2. DPIE, Sydney.

DotEE (2020a). Matters of National Environmental Significance Search Tool. http://www.environment.gov.au/epbc/pmst/index.html

DotEE (2020b). Species Profiles and Threats (SPRAT) Database. http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl

DotEE (2018). Conservation advice (incorporating listing advice) for the Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community.

DotE (2014). Approved Conservation Advice for *Diuris flavescens*. http://www.environment.gov.au/biodiversity/threatened/species/pubs/55075-conservation-advice.pdf

DEWHA (2011a). Survey guidelines for Australia’s threatened mammals: Guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Department of Environment, Water, Heritage and the Arts, Canberra.

DEWHA (2011b). Survey guidelines for Australia’s threatened bats: Guidelines for detecting bat listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Department of Environment, Water, Heritage and the Arts, Canberra.

DEWHA (2010a). Survey guidelines for Australia’s threatened reptiles: Guidelines for detecting reptiles listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999*. Department of Environment, Water, Heritage and the Arts, Canberra.

DEWHA (2010b). Survey guidelines for Australia’s threatened birds: Guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999.* Department of Environment, Water, Heritage and the Arts, Canberra.

DEWHA (2010c). Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999.* Department of Environment, Water, Heritage and the Arts, Canberra.

DSEWPC (2014).Interim Koala Referral Advice for Proponents. www.environment.gov.au/epbc

Durant R, Luck GW, Matthews A (2009) Nest-box use by arboreal mammals in a peri-urban landscape. Wildlife Research 36:565–573.

Goldingay, R.L. and Stevens, J.R. (2009). Use of artificial tree hollows by Australian birds and bats. Wildlife Research: 36, 81–97

JBEnviro (2018). Preliminary ecological constraints assessment for future development of Lot 50 DP 863972, Lot 2 DP 827097, Lot 2 DP 573214 and Lot 20 DP 836884, Eriksson Lane and Glenthorne Road, Taree South. Unpublished report to Bluesky Planning Pty Ltd. JBE, Port Macquarie.

Keith (2004). Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT. NSW Department of Environment and Conservation, Sydney.

Keith, D. and Scott, J. (2005). Native vegetation of coastal floodplains – a diagnosis of the major plant communities in New South Wales. Pacific Conservation Biology, 11: 81-104.

Keith, D.A., Chalson, J.M. & Auld, T.D. (1997). Assessing the status of threatened plants: a new methodology and an application to the vascular flora of New South Wales. Final Report to Environment Australia, Endangered Species Program Project No. 450.

Le Roux, D.S., Ikin, K., Lindenmayer, D.B., Bistricer, G, Manning, A.D., and Gibbons, P. (2016). Enriching small trees with artificial nest boxes cannot mimic the value of large trees for hollow-nesting birds. Restoration Ecology Vol. 24, No. 2, pp. 252–258.

Lindenmayer DB, Welsh A, Donnelly C, Crane M, Michael D, Macgregor C, Mcburney L, Montague-Drake R, Gibbons P (2009) Are nest boxes a viable alternative source of cavities for hollow-dependent animals? Long-term monitoring of nest box occupancy, pest use and attrition. Biological Conservation 142:33–42

Naturecall (2015). Kolodong Industrial Estate - Koala Plan of Management Annual Monitoring Report: Year 1. Unpublished report to Greater Taree City Council.

NSWSC (2004a). Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing: final determination. www.npws.nsw.gov.au.

NSWSC (2004b). Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing: final determination. www.npws.nsw.gov.au.

NSWSC (2004c). Freshwater wetlands on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - endangered ecological community listing: final determination. www.npws.nsw.gov.au.

Office of Environment and Heritage (2018a). Biodiversity Assessment Method Operation Method – Stage 1. Office of Environment and Heritage, Sydney.

OEH (2018b). Species Credit Threatened Bats and Their Habitats: NSW Survey Guide for the Biodiversity Offset Method. OEH, Hurstville.

OEH (2017) Biodiversity Assessment Method. OEH, Hurstville

OEH (2016). NSW Guide to Surveying Threatened Plants. NSW OEH, Hurstville.

DECC (2009). Threatened Species Survey and Assessment Guidelines: Field Survey Methods for Fauna – Amphibians

OEH (2004). Identification of Old Growth Forests: Field Identification on Private Land. OEH, Coffs Harbour. https://www.epa.nsw.gov.au/~/media/EPA/Corporate%20Site/resources/pnf/OGRFreviewFieldIdent.ashx

Royal Botanical Gardens Herbarium. Plantnet website (www.plantnet.rbgsyd.nsw.gov.au/search)

Smith GC, Agnew G (2002) The value of 'bat boxes' for attracting hollow dependent fauna to farm forestry plantations in southeast Queensland. Ecological Management and Restoration 3:37–46

Scotts, D. (2002) editor. Key Habitats and Corridors for Forest Fauna of North-East NSW: A regional landscape to focus conservation, planning, assessment and management. NSW NPWS, Hurstville.

Ravallion, J. (2019). RMS nest box use – future direction. Presentation to NSW ECA Conference 2019. www.ecansw.org.au

Thomson, Chris N. A Trial of the Use of Artificial Nest-boxes for the Masked Owl Tyto novaehollandiae near Newcastle, New South Wales [online]. Australian Field Ornithology, Vol. 23, No. 4, Dec 2006: 192-197.

Troedson A.L. & Hashimoto T.R. (2008). Coastal Quaternary Geology – north and south coast of NSW. Geological Survey of New South Wales, Bulletin 34.

Land and Environment Court Citations:

CBD Prestige Holdings Pty Ltd v Lake Macquarie City Council [2005] NSWLEC 367

Gales Holdings Pty Limited v Tweed Shire Council [2008] NSWLEC 209

Motorplex (Australia) Pty Limited v Port Stephens Council [2007] NSWLEC 74.

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APPENDIX 1: REPORT AUTHORSHIP

Table 44: Sections completed by accredited assessors and other persons

Section	Completed by accredited person	Completed by non-accredited person
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2.2	Jason Berrigan	-
2.3	Matt Bailey, Jason Berrigan	-
2.4	Matt Bailey, Jason Berrigan	-
2.5	Matt Bailey, Jason Berrigan	-
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3.2	Jason Berrigan	-
3.3	Jason Berrigan	-
3.4	Jason Berrigan	-
3.5	Jason Berrigan	-
3.6	Jason Berrigan	-
3.7	Jason Berrigan	-
4	Jason Berrigan	-
5	Jason Berrigan	-
Appendix 2	Jason Berrigan	-

APPENDIX 2: EPBC ACT MNES SPECIES OCCURRENCE ASSESSMENT

The following table assesses threatened species determined listed in the Protected Matters search tool as likely to occur in the locality:

Table 45: Potential to occur - Flora

Species	Legal Status	Local records	Habitat Requirements	Likelihood of Occurrence	MNES assessment
Trailing Woodruff (*Asperula asthenes)*	V-BCA V-EPBCA	1	A herb found in damp sites along riverbanks and similar areas.	Targeted survey failed to detect any potential plants and unlikely to occur as cattle have access to all areas and highly trampled.	Unlikely to occur hence assessment not required
Leafless Tongue-orchid (*Cryptostylis hunteriana*)	V-BCA V-EPBCA	0	A leafless saprophytic terrestrial orchid with a poorly developed root system. This orchid is only detectable during the flowering period of Nov-Feb (Bell 2001). It has been described from isolated records as occurring in a variety of habitats from swamp fringes to bare hillsides in eucalypt forest, with favoured soils being sandy but with records in clay (Bishop 1996	Unlikely – no LGA records and very patchy distribution in NSW. Failed to detect by targeted survey in January-February.	Unlikely to occur hence assessment not required
White-flowered Wax Plant (*Cynanchum elegans*)	E-BCA E-EPBCA	0	A twiner occurring predominately in dry rainforest, littoral rainforest and the ecotone between dry rainforest and open forest, however it has been found in the Manning Valley and Hastings in Open Forest types on specific geologies eg limestone and serpentine respectively (Garry Germon pers. comm. 2004, personal observations). It occurs on a variety of lithology's and soil types. It has been found between the altitudinal ranges of 0 to 600 metres ASL and rainfall >760mm annually (NPWS 1999). Common associated species include *Geijera parviflora, Notelaea microcarpa, Banksia integrifolia, Ficus spp., Guioa semiglauca, Melia azedarach, Streblus brunonianus* and *Pittosporum revolutum*	Unlikely. Not preferred vegetation type and failed to detect by targeted survey.	Unlikely to occur hence assessment not required

Species	Legal Status	Local records	Habitat Requirements	Likelihood of Occurrence	MNES assessment
Pale Yellow Doubletail (*Diuris flavescens*)	E-BCA CE-EPBCA	2	Only known to occur in the Tinonee-Wingham area. Grows in grassy tall eucalypt forest with Kangaroo Grass and Bladey Grass on brown clay soil. Flowers September to October	Good potential habitat on Lot 2 DP573214 where native groundcover dominates but possibly cultivated in past. Marginal potential habitat in Eriksson Lane given high weed content and evident disturbance of ground from maintenance, direction of stormwater off the road, and weed invasion.	No loss of potential habitat on Lot 2. Not considered likely to occur in road reserve given poor conditions. No assessment required.
Slaty Red Gum (*Eucalyptus glaucina*)		6	A tall tree to 30m in height. Grows in woodland and open forest on deep moderately fertile soils.	Some generic potential habitat in Erikssons' Lane and VZ 7, but confirmed only Forest Red Gums present.	No loss of known habitat, hence no assessment required.
Craven Grey Box (*E. largeana*).	E-BCA E-EPBCA	1	Tall to very tall tree, confined to Gloucester-Craven district and near Pokolbin, over number of known populations. Occurs in wet forest on sloping sites on sub-coastal ranges. Unconfirmed record in Talawahl Nature Reserve.	Outside known range and no suitable potential habitat. Unlikely to occur.	Unlikely to occur hence assessment not required
Euphrasia arguta	CE-BCA CE-EPBCA	0	Erect annual herb to 20-35cm only found in Nundle area of NSW north-western slopes and tablelands, and originally from Sydney to Bathurst.	Site is far beyond range.	Unlikely to occur hence assessment not required
Smooth-shelled Macadamia (*Macadamia integrifolia*)	V-EPBCA	0	Rainforest tree to 20m high (now commercially cultivated) from Mt Bauple to Lismore area.	Far south of known range and absent. *M. tetraphylla* on site as planted horticultural trees.	Unlikely to occur hence assessment not required

Species	Legal Status	Local records	Habitat Requirements	Likelihood of Occurrence	MNES assessment
Biconvex Paperbark (*Melaleuca biconvexa*)	V-BCA V-EPBCA	0	A paperbark shrub/small tree found in damp places, often near streams, on the coast and adjacent tablelands from Jervis Bay to Port Macquarie. Restricted to Thrumster soil landscape in PMHC LGA. Occurs on alluvials in Jervis Bay.	Nil – no found on site or in locality.	Unlikely to occur hence assessment not required
Tall Knotweed *(Persicaria elatior)*	V-BCA V-EPBCA	0	Herb up to 90cm tall found in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance. Recently found north of Kempsey	No found by targeted survey of dams and swamp forest. Unlikley to occur.	Unlikely to occur hence assessment not required
Lesser Swamp-orchid (*Phaius australis*)	E-BCA E-EPBCA	0	Generally grow in *Melaleuca quinquenervia* swamps on the coast or at sea level, as well as littoral rainforest, dunes (including stabilised dunes), riparian forests (including gallery rainforests), swamp forests, swamps (including marshes and intermittent wetlands), and Blackbutt-dominated wet sclerophyll on clay, mainly at low altitudes. Sandy alluvium is the favoured geology and sandy, damp to humic soils are favoured.	Nil – no suitable habitat.	Unlikely to occur hence assessment not required
Magenta Lilly Pilly *(Syzygium paniculatum)*	V-BCA V-EPBCA	0	A type of Lilly Pilly, which has a shrub to small tree habit and grows in subtropical and littoral rainforest on sandy soils or stabilised dunes on the coast. It is also widely cultivated as an ornamental.	Nil – no suitable habitat.	Unlikely to occur hence assessment not required
Austral Toadflax (*Thesium australe*)	V-BCA V-EPBCA	3	A parasitic herb commonly associated with Kangaroo Grass, and has been recorded on coastal headlands at Coffs Harbour, Hat Head, Crescent Head, Diamond Head and Perpendicular Point in Kangaroo Grass areas.	Unlikely – no local records and very patchy. Not preferred habitat.	Unlikely to occur hence assessment not required

Table 46: Potential to occur – Fauna

Marine and estuarine fauna and all fish are not assessed due to complete lack of habitat on site or in the study area.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
Dwyer's Bat/Large Eared Pied Bat (*Chalinobus dwyeri)*	V-BCA V-EPBCA	0	Found in moderately wooded habitats such as dry sclerophyll forest, tall open eucalypt forests, woodlands, sub-alpine woodlands, edge of rainforest and wet sclerophyll forest. Roosts in caves, mines and abandoned bottle-shaped mud nests of Fairy Martins. In caves and mines, tend to roost in twilight sections near entrance. Insectivorous but habits poorly known. Fly relatively slowly, direct and maneuverable, low to ground or 6-10m above ground.	General foraging preferences of this poorly known species suggests locality potentially generically structurally suitable foraging habitat. No cave, mines, etc on or near site for roosting. Not recorded within 10km radius of site (or LGA, and very few regional records). Likelihood to occur on site considered unlikely.	Unlikely to occur hence assessment not required
Grey-headed Fruit-bat/Flying Fox (*Pteropus poliocephalus*)	V-BCA V-EPBCA	76	Nomadic frugivore and nectarivore on rainforest, eucalypt, melaleuca and banksia. Recorded flying up to 45km from roost (generally max. of 20km). Roosts colonially with short term individual or small groups, mostly near watercourses. Spring or Summer roosts are maternity sites. Dependant on Winter flowering species eg *E. robusta* and *E. tereticornis.*	Site contains some potential nectar and pollen and fruit sources, and is considered highly likely to form a small part of the species wider foraging range. No roosting habitat on/adjacent to the site. Recorded foraging adjacent to site by previous survey	Proposal will remove some potential foraging resources and observed adjacent – **MNES assessment required**.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
Spotted-tail Quoll (*Dasyurus maculatus*)	V-BCA E-EPBCA	2	Various forested habitats with preference for dense forests. Requires tree hollows, hollow logs or caves for nesting. Large home range (>500ha) and may move over several kilometres in a few days. Tends to follow drainage lines.	Site forms fragmented fringe of a remnant about 60ha in size to the east, separated from other potential habitat east and more so south by Pacific Highway and Manning River Drive, from large expanse of known habitat to south. Very low to unlikely to occur due to these barriers and extreme threats, and would be exposed to major threats. Unlikely to occur.	Unlikely to occur hence assessment not required
Greater Glider (*Petauroides volans*)	V-EPBCA	4	Restricted to eucalypt forests and woodlands of eastern Australia. Its diet is mostly eucalypt leaves and occasional flowers and is found in highest abundance in taller, montane, moist eucalypt forests, with relatively old trees and abundant hollows. The distribution may be patchy even in suitable habitat. Forests with a diversity of eucalypt species, due to seasonal variation, is its preferred tree species.	Not recorded on-site or in the locality. Sclerophyll forest structurally suitable and contains potential foraging and denning sources, but very poorly connected to other habitat to south. Given failure to detect and lack of local records, this species is considered an unlikely occurrence.	Unlikely to occur hence assessment not required

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
Long-nosed Potoroo (*Potorous tridactylous*)	V-BCA V-EPBCA	1	Coastal heath and shrublands; paperbark forest; woodland with dry heathy understorey; dry and wet sclerophyll forests; high elevation rainforest or moist hardwood forest; moist shrublands with dense or moderately dense understoreys and sedge-dominated groundcover; wet or dry sclerophyll forests where average annual precipitation exceeds 760mm. Requires thick groundcover for refuge, while foraging in open areas on ridges, slopes or gullies, typically on ecotones, and prefers sandy soils for digging. Eats roots, tubers, fungi, fleshy fruits, leaves, insects and other soil invertebrates. Optimum habitat generally considered a mosaic of regenerating dense understorey vegetation as result of patchwork of periodic low to medium intensity fires. Home range 2-5ha (NSW NPWS 2000).	Not recorded on-site or in the locality. Sclerophyll forest structurally suitable and contains potential foraging sources, but very poorly connected to other habitat to south. Given failure to detect and lack of local records, this species is considered an unlikely occurrence.	Unlikely potential to occur. Hence assessment not required.
Koala (*Phascolarctos cinereus*)	V-BCA V-EPBCA	272	Areas where preferred food species occur in sufficient concentrations and diversity, and generally on more fertile soils.	**Recorded on site**.	**MNES assessment as per Koala protocol automatically required**.

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
New Holland Mouse (*Pseudomys novaehollandiae*)	V-EPBCA	2	Swamp forest, heath, open forest on sand. Most often found in heath dominated by leguminous shrubs <1m high with sparse groundcover. Depends on a specific fire regime – prefers early stages of post-fire recovery. Diet varies with season. Seeds preferred in spring-summer, with insects and invertebrates in winter, plus leaves, flowers and fungi. Nocturnal with burrows in sandy soil, temporary to up to 5m long with nest chamber and various residences, and expected to be occupied by family groups. Home range of breeding females overlap but not males. Breeds in late winter to early summer, with peak breeding in 2nd year (only live for about 2 years), with peak size in 2nd year. Population peaks in autumn, lowest in spring, with peak density of 17/ha in ideal conditions.	Marginal generic potential. No local records. Not recorded by targeted survey. Unlikely to occur.	Unlikely to occur hence assessment not required
Australasian Bittern (*Botaurus poiciloptilus*)	E-BCA E-EPBCA	1	Inhabits estuarine and freshwater wetlands, generally with permanent water and dense vegetation of sedges, rushes and reeds, particularly Bullrush and Spikerush. Solitary or groups up to 12. Usually sedentary. Roosts in reeds by day, forages in shallow water at dusk/night for frogs, fish, invertebrates, fruit, leaves. Tramples reeds, sedges to make a foraging platform. Nests in dense vegetation over water. (NSW NPWS 2000)	Dams too small and isolated from any major habitat this bird may be attracted to for foraging or roosting. Unlikely to occur.	Unlikely to occur hence assessment not required

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
Eastern Bristlebird *(Dasyornis brachypterus)*	E-BCA E-EPBCA	0	This species habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years.	Outside known range of southern and northern NSW populations and unsuitable habitat. Unlikely to occur.	Unlikely to occur hence assessment not required
Red Goshawk (*Erythrotriorchis radiatus*)	CE-BCA V-EPBCA	0	Found in tropical open woodland, taller woodland, open forests, rainforest edges and dense riparian vegetation of coastal and subcoastal drainages. Territorial and utilise same nest. Breeding territories estimated 50-220km^2. Preys on bird especially Honeyeaters, parrots, kookaburras and slight waterbirds, as well as some mammals, reptiles and large insects. No recent records south of Clarence.	Not recorded on-site or in locality (nearest record is in Kempsey Shire but this is old – no recent records south of Clarence Valley). General locality is potentially suitable. Site may form marginal part of larger territory. Unlikely potential to occur due to sparseness of records – possibly only as extremely rare occurrence.	Outside known range and very low at best chance of occurrence as transient in extreme climate conditions – assessment not required.
Painted Honeyeater (*Grantiella picta*)	V-BCA V-EPBCA	0	Strongly migratory and locally nomadic. Exploits almost exclusively mistletoe-infested (mainly *Amyema* genus) eucalypt forest/woodland in mainly drier areas particularly Boree, Brigalow and Box-Gum woodlands – core range is inland central NSW (New England to west of Canberra) with limited coastal occurrences eg Hunter and Cumberland Valleys). Leaf insects occasionally taken. May extend range or visit woodland remnants and suburban gardens during poor seasons. Breeding habitat is mistletoe-laden eucalypt forest/woodland.	Not recorded on site or in locality. No significant mistletoe infestations on site. Overall thus site has unlikely potential for foraging as part of nomadic range for this species. Very unlikely potential to occur at best as rare transient.	Unlikely to occur hence assessment not required

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
White-throated Needletail (*Hirundapus caudacutus*)	V-EPBCA	Yes	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 2010). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993).	Regularly recorded in similar habitat in locality. Likely to periodically forage over site as minute part of nomadic migratory range.	Likely to occur hence **assessment required.**
Swift Parrot (*Lathamus discolour*)	CE-BCA E-EPBCA	19	Breeds in Tasmania and winters in Victoria with some dispersal northwards. Feeds mostly on pollen and nectar of winter flowering eucalypts, but also feeds on fruit, seeds, lerps and insect larvae (Schodde and Tideman 1990). Also favours profusely flowering banksias. Favoured species are *E. robusta*, *Corymbia gummifera*, *E. globulus, E. sideroxylon, E. leucoxylon, E. labens, E. ovata, C. maculata, Banksia serrata* and *B. integrifolia*	Forest Red Gum present as handful of mature trees and similar number of young trees, but not other preferred species. Very small chance of opportunistic forage as part of occurrence in local area.	Very low chance of occurrence, and no impact to a repeat foraging area, or increased mortality hence, assessment not required
Painted Snipe (*Rostratula benghalensis*)	E-EPBCA	-	Prefers shallow, freshwater swamps and bogs. Most active at night, feeding on aquatic insects, grasshoppers, crickets, earthworms and various plant seeds. Usually solitary and nomadic.	Marginal potential habitat around dams but isolated from other preferred habitat, and prone to fox predation, thus unlikely to occur.	Unlikely to occur hence assessment not required

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
Regent Honeyeater (*Xanthomyza phrygia*)	CE-BCA CE-EPBCA	0	Nomadic. Inhabits temperate eucalypt woodlands and open forest, including forest edges, woodland remnants on farmland and urban areas. Also uses *Casuarina cunninghamiana* gallery forests. Requires reliable and ample nectar supplies to support semi-permanent (core breeding) habitat. Favoured nectar sources are *E. sideroxylon, E. albens, E. melliodora, E. leucoxylon, E. robusta, E. planchoniana*, and heavy infestations of mistletoe. Also take insects and orchard fruits. Breeds in pairs or small colonies in open woodland/forest and occasionally more disturbed woodland near housing and farmland, depending on food availability, from August-January. Breeding less likely to occur if nectar flows are low or unreliable, or heavy competition with more aggressive honeyeaters eg Noisy Miner, Red Wattlebirds and Noisy Friarbirds.	No preferred species present or very rare – extreme rarity of this bird renders local records only as rare vagrants. Site does not have habitat which would attract this bird.	Unlikely to occur hence assessment not required
Green and Golden Bell Frog (*Litoria aurea*)	E-BCA V-EPBCA	0	Found in permanent swamps and ponds. Prefers water bodies which are: still; shallow; unshaded; ephemeral; unpolluted; generally isolated; and free of native fish species or Plague Minnow (Gambusia holbrooki) and little macro-algae. Requires emergent vegetation, grass tussocks or rocks for shelter. May use disturbed sites opportunistically - may depend on several stages. Eats insects and other frogs. Summer breeder. (Hero et al 2004).	Dams in VZ 8 and 10 offer generic potential, but failed to detect by targeted survey and no local records. Unlikely to occur.	Unlikely to occur hence not required

Name	Legal Status	Records	Habitat Requirements	Likelihood Of Occurrence	EPBC Act assessment required?
Giant Barred Frog (*Mixophyes iteratus)*	E-BCA, E-EPBCA	0	Moist hardwood forest, Antarctic Beech and rainforest near flowing streams. May also occur in coastal riverine rainforest and riparian vegetation. Forages in areas adjacent to riparian zones. Males call from under leaf litter or rocks by flowing streams. Eggs laid at streamside to await washing into stream by rainfall.	No suitable habitat on site or in study area. No local records. Unlikely to occur.	Unlikely to occur hence not required
Giant Barred Frog (*Mixophyes balbus)*	E-BCA V-EPBCA	0	Moist hardwood forest, Antarctic Beech and rainforest near flowing streams. May also occur in coastal riverine rainforest and riparian vegetation. Forages in areas adjacent to riparian zones. Males call from under leaf litter or rocks by flowing streams. Eggs laid at streamside to await washing into stream by rainfall	No suitable habitat on site or in study area. No local records. Unlikely to occur.	Unlikely to occur hence assessment not required

APPENDIX 3: HOLLOW-BEARING TREE DATA

Wpt	HBT	Spp	DBH	Termitaria/Fissure /Basal/Hollow type	Trunk <5cm	Trunk 5-15cm	Trunk >15	Branch <5cm	Branch 5-15cm	Branch >15	Notes
2818 -31.9389 152.4691	T1	White Mahogany	100cm	Termitaria		1					Termitaria with at least one cavity. Tree has a major basal fire scar at the base making it a structural defect.
2819 -31.9388 152.4692	H1	Blue Gum	85cm	Spout			1				Large open cavity in broken second leader. Cavity was inspected and has no depth – completely open on one side.
2820 -31.9386 152.4693	H2	White Mahogany	110cm	Bark fissure	1						Bark has split 3 meters up the tree. The cavity is large length wise and provides enough room for it to provide habitat.
2821 -31.9381 152.4694	H3	White Mahogany	70cm	Vertical slit in trunk		1					Long bark fissure 4 meters from the base, which offers some potential for microbat roosts.

					Trunk			Branch			
Wpt	**HBT**	**Spp**	**DBH**	**Termitaria/Fissure /Basal/Hollow type**	**<5cm**	**5-15cm**	**>15**	**<5cm**	**5-15cm**	**>15**	**Notes**
2822 -31.9377 152.4694	H4	Blue Gum	65cm	Trunk		1					Open cavity in between the beginning of a double leader. Cavity was checked, was only 20cm deep and full of water: uninhabitable.
2823 -31.9375 152.4695	H5	Tallowwood	100cm	Branch opening				1			Small open cavity on a dead branch. Large tree with multiple dead branches and potential for multiple hollows in time.
2824 -31.9373 152.4695	H6	Tallowwood	120cm	Branch opening				1			Small opening on dead limb at the base of the tree. Tree is large with multiple dead branches and potential for multiple hollows in time.
2825 -31.9369 152.4696	T2	White Mahogany	90cm	Termitaria		1					Termitaria at the base of the leader.

					Trunk			Branch			
Wpt	**HBT**	**Spp**	**DBH**	**Termitaria/Fissure /Basal/Hollow type**	**<5cm**	**5-15cm**	**>15**	**<5cm**	**5-15cm**	**>15**	**Notes**
2826 -31.9368 152.4695	H7	White Mahogany	60cm	Spout		1					Opening in the middle of the second leader where the branch has broken off.
2827 -31.9368 152.4695	T3	Tallowwood	55cm	Termitaria		1					Termitaria with opening at the beginning of a double leader.
2828 -31.9359 152.4697	H8	Blackbutt	180cm	Branch opening	3	1					Cavity entrance on the first leader to the east, with several potential hollows on upturned stubs and ends of branches.
2829 -31.9353 152.4699	H9	Blackbutt	200cm	Trunk Branch opening	2	2					Large burnt tree with no visible defects supporting multiple hollows.
2833 -31.935 152.4702	H10	Tallowwood	120cm	Branch opening	2	1					Large burnt tree with new growth and no visible defect supporting multiple branch opening hollows.

Wpt	HBT	Spp	DBH	Termitaria/Fissure /Basal/Hollow type	Trunk			Branch			Notes
					<5cm	5-15cm	>15	<5cm	5-15cm	>15	
2830 -31.935 152.4697	H11	Stag	70cm	Chimney		1					Dead tree with an open cavity in the centre and structurally unsustainable core.
2831 -31.9354 152.4698	H12	Blackbutt	60cm	Trunk		1					Burnt tree with fire scar and opening at the base, making structurally weak.
2834 -31.9357 152.4697	H13	Blackbutt	50cm	Trunk		1					Burnt tree with open cavity 3 meters up the trunk.
2832 -31.9364 152.4695	H14	Thick Leaved Mahogany	85cm	Chimney		1					Opening in the centre of the where the double leader begins.

T1.

HBT 1.

HBT 2.

HBT3.

HBT 4.

HBT 5.

HBT 6.

HBT 7.

T3.

HBT 8.

HBT 9.

H10.

H11.

H12:

H13.

H14:

H15.

H16:

APPENDIX 4: BAMC OUTPUTS

BAM Credit Summary Report

Proposal Details

Assessment Id

00019564/BAAS18079/20/00019565

Proposal Name

Glenthorne Industral Planning Proposal

BAM data last updated *

04/06/2020

Assessor Name

Report Created

15/06/2020

BAM Data version *

27

Assessor Number

BAM Case Status

Open

Date Finalised

To be finalised

Assessment Revision

0

Assessment Type

Part 4 Developments (General)

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion								
10	1064_vz9high	38.5	0.1	0.25	High Sensitivity to Potential Gain	2.00		1
							Subtotal	**1**

Tall Spike Rush freshwater wetland								
9	1740_VZ8moderate	36.5	0.0	0.25	Moderate Sensitivity to Potential Gain	1.75		1
							Subtotal	**1**
Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast								
1	1262_VZ1moderate1	38.9	0.1	0.25	High Sensitivity to Potential Gain	1.50		1
2	1262_VZ2moderate2	65.5	1.2	0.25	High Sensitivity to Potential Gain	1.50		28
3	1262_VZ3low1	16.6	4.5	0.25	Moderate Sensitivity to Potential Gain	1.25		0
4	1262_VZ4verylow1	0.5	4.8	0.25	Moderate Sensitivity to Potential Gain	1.25		0
5	1262_VZ5low2	0.6	1.2	0.25	High Sensitivity to Potential Gain	1.50		0
6	1262_VZ6low3	2.2	1.5	0.25	High Sensitivity to Potential Gain	1.50		0
7	1262_VZ7moderate3	52.8	0.2	0.25	High Sensitivity to Potential Gain	1.50		5
8	1262_VZ11verylow2	0.9	1.3	0.25	High Sensitivity to Potential Gain	1.50		0
							Subtotal	**34**

Typha rushland								
11	1737_vz10moderate	59.8	0.2	0.25	Moderate Sensitivity to Potential Gain	1.75		4
							Subtotal	**4**
							Total	**40**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Diuris flavescens / Pale Yellow Doubletail (Flora)						
1262_VZ1moderate1	38.9	0.09	0.25	3	True	3
1262_VZ2moderate2	65.5	1.15	0.25	3	True	57
					Subtotal	**60**
Myotis macropus / Southern Myotis (Fauna)						
1262_VZ2moderate2	65.5	0.21	0.25	2	False	7
1262_VZ4verylow1	0.5	2.65	0.25	2	False	1
1262_VZ5low2	0.6	1.17	0.25	2	False	0
1262_VZ6low3	2.2	1.5	0.25	2	False	2
1262_VZ7moderate3	52.8	0.24	0.25	2	False	6
1740_VZ8moderate	36.5	0.04	0.25	2	False	1
1737_vz10moderate	59.8	0.16	0.25	2	False	5
					Subtotal	**22**

Phascolarctos cinereus / Koala (Fauna)						
1262_VZ1moderate1	38.9	0.01	0.25	2	False	0
1262_VZ2moderate2	65.5	0.46	0.25	2	False	15
1262_VZ3low1	16.6	0	0.25	2	False	0
1262_VZ5low2	0.6	0	0.25	2	False	0
1262_VZ7moderate3	52.8	0.24	0.25	2	False	6
1740_VZ8moderate	36.5	0	0.25	2	False	0
1064_vz9high	38.5	0	0.25	2	False	0
					Subtotal	**21**
Pterostylis chaetophora / Pterostylis chaetophora (Flora)						
1262_VZ1moderate1	38.9	0.09	0.25	2	False	2
1262_VZ2moderate2	65.5	1.15	0.25	2	False	38
					Subtotal	**40**

Biodiversity payment summary report

Assessment Id	Payment data version	Assessment Revision	Report created
00019564/BAAS18079/20/00019565	63	0	15/06/2020

Assessor Name	Assessor Number	Proposal Name	BAM Case Status
		Glenthorne Industral Planning Proposal	Open

Assessment Type	Date Finalised
Part 4 Developments (General)	To be finalised

PCT list

Price calculated	PCT common name	Credits
Yes	**1262 -** Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	34
Yes	**1064 -** Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	1
Yes	**1737 -** Typha rushland	4
Yes	**1740 -** Tall Spike Rush freshwater wetland	1

Species list

Price calculated	Species	Credits
Yes	***Diuris flavescens*** (Pale Yellow Doubletail)	60
Yes	***Myotis macropus*** (Southern Myotis)	22
Yes	***Phascolarctos cinereus*** (Koala)	21
Yes	***Pterostylis chaetophora*** (Pterostylis chaetophora)	40

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

IBRA sub region	PCT common name	Threat status	Offset trading group	Risk premium	Administrative cost	Methodology adjustment factor	Price per credit	No. of ecosystem credits	Final credits price
Karuah Manning	**1262 -** Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	No	Northern Hinterland Wet Sclerophyll Forests <50%	19.73%	$82.51	2.1194	$2,552.26	34	$86,776.84
Karuah Manning	**1064 -** Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Yes	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	15.97%	$295.60	2.7714	$8,865.68	1	$8,865.68

Karuah Manning	**1737 -** Typha rushland	Yes	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	15.97%	$280.81	1.9060	$8,422.27	4	$33,689.06
Karuah Manning	**1740 -** Tall Spike Rush freshwater wetland	No	Coastal Freshwater Lagoons >=70% and <90%	19.73%	$356.20	2.4103	$ 11,018.29	1	$11,018.29

Subtotal (excl. GST)	**$140,349.87**
GST	**$14,034.99**
Total ecosystem credits (incl. GST)	**$154,384.86**

Species credits for threatened species

Species profile ID	Species	Threat status	Price per credit	Risk premium	Administrative cost	No. of species credits	Final credits price
10238	***Diuris flavescens*** (Pale Yellow Doubletail)	Critically Endangered	$865.08	34.3100%	$80.00	60	$74,513.34
10549	***Myotis macropus*** (Southern Myotis)	Vulnerable	$741.31	34.3100%	$80.00	22	$23,664.38
10616	***Phascolarctos cinereus*** (Koala)	Vulnerable	$636.69	34.3100%	$80.00	21	$19,637.91
20280	***Pterostylis chaetophora*** (Pterostylis chaetophora)	Vulnerable	$150.00	34.3100%	$80.00	40	$11,258.60

Subtotal (excl. GST)	**$129,074.23**
GST	**$12,907.42**
Total species credits (incl. GST)	**$141,981.65**
Grand total	**$296,366.51**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00019564/BAAS18079/20/00019565	Glenthorne Industral Planning Proposal	04/06/2020
Assessor Name	Assessor Number	BAM Data version *
		27
Proponent Names	Report Created	BAM Case Status
	15/06/2020	Open
Assessment Revision	Assessment Type	Date Finalised
0	Part 4 Developments (General)	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Diuris flavescens / Pale Yellow Doubletail
Diuris flavescens / Pale Yellow Doubletail

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Anseranas semipalmata / Magpie Goose
Calidris tenuirostris / Great Knot
Calyptorhynchus lathami / Glossy Black-Cockatoo
Ptilinopus superbus / Superb Fruit-Dove
Climacteris picumnus victoriae / Brown Treecreeper (eastern subspecies)
Coracina lineata / Barred Cuckoo-shrike
Dasyurus maculatus / Spotted-tailed Quoll
Irediparra gallinacea / Comb-crested Jacana
Ixobrychus flavicollis / Black Bittern
Phoniscus papuensis / Golden-tipped Bat
Limicola falcinellus / Broad-billed Sandpiper
Limosa limosa / Black-tailed Godwit
Haliaeetus leucogaster / White-bellied Sea-Eagle
Stictonetta naevosa / Freckled Duck
Syconycteris australis / Common Blossom-bat
Xenus cinereus / Terek Sandpiper
Epthianura albifrons / White-fronted Chat

Calidris ferruginea / Curlew Sandpiper
Ninox connivens / Barking Owl
Pandion cristatus / Eastern Osprey
Pomatostomus temporalis temporalis / Grey-crowned Babbler (eastern subspecies)
Pseudomys gracilicaudatus / Eastern Chestnut Mouse
Rostratula australis / Australian Painted Snipe

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1262-Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Not a TEC	14.7	34.00
1740-Tall Spike Rush freshwater wetland	Not a TEC	0.0	1.00
1064-Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.1	1.00
1737-Typha rushland	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.2	4.00

1064-Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 837, 839, 971, 1064, 1092, 1227, 1230, 1231, 1232, 1235, 1649, 1715, 1716, 1717, 1718, 1719, 1721, 1722, 1723, 1724, 1725, 1730, 1795, 1798	-	No	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1262-Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914	Northern Hinterland Wet Sclerophyll Forests <50%	Yes	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1737-Typha rushland

Like-for-like credit retirement options

Name of offset trading group	Trading group	HBT	IBRA region
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 780, 781, 782, 828, 1071, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1911	-	No	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1740-Tall Spike Rush freshwater wetland

Like-for-like credit retirement options

Class	Trading group	HBT	IBRA region
Coastal Freshwater Lagoons This includes PCT's: 781, 783, 1071, 1735, 1736, 1737, 1740, 1741, 1742	Coastal Freshwater Lagoons >=70% and <90%	No	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Area	Credits
Diuris flavescens / Pale Yellow Doubletail	1.2	60.00
Myotis macropus / Southern Myotis	6.0	22.00
Phascolarctos cinereus / Koala	0.7	21.00
Pterostylis chaetophora / Pterostylis chaetophora	1.2	40.00

Diuris flavescens/ Pale Yellow Doubletail	1262_VZ1moderate1	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Diuris flavescens/Pale Yellow Doubletail	Any in NSW
	1262_VZ2moderate2	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Diuris flavescens/Pale Yellow Doubletail	Any in NSW
Myotis macropus/ Southern Myotis	1262_VZ2moderate2	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW
	1262_VZ4verylow1	**Like-for-like credit retirement options**	

		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW
	1262_VZ5low2	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW
	1262_VZ6low3	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW
	1262_VZ7moderate3	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW

	1737_vz10moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW
	1740_VZ8moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Myotis macropus/Southern Myotis	Any in NSW
Phascolarctos cinereus/ Koala	1064_vz9high	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW

Phascolarctos cinereus/ Koala	1262_VZ1moderate1	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	1262_VZ2moderate2	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	1262_VZ3low1	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	1262_VZ5low2	**Like-for-like credit retirement options**	
		Spp	IBRA region

		Phascolarctos cinereus/Koala	Any in NSW
	1262_VZ7moderate3	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
	1740_VZ8moderate	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Phascolarctos cinereus/Koala	Any in NSW
Pterostylis chaetophora/ Pterostylis chaetophora	1262_VZ1moderate1	**Like-for-like credit retirement options**	
		Spp	IBRA region
		Pterostylis chaetophora/Pterostylis chaetophora	Any in NSW

<table>
<tr><td rowspan="2">Pterostylis chaetophora/
Pterostylis chaetophora</td><td>1262_VZ1moderate1</td><td></td></tr>
<tr><td>1262_VZ2moderate2</td><td>
<table>
<tr><th colspan="2">Like-for-like credit retirement options</th></tr>
<tr><td>Spp</td><td>IBRA region</td></tr>
<tr><td>Pterostylis chaetophora/Pterostylis chaetophora</td><td>Any in NSW</td></tr>
<tr><td colspan="2"></td></tr>
</table>
</td></tr>
</table>

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00019564/BAAS18079/20/00019565	Glenthorne Industral Planning Proposal	04/06/2020
Assessor Name	Assessor Number	BAM Data version *
		27
Proponent Name(s)	Report Created	BAM Case Status
	15/06/2020	Open
Assessment Revision	Assessment Type	Date Finalised
0	Part 4 Developments (General)	To be finalised

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Potential Serious and Irreversible Impacts

Nil

Species
Diuris flavescens / Pale Yellow Doubletail
Diuris flavescens / Pale Yellow Doubletail

Additional Information for Approval

PCTs With Customized Benchmarks

No Changes

Predicted Threatened Species Not On Site

Name
Anseranas semipalmata / Magpie Goose
Calidris tenuirostris / Great Knot
Calyptorhynchus lathami / Glossy Black-Cockatoo
Ptilinopus superbus / Superb Fruit-Dove
Climacteris picumnus victoriae / Brown Treecreeper (eastern subspecies)
Coracina lineata / Barred Cuckoo-shrike
Dasyurus maculatus / Spotted-tailed Quoll
Irediparra gallinacea / Comb-crested Jacana
Ixobrychus flavicollis / Black Bittern
Phoniscus papuensis / Golden-tipped Bat
Limicola falcinellus / Broad-billed Sandpiper
Limosa limosa / Black-tailed Godwit
Haliaeetus leucogaster / White-bellied Sea-Eagle
Stictonetta naevosa / Freckled Duck
Syconycteris australis / Common Blossom-bat
Xenus cinereus / Terek Sandpiper
Epthianura albifrons / White-fronted Chat

Calidris ferruginea / Curlew Sandpiper
Ninox connivens / Barking Owl
Pandion cristatus / Eastern Osprey
Pomatostomus temporalis temporalis / Grey-crowned Babbler (eastern subspecies)
Pseudomys gracilicaudatus / Eastern Chestnut Mouse
Rostratula australis / Australian Painted Snipe

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	Number of credits to be retired
1262-Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	Not a TEC	14.7	34.00
1740-Tall Spike Rush freshwater wetland	Not a TEC	0.0	1.00
1064-Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.1	1.00
1737-Typha rushland	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.2	4.00

1064-Paperbark swamp forest of the coastal lowlands of the NSW North Coast Bioregion and Sydney Basin Bioregion	**Like-for-like credit retirement options**			
	Name of offset trading group	Trading group	HBT	IBRA region

	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 837, 839, 971, 1064, 1092, 1227, 1230, 1231, 1232, 1235, 1649, 1715, 1716, 1717, 1718, 1719, 1721, 1722, 1723, 1724, 1725, 1730, 1795, 1798	-	No	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options			
	Formation	Trading group	HBT	IBRA region
	Forested Wetlands	Tier 3 or higher	No	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1262-Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast	**Like-for-like credit retirement options**			
	Class	Trading group	HBT	IBRA region
	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914	Northern Hinterland Wet Sclerophyll Forests <50%	Yes	Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

<table>
<tr><td rowspan="3">1262-Tallowwood - Small-fruited Grey Gum dry grassy open forest of the foothills of the NSW North Coast</td><td colspan="4">Variation options</td></tr>
<tr><td>Formation</td><td>Trading group</td><td>HBT</td><td>IBRA region</td></tr>
<tr><td>Wet Sclerophyll Forests (Grassy sub-formation)</td><td>Tier 7 or higher</td><td>Yes (including artificial)</td><td>IBRA Region: NSW North Coast,
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
<tr><td rowspan="6">1737-Typha rushland</td><td colspan="4">Like-for-like credit retirement options</td></tr>
<tr><td>Name of offset trading group</td><td>Trading group</td><td>HBT</td><td>IBRA region</td></tr>
<tr><td>Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions
This includes PCT's:
780, 781, 782, 828, 1071, 1735, 1736, 1737, 1738, 1739, 1740, 1741, 1742, 1911</td><td>-</td><td>No</td><td>Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
<tr><td colspan="4">Variation options</td></tr>
<tr><td>Formation</td><td>Trading group</td><td>HBT</td><td>IBRA region</td></tr>
<tr><td>Freshwater Wetlands</td><td>Tier 3 or higher</td><td>No</td><td>IBRA Region: NSW North Coast,
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
</table>

<table>
<tr><td rowspan="6">1740-Tall Spike Rush freshwater wetland</td><td colspan="4">Like-for-like credit retirement options</td></tr>
<tr><td>Class</td><td>Trading group</td><td>HBT</td><td>IBRA region</td></tr>
<tr><td>Coastal Freshwater Lagoons
This includes PCT's:
781, 783, 1071, 1735, 1736, 1737, 1740, 1741, 1742</td><td>Coastal Freshwater Lagoons >=70% and <90%</td><td>No</td><td>Karuah Manning,Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
<tr><td colspan="4">Variation options</td></tr>
<tr><td>Formation</td><td>Trading group</td><td>HBT</td><td>IBRA region</td></tr>
<tr><td>Freshwater Wetlands</td><td>Tier 4 or higher</td><td>No</td><td>IBRA Region: NSW North Coast,
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
</table>

Species Credit Summary

Species	Area	Credits
Diuris flavescens / Pale Yellow Doubletail	1.2	60.00
Myotis macropus / Southern Myotis	6.0	22.00
Phascolarctos cinereus / Koala	0.7	21.00
Pterostylis chaetophora / Pterostylis chaetophora	1.2	40.00

<table>
<tr><td rowspan="6">Diuris flavescens/
Pale Yellow Doubletail</td><td rowspan="3">1262_VZ1moderate1</td><td colspan="4">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td colspan="2">IBRA region</td></tr>
<tr><td colspan="2">Diuris flavescens/Pale Yellow Doubletail</td><td colspan="2">Any in NSW</td></tr>
<tr><td rowspan="3">1262_VZ2moderate2</td><td colspan="4">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td colspan="2">IBRA region</td></tr>
<tr><td colspan="2">Diuris flavescens/Pale Yellow Doubletail</td><td colspan="2">Any in NSW</td></tr>
<tr><td rowspan="6">Myotis macropus/
Southern Myotis</td><td rowspan="6">1262_VZ2moderate2</td><td colspan="4">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td colspan="2">IBRA region</td></tr>
<tr><td colspan="2">Myotis macropus/Southern Myotis</td><td colspan="2">Any in NSW</td></tr>
<tr><td colspan="4">Variation options</td></tr>
<tr><td>Kingdom</td><td colspan="2">Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
<tr><td>Fauna</td><td colspan="2">Vulnerable</td><td>Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
</table>

<table>
<tr><td rowspan="11">Myotis macropus/
Southern Myotis</td><td rowspan="6">1262_VZ4verylow1</td><td colspan="4">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td colspan="2">IBRA region</td></tr>
<tr><td colspan="2">Myotis macropus/Southern Myotis</td><td colspan="2">Any in NSW</td></tr>
<tr><td colspan="4">Variation options</td></tr>
<tr><td>Kingdom</td><td colspan="2">Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
<tr><td>Fauna</td><td colspan="2">Vulnerable</td><td>Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
<tr><td rowspan="5">1262_VZ5low2</td><td colspan="4">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td colspan="2">IBRA region</td></tr>
<tr><td colspan="2">Myotis macropus/Southern Myotis</td><td colspan="2">Any in NSW</td></tr>
<tr><td colspan="4">Variation options</td></tr>
<tr><td>Kingdom</td><td colspan="2">Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
</table>

		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1262_VZ6low3	**Like-for-like options**		
		Spp	IBRA region	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1262_VZ7moderate3	**Like-for-like options**		
		Spp	IBRA region	

<table>
<tr><td rowspan="9"></td><td rowspan="4"></td><td colspan="2">Myotis macropus/Southern Myotis</td><td>Any in NSW</td></tr>
<tr><td colspan="3">Variation options</td></tr>
<tr><td>Kingdom</td><td>Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
<tr><td>Fauna</td><td>Vulnerable</td><td>Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
<tr><td rowspan="5">1737_vz10moderate</td><td colspan="3">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td>IBRA region</td></tr>
<tr><td colspan="2">Myotis macropus/Southern Myotis</td><td>Any in NSW</td></tr>
<tr><td colspan="3">Variation options</td></tr>
<tr><td>Kingdom</td><td>Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
</table>

		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1740_VZ8moderate	**Like-for-like options**		
		Spp	IBRA region	
		Myotis macropus/Southern Myotis	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	1064_vz9high	**Like-for-like options**		
		Spp	IBRA region	

Phascolarctos cinereus/Koala	Any in NSW

Variation options

Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1262_VZ1moderate1

Like-for-like options

Spp	IBRA region
Phascolarctos cinereus/Koala	Any in NSW

Variation options

Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1262_VZ2moderate2	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1262_VZ3low1	**Like-for-like options**		
		Spp	IBRA region	

		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1262_VZ5low2	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1262_VZ7moderate3	**Like-for-like options**		
		Spp	IBRA region	
		Phascolarctos cinereus/Koala	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Fauna	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1740_VZ8moderate	**Like-for-like options**		
		Spp	IBRA region	

<table>
<tr><td rowspan="4"></td><td rowspan="4"></td><td colspan="2">Phascolarctos cinereus/Koala</td><td>Any in NSW</td></tr>
<tr><td colspan="3">Variation options</td></tr>
<tr><td>Kingdom</td><td>Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
<tr><td>Fauna</td><td>Vulnerable</td><td>Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter.
or
Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</td></tr>
<tr><td rowspan="5">Pterostylis chaetophora/ Pterostylis chaetophora</td><td rowspan="5">1262_VZ1moderate1</td><td colspan="3">Like-for-like options</td></tr>
<tr><td colspan="2">Spp</td><td>IBRA region</td></tr>
<tr><td colspan="2">Pterostylis chaetophora/Pterostylis chaetophora</td><td>Any in NSW</td></tr>
<tr><td colspan="3">Variation options</td></tr>
<tr><td>Kingdom</td><td>Any species with same or higher category of listing under Part 4 of the BC Act shown below</td><td>IBRA region</td></tr>
</table>

		Flora	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	1262_VZ2moderate2	**Like-for-like options**		
		Spp	IBRA region	
		Pterostylis chaetophora/Pterostylis chaetophora	Any in NSW	
		Variation options		
		Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
		Flora	Vulnerable	Karuah Manning, Hunter, Macleay Hastings, Mummel Escarpment and Upper Hunter. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

APPENDIX 5: VEGETATION PLOT DATA SHEETS

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier	Recorders			
Date	19 02 20	Glenthorne	P1	MB			
Zone 56	Datum GDA94	**IBRA region**	WP1830	**Photo #**		**Zone ID**	
Easting 449929	Northing 6466528	**Plot Dimensions**		**Orientation of midline from the 0 m point.**	226° SW mag		225
Likely Vegetation Class						Confidence: H M L	
Plant Community Type		V21 1262			EEC:	Confidence: H M L	

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	2
	Grasses etc.	13
	Forbs	8
	Ferns	0
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	21.1
	Shrubs	0.2
	Grasses etc.	59.4
	Forbs	2.5
	Ferns	0
	Other	30
High Threat Weed cover %		1.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot) dbh	Stem Classes and Hollows Number Tree Stem count	Hollows†
80 + cm	nil	0
50 – 79 cm	nil	
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	✓ 1111	0
10 – 19 cm	✓ ~~3~~40	
5 – 9 cm	✓ 20	
< 5 cm	✓ 200	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0 Tally space	total

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	40	1	50	15	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	22.2																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Recently burnt, regenerating following rain.
Euc tereticornis, Euc sideroxylon, Euc acmenoides
Euc carnea, Mel linariifolia
Many Euc seedlings 7100

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 19/02/20	Glenthorne	P1	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1 Setaria sphacelata	E	1	50		
F	2 Murdannia graminea	N	0.5	40		
F	3 Pratia purpurascens	N	0.2	400		
F	4 Tricoryne elatior	N	1	200		
G	5 Microlaena stipoides	N	35	1000		
V	6 Polymeria ~~ambescens~~ calycina	N	30	5000		
R	7 Lomandra filiformis	N	0.1	3		
F	8 Centella asiatica	N	0.2	40		
F	9 Dampiera stricta	N	0.3	70		
F	10 Dianella longifolia var. longifolia	N	0.1	2		
G	11 Entolasia marginata	N	0.1	1		
G	12 Grass 1 - Paspalidium distans	N	0.5	40		
	13 Camphor Laurel seedling	HTE	0.1	1		
G	14 ~~Grass 2~~ Ischaem australe	N	5	600		
R	15 Lomandra longifolia ||	N	0.2	2		
T	16 Euc tereticornis |||| 𝍸 𝍸 𝍸 𝍸 𝍸	N	20	29		
V	17 Carex sp.	N	1	300		
G	18 Imperata cylindrica	N	7	200		
T	19 Euc siderophloia ||||	N	1	4		
G	20 Echinopogon caespitosus	N	0.1	2		
T	21 Euc microcorys |	N	0.1	1		
F	22 Dichondra repens |	N	0.1	3		
	23 Oxalis corniculata	E	0.1	6		
G	24 ~~Poa~~ Panicum simile || 𝍸	N	0.2	7		
S	25 Pimelea linifolia ||	N	0.1	2		
V	26 ~~Cyperus sp.~~ Fimbristylis dichotoma	N	10	5000		
F	27 Hydrocotyle peduncularis	N	0.1	3		
	28 Cenchrus clandestinus | 𝍸	HTE	0.1	6		
	29 Paspalum dilatatum	HTE	1	50		
G	30 Paspalum orbiculare |	N	0.1	1		
	31 Paspalum urvillei 𝍸	E	1	60		
R	32 Juncus sp.	N	0.1	2		
	33 Solanum nigrum 𝍸	E	0.1	5		
S	34 Breynia oblongifolia ||	N	0.1	2		
	35 Verbena rigida 8	E	0.2	8		
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier	Recorders	
Date	19/02/20	Glenthorne	Plot 2	MB	
Zone 56	Datum GDA94	**IBRA region**		**Photo #**	**Zone ID**
Easting 450027	Northing 6466522	**Plot Dimensions**	m	**Orientation of midline from the 0 m point.**	226° SW

Likely Vegetation Class	WP832		Confidence: H M L
Plant Community Type	V21 1262	**EEC:**	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	7
	Grasses etc.	8
	Forbs	4
	Ferns	1
	Other	1
Sum of Cover of native vascular plants by growth form group	Trees	2.3
	Shrubs	16.3
	Grasses etc.	26
	Forbs	1.3
	Ferns	0.1
	Other	0.1
High Threat Weed cover %		62.9

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	0
50 – 79 cm	nil	
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	nil	0
10 – 19 cm	nil	
5 – 9 cm	||	
< 5 cm	||	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	Tally space 0	total 0

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	50	35	60	60	5	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	42																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Free Text Section for brief site description

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

0 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 19/02/20	Glenthorne	Plot 2	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
S	1 Acacia longifolia /	N	0.3	1		
T	2 Eucalyptus microcorys /	N	2	1		
T	3 Acacia melanoxylon ///	N	0.2	3		
S	4 Acacia ulicifolia /	N	6	30		
S	5 Leucopogon juniperinus	N	0.1	1		
	6 Senecio madagascariensis // 𝍸	HTE	0.1	7		
	7 Paspalum dilatatum	HTE	60	2000		
G	8 Eragrostis brownii	N	0.2	6		
	9 Verbena rigida	E	2	50		
S	10 Daviesia ulicifolia 1	N	0.1	1		
	11 Lantana camara /	HTE	0.1	1		
G	12 Poa affinis /	N	1	40		
G	13 Microlaena stipoides	N	6	400		
	14 Axonopus fissifolius	HTE	2	200		
	15 Andropogon virginicus	HTE	0.5	20		
	16 Conyza bonariensis // 𝍸 𝍸	E	0.1	20		
G	17 Panicum simile	N	10	300		
F	18 Tricoryne elatior	N	1	50		
	19 Sporobolus africanus ////	E	0.2	4		
	20 Briza subaristata	HTE	0.1	1 𝍸		
S	21 Hakea salicifolia x2	N	0.5	2		
F	22 Pratia purpurascens	N	0.1	30		
	23 Ochna serrulata /	HTE	0.1	1		
G	24 Entolasia marginata //	N	0.1	2		
F	25 Dianella longifolia var. long	N	0.1	1		
F	26 Centella asiatica	N	0.1	20		
G	27 Cymbopogon refractus ////	N	0.2	8		
G	28 Cynodon dactylon	N	8	300		
G	29 Eragrostis leptostachya	N	0.5	40		
Fern	30 Pteridium esculentum //	N	0.1	2		
T	31 Corymbia intermedia //	N	0.1	2		
S	32 Pimelea linifolia ////	N	0.2	4		
	33 ~~Centella asiatica~~					
K	34 Glycine microphylla ///	N	0.1	3		
	35 Oxalis corniculata // 𝍸	E	0.1	7		
S	36 Rubus parviflorus	N	0.1	1		
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier		Recorders		
Date	19/02/20	Glenthorne	P3		MB		
Zone 56	Datum GDA 94	**IBRA region**		**Photo #**		**Zone ID**	
Easting 450079	Northing 6466368	**Plot Dimensions**			**Orientation of midline from the 0 m point.**	182° S Magnetic	
Likely Vegetation Class		V2 11 [illegible]					Confidence: H M L
Plant Community Type		1262			EEC:		Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified. magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	6
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	1.6
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover %		80.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	nil
50 – 79 cm	nil	
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	✓ Coral tree	nil
10 – 19 cm	nil tick	
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	nil	total nil

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	1	5	4	2	1	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	2.6																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Mown lawn + landscape plants/trees

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

m^2 plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 19 02 20	Glenthorne	P3	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1 Axonopus fissifolius	HTE	5	200		
G	2 Eragrostis brownii ||	N	0.5	30		
~~G~~	3 Fimbristylis dichotoma |||	N	0.1	3		
G	4 Themeda australis 16 + ||| ||||	N	0.5	40		
G	5 Dicanthium sericeum 7	N	0.1	7		
	6 Sporobolus africanus ||| |||| ||||	E	5	200		
	7 Hypochaeris radicata | ||||	E	0.2	20		
	8 Cyperus sesquiflorus |	E	0.1	1		
G	9 Cynodon dactylon	N	0.2	20		
	10 Cenchrus clandestinus ||	HTE	0.1	2		
	11 Oxalis corniculata	E	0.1	3		
F	12 Wahlenbergia gracilis |	N	0.1	1		
R	13 Lomandra filiformis ||	N	0.1	2		
	14 Senecio madagascariensis	HTE	0.1	1		
	15 Buffalo - Stenotaphrum secundatum	HTE	75	8000		
G	16 Digitaria parviflora	N	0.1	3		
	17 Gamochaeta spicata	E	0.1	30		
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	**Plot Identifier**	**Recorders**	
Date	20.02.20	Glenthorne	P4	mB	
Zone 56	Datum GDA94	**IBRA region**		**Photo #**	**Zone ID**
Easting 449961	Northing 6466295	**Plot Dimensions**	m	**Orientation of midline from the 0 m point.**	155° SE magnetic
Likely Vegetation Class	WP 1836 PCT 1262				Confidence: H M L
Plant Community Type	V23			EEC:	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified. magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		**Sum values**
Count of **Native Richness**	Trees	0
	Shrubs	5
	Grasses etc.	9
	Forbs	9
	Ferns	2
	Other	5
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	1.0
	Grasses etc.	56.9
	Forbs	2.4
	Ferns	0.6
	Other	0.7
High Threat Weed cover %		9.5

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot) dbh	**Stem Classes and Hollows** Number Tree Stem count	Hollows†
80 + cm	nil	
50 – 79 cm	nil	nil
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	nil	
10 – 19 cm	nil	nil
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	nil Tally space	total nil

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate *if it* is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	**Litter cover (%)**					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	15	15	25	40	15	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	22																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Pasture, grazed.

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 20 02 20	Glenthorne	P4	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
S	1 Acacia ulicifolia 44	N	0.5	20		
F	2 Tricoryne elatior	N	0.5	300		
K	3 Hardenbergia violacea	N	0.2	6		
G	4 Themeda australis 60 + 20	N	5	80		
G	5 Capillipedium spicigerum	N	50	8000		
	6 Verbena rigida	E	1	700		
	7 Axonopus fissifolius	HTE	5	2000		
	8 Sporobolus africanus	E	0.5	20		
G	9 Cymbopogon refractus	N	0.5	20		
K	10 Glycine microphylla	N	0.1	9		
Fern	11 Pteridium esculentum	N	0.1	20		
	12 Hypochaeris radicata	E	0.5	600		
R	13 Lomandra filiformis	N	0.1	3		
	14 Richardia brasiliensis	E	0.5	200		
F	15 St Johns wort - Hypericum gramineum	N	0.2	300		
	16 Gamochaeta spicata	E	0.1	4		
F	17 Goodenia bellidifolia subsp. argentea	N	0.5	1000		
Fern	18 Cheilanthes distans 10 +	N	0.5	200		
F	19 Opercularia aspera	N	0.3	40		
V	20 Fimbristylis dichotoma	N	0.2	20		
	21 Andropogon virginicus	HTE	4	70		
	22 Plantago lanceolata	E	0.2	40		
S	23 Pultenaea sp.	N	0.2	20		
G	24 Microlaena stipoides	N	0.5	60		
K	25 Hibbertia scandens	N	0.1	1		
	26 Senecio madagascariensis	HTE	0.1	20		
	27 Chloris gayana	HTE	0.1	3		
F	28 Centella asiatica	N	0.5	200		
	29 Blackberry - Rubus anglocandicans	HTE	0.1	6		
G	30 Paspalidium distans Conyza bonariensis	N E	0.3 0.1	20 5		
	31 Verbena litoralis	E	0.1	2		
S	32 Breynia oblongifolia	N	0.1	1		
	33 Paspalum dilatatum	HTE	0.2	8		
K	34 Desmodium varians	N	0.2	20		
S	35 Acacia longifolia	N	0.1	1		
S	36 Pimelea linifolia	N	0.1	4		
F	37 Drosera spathulata	N	0.1	2		
G	38 Aristida vagans	N	0.2	20		
G	39 Eragrostis leptostachya	N	0.1	8		
F	40 Pseuderanthemum variabile	N	0.1	2		

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Setaria sphacelata — E 25 3000

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

F Oxalis perennans — N 0.1 3

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F Hybanthus stellarioides — N 0.1 1

L Polymeria calycina — N 0.1 8

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name		Plot Identifier	Recorders	
Date	20 02 20	Glenthorne		P5	MB	
Zone 56	Datum GDA94	**IBRA region**		**Photo #**		**Zone ID**
Easting 450022	Northing 6466226	**Plot Dimensions** (e.g. 20 x 20 to 20 x 50)	m		**Orientation of midline from the 0 m point.**	160 S Magnetic °
Likely Vegetation Class		WP1838				Confidence: H M L
Plant Community Type		1262			EEC:	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	1
	Grasses etc.	8
	Forbs	3
	Ferns	1
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0.3
	Grasses etc.	20.9
	Forbs	0.6
	Ferns	0.2
	Other	0
High Threat Weed cover %		5.9

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	0
50 – 79 cm	nil	
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	nil	0
10 – 19 cm	nil	
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0 Tally space	total 0

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree,** only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	10	10	50	50	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	25																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Free Text Section for brief site description

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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50 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 20 02 20	Glenthorne	P5	MB

GF Code		Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1	Setaria sphacelata	E	55	600		
G	2	Capillipedium spicigerum	N	20	2800		
	3	Chloris gayana	HTE	5	600		
	4	Paspalum dilatatum	HTE	0.3	20		
	5	Verbena rigida	E	1	400		
	6	Oxalis corniculata 30+ ||| ||||	E	0.3	200		
	7	Sporobolus virginicus	E	0.2	20		
F	8	Centella asiatica	N	0.3	200		
F	9	Tricoryne elatior	N	0.2	80		
	10	Hypochaeris radicata	E	0.2	100		
	11	Axonopus virginicus	HTE	0.3	50		
G	12	Cynodon dactylon	N	0.2	20		
	13	Sonchus oleraceus |||	E	0.1	3		
	14	Senecio madagascariensis ||| |||| |||| ||||	HTE	0.2	40		
R	15	Lomandra filiformis |||	N	0.1	3		
	16	Paspalum mandiocanum ||	HTE	0.1	2		
S	17	Rubus parvifolius || |||| ||||	N	0.3	20		
	18	Plantago lanceolata || |||| |||| |||| ||||	E	0.2	30		
G	19	Themeda triandra ||||	N	0.2	9		
	20	Verbena litoralis +20 |||| ||||	E	0.3	40		
G	21	Eragrostis leptostachya ||	N	0.1	2		
	22	Verbena bonariensis 14	E	0.5	14		
	23	Conyza bonariensis 11+3+10+ || |||| ||||	E	0.3	40		
	24	Richardia brasiliensis ||	E	0.1	2		
Fern	25	Cheilanthes distans 20+ ||||	N	0.2	30		
F	26	Pratia purpurascens |||| |||| ||||	N	0.1	20		
V	27	Cyperus sp. 30+	N	0.1	40		
	28	Gamochaeta spicata || ||||	E	0.1	7		
	29	Setaria parviflora |||	E	0.1	3		
G	30	Digitaria parviflora |	N	0.1	1		
	31	Sida rhombifolia |||	E	0.1	3		
R	32	Lomandra longifolia |||	N	0.1	3		
	33	Taraxacum officinale |	E	0.1	1		
	34						
	35						
	36						
	37						
	38						
	39						
	40						

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, …100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier		Recorders	
Date	20/02/20	Glenthorne	P6		MB	
Zone 56	Datum GDA94	**IBRA region**		**Photo #**		**Zone ID**
Easting 449822	Northing 6466611	**Plot Dimensions**	m	**Orientation of midline from the 0 m point.**	347° N	
Likely Vegetation Class		V25 1262				Confidence: H M L
Plant Community Type				**EEC:**		Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	6
	Forbs	2
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	10.6
	Forbs	0.4
	Ferns	0
	Other	0
High Threat Weed cover %		33.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	nil
50 – 79 cm	nil	
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	nil	nil
10 – 19 cm	nil	
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	nil	total nil

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	2	1	1	2	2	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	1.6																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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n² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 20 02 20	Glenthorne	P6	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1 Paspalum dilatatum	HTE	30	2000		
	2 Verbena litoralis	E	.03	50		
G	3 Cynodon dactylon	N	10	2000		
	4 Chamaesyce prostrata |||	E	0.1	3		
	5 Hypochaeris radicata	E	0.3	400		
	6 Summer grass - Digitaria sanguinalis	E	6	1000		
✓	7 Cyperus polystachyos	N	0.1	1		
	8 Senecio madagascariensis	HTE	0.2	200		
	9 Conyza bonariensis	E	0.2	60		
	10 Xanthium occidentale	HTE	0.5	200		
	11 Sporobolus africanus 7	E	1	40		
	12 Portulaca oleracea	E	0.2	2		
	13 Aster subulata ||	E	0.2	50		
	14 Cyperus eragrostis	HTE	2	300		
	15 Chloris gayana	HTE	0.2	20		
✓	16 Fimbristylis dichotoma ||𝍸𝍸	N	0.1	20		
✓	17 Axonopus fissifolius	HTE	0.3	30		
	18 Eleusine indica	E	0.5	40		
F	19 Alternanthera denticulata || 𝍸 𝍸	N	0.2	20		
	20 Richardia brasiliensis	E	0.1	60		
F	21 Centella asiatica || 𝍸	N	0.2	7		
G	22 Paspalidium distans 7	N	0.1	1		
	23 Setaria parviflora	E	0.2	40		
R	24 Juncus usitatus 10	N	0.2	10		
	25 Digitaria violascens	E	50	7000		
G	26 Eragrostis leptostachya ||	N	0.1	2		
	27 Solanum nigrum	E	0.1	2		
	28					
	29					
	30					
	31					
	32					
	33					
	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, …100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier			Recorders	
Date	20 02 20	Glenthorne	P7			MB	
Zone 56	Datum	**IBRA region**		**Photo #**		**Zone ID**	
Easting 449805	Northing 6466701	**Plot Dimensions**	m		**Orientation of midline from the 0 m point.**	Magnetic °	
Likely Vegetation Class		VZ 8 Dam					Confidence: H M L
Plant Community Type		1740				EEC:	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		**Sum values**
Count of **Native Richness**	**Trees**	1
	Shrubs	0
	Grasses etc.	7
	Forbs	7
	Ferns	0
	Other	0
Sum of **Cover** of native vascular plants by growth form group	**Trees**	5
	Shrubs	0
	Grasses etc.	48
	Forbs	36.9
	Ferns	0
	Other	0
High Threat Weed cover %		1.1

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	**Stem Classes and Hollows**	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	nil
50 – 79 cm	nil	
30 – 49 cm	✓ 1	Hollows 20cm+
20 – 29 cm	nil	nil
10 – 19 cm	nil	
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	nil Tally space	total nil

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	**Litter cover (%)**					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	0	0	0	0	0	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	0																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Free Text Section for brief site description

Dam

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

0 m^2 plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	20 02 20	Glenthorne	P7	MB

GF Code		Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
G	1	Paspalum distichum	N	25	5000		
F	2	Persicaria strigosa	N	25	4000		
F	3	Commelina cyanea	N	0.2	20		
	4	Nymphaea alba	E	15	1000		
	5	Myriophyllum aquaticum Parrot Feather	E	8	2000		
F	6	Ludwigia peploides	N	10	1000		
F	7	Ranunculus inundatus	N	0.5	400		
	8	Cyperus eragrostis |||	HTE	0.1	3		
F	9	Persicaria lapathifolia	N	0.5	50		
V	10	Eleocharis ? acuta ?	N	20	4000		
	11	Echinochloa crusgalli	E	0.2	7		
F	12	Philydrum lanuginosum	N	0.5	30		
R	13	Juncus usitatus	N	0.5	60		
V	14	Carex appressa	N	0.2	3		
G	15	Cynodon dactylon	N	2	200		
	16	Paspalum urvillei	E	0.5	30		
V	17	Cyperus polystachyos 10+ ~~||||~~	N	0.5	20		
	18	Paspalum dilatatum	HTE	1	200		
F	19	Centella asiatica	N	0.2	20		
	20	Cyperus brevifolius	E	0.1	6		
V	21	Cyperus exaltatus | ~~||||~~	N	0.3	6		
T	22	Eucalyptus tereticornis	N	5	1		
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N**: native, **E**: exotic, **HTE**: high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Form version designed 15 September 2017

Printed 18 February 2020

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier	Recorders
Date	21 02 20	Glenthorne	P8	MR

Zone 56	Datum GDA94	**IBRA region**		**Photo #**		**Zone ID**
Easting 449832	Northing 6466204	**Plot Dimensions** (eg. 20 x 20 to 20 x 50)	m	**Orientation of midline from the 0 m point.**	40 NE Magnetic	

Likely Vegetation Class	WP1844 V29		Confidence: H M L
Plant Community Type	1064	**EEC:**	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	3
	Shrubs	4
	Grasses etc.	10
	Forbs	10
	Ferns	0
	Other	6
Sum of Cover of native vascular plants by growth form group	Trees	38.3
	Shrubs	45.1
	Grasses etc.	17.5
	Forbs	8.1
	Ferns	0
	Other	6.5
High Threat Weed cover %		3.3

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	nil
50 – 79 cm	✓ 2 ||	
30 – 49 cm	✓ 4 ||||	Hollows 20cm+
20 – 29 cm	✓ 10 |||| ||||	nil
10 – 19 cm	✓ |||| |||| |||| 30	
5 – 9 cm	✓ 5 ||||	
< 5 cm	0	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	1	total 1

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	20	0	0	0	2	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	4.4																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date	Glenthorne	P8	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
S	1 Melaleuca styphelioides	N	25	8		
T	2 Corymbia intermedia |	N	3	1		
T	3 Acacia melanoxylon ||	N	0.3	2		
T	4 Melaleuca linariifolia |||||	N	35	~~31~~ 8		
L	5 Maclura cochinchinensis	N	2	1		
other	6 Dendrobium linguiforme || 𝍸 𝍸 𝍸	N	0.2	30		
	7 Camphor Laurel	HTE	0.1	1		
Other	8 Notothixos incanus Sm glaucous ||	N	0.2	2		
V	9 Carex appressa	N	3	60		
	10 Myriophyllum aquaticum	E	2	70		
F	11 Commelina cyanea	N	1	400		
L	12 Parsonsia straminea ||| 𝍸 𝍸	N	2	20		
F	13 Pratia purpurascens	N	2	1000		
F	14 Dichondra repens	N	0.5	300		
	15 Ochna serrulata |||	HTE	0.1	3		
F	16 Persicaria lapathifolia	N	3	40		
	17 Cyperus eragrostis	HTE	0.5	200		
F	18 Ranunculus inundatus	N	0.2	300		
	19 Aster subulata ||| 𝍸 𝍸	E	0.1	20		
L	20 Eustrephus latifolius |	N	0.1	1		
R	21 Juncus usitatus	N	0.5	200		
S	22 Pittosporum undulatum |	N	0.1	1		
G	23 Microlaena stipoides	N	3	300		
V	24 Carex longebrachiata	N	5	200		
G	25 Entolasia marginata	N	0.5	40		
F	26 Ludwigia peploides ||| 𝍸	N	0.2	8		
	27 Lantana camara |	HTE	0.1	1		
	28 Ligustrum sinense |	HTE	0.1	1		
	29 Rumex crispus ||| 𝍸 𝍸	E	0.2	20		
	30 Solanum pseudocapsicum || 𝍸	E	0.2	7		
R	31 Eleocharis	N	2	300		
F	32 Alternanthera denticulata	N	0.3	60		
	33 Sida rhombifolia	E	0.1	30		
G	34 Cynodon dactylon	N	3	400		
V	35 Carex inversa	N	0.3	200		
F	36 Centella asiatica	N	0.5	500		
F	37 Flickweed - Rorippa laciniata	N	0.2	600		
	38 Axonopus fissifolius	HTE	2	400		
F	39 Hydrocotyle sibthorpioides	N	0.2	200		
	40 Xanthium occidentale	HTE	0.1	60		

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

m^2 plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 21.02.20	Glenthorne	P8	mB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1 Verbena litoralis	E	0.1	20		
	2 Digitaria violascens	E	0.3	30		
	3 Setaria parviflora	E	0.3	200		
R.	4 Fimbristylis dichotoma	N	0.1	8		
	5 Conyza bonariensis III	E	0.1	20		
	6 Plantago lanceolata	E	0.1	20		
	7 Gamochaeta spicata	E	0.1	20		
V	8 Cyperus polystachyos III	N	0.1	3		
	9 Juncus cognatus IIII	E	0.1	4		
other	10 Amyema sp. IIII	N	2	4		
S	11 melaleuca nodosa	N	20	23		
	12 Paspalum dilatatum	HTE	0.3	40		
	13 Cyperus brevifolius	E	0.1	30		
	14					
	15					
	16					
	17					
	18					
	19					
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	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	**Plot Identifier**	**Recorders**	
Date	21/02/20	Glenthorne	P9	MB	
Zone 56	Datum	**IBRA region**		**Photo #**	**Zone ID**
Easting 449853	Northing 6466335	**Plot Dimensions**	18 x 22.2m	**Orientation of midline from the 0 m point.**	346° Magnetic
Likely Vegetation Class		V22			Confidence: H M L
Plant Community Type		1262		**EEC:**	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		**Sum values**
Count of Native Richness	**Trees**	9
	Shrubs	10
	Grasses etc.	9
	Forbs	8
	Ferns	1
	Other	7
Sum of Cover of native vascular plants by growth form group	**Trees**	53.6
	Shrubs	2.8
	Grasses etc.	3
	Forbs	1.2
	Ferns	0.5
	Other	1.8
High Threat Weed cover %		15

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	**Stem Classes and Hollows**		
dbh	Number Tree Stem count		Hollows†
80 + cm	✓	120 |||	1
50 – 79 cm	✓	|||	
30 – 49 cm	✓	𝍸	Hollows 20cm+
20 – 29 cm	✓	| 𝍸	6
10 – 19 cm	✓	𝍸 𝍸 ||	
5 – 9 cm	✓	||||	
< 5 cm	✓	𝍸 𝍸	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	13	Tally space	total 13

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	**Litter cover (%)**					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	90	100	100	100	100	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	98																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Eriksson Lane forested corridor
Unsealed Road in centre
BT Possum Roadkill

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

m² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date	21 02 20	Glenthorne	P9	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
T	1 Eucalyptus saligna |||	N	8	12		
T	2 Euc microcorys |||| ||||	N	29	8		
	3 Lantana camara 8+6+	HTE	4	14		
Fern	4 Pteridium esculentum	N	0.5	30		
L	5 Morinda jasminoides	N	0.2	3		
L	6 Clematis aristata	N	0.2	2		
L	7 Geitonoplesium cymosum	N	0.5	40		
G	8 Imperata cylindrica	N	1	300		
S	9 Breynia oblongifolia 10+8 ||| |||| ||||	N	1	40		
T	10 Corymbia intermedia |||| ||||	N	2	8		
T	11 Melia azedarach 6	N	0.1	50		
G	12 Oplismenus aemulus	N	0.5	200		
F	13 Pseuderanthemum variabile ||||	N	0.1	20		
R	14 Lomandra filiformis || ||||	N	0.1	7		
	15 Ehrharta erecta	HTE	4	2000		
	16 Bidens pilosa	HTE	2	1000		
	17 Ipomea indica	HTE	5	60		
L	18 Hardenbergia violacea || |||| ||||	N	0.5	20		
	19 Passiflora suberosa		HTE	0.5	30		
L	20 Eustrephus latifolius	N	0.2	20		
	21 Paspalum mandiocanum	HTE	1	200		
G	22 Entolasia marginata ||||	N	0.3	20		
R	23 Lomandra longifolia |||| ||||	N	0.5	10		
F	24 Desmodium gunnii	N	0.3	40		
F	25 Pratia purpurascens	N	0.3	300		
L	26 Billardiera scandens	N	0.1	2		
T	27 Eucalyptus carnea ||| |||| ||||	N	15	20		
	28					
F	29 Hybanthus stellarioides 7	N	0.1	7		
	30 Sida rhombifolia	E	0.2	300		
T	31 Euc globoidea || ||||	N	5	7		
	32 Camphor laurel ||	HTE	0.1	2		
	33 Blackberry - Rubus anglocandicans ||||	HTE	0.1	4		
S	34 Pultenaea linophylla	N	0.1	1		
T	35 Tuckeroo - Cupaniopsis anacardioides |||	N	0.1	3		
	36 Jacaranda mimosifolia	E	0.2	2		
	37 Ochna serrulata |||| ||||	HTE	0.2	9		
F	38 Geranium homeanum	N	0.1	20		
G	39 Cynodon dactylon	N	0.1	5		
S	40 Jacksonia scoparia |||| ||||	N	0.5	5		

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 21 02 20	Glenthorne	P9	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
S	1 Rapanea howittiana IIII	N	0.3	4		
F	2 Oxytes brachypodum - Desmodium III	N	0.1	30		
V	3 Glycine microphylla	N	0.1	20		
G	4 Paspalidium distans	N	0.1	2		
T	5 Glochidion ferdinandi II	N	0.1	2		
T	6 Alphitonia excelsa	N	0.3	1		
F	7 Dichondra repens	N	0.1	40		
	8 ~~Pratia purpurascens~~					
F	9 Desmodium varians	N	0.1	30		
S	10 Polyscias sambucifolia III ~~IIII~~	N	0.2	8		
	11 Ligustrum sinense II	HTE	0.1	2		
S	12 Pittosporum revolutum	N	0.1	1		
S	13 Indigofera australis	N	0.1	1		
S	14 Clerodendrum tomentosum IIII	N	0.3	5		
S	15 Acacia implexa III	N	0.1	3		
L	16 Hibbertia scandens	N	0.1	2		
S	17 Rubus parviflorus IIII	N	0.1	4		
A	18 Entolasia stricta	N	0.3	30		
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
	27					
	28					
	29					
	30					
	31					
	32					
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	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no: 1 of

Date	21.02.20	**Survey Name**	**Plot Identifier**	**Recorders**
Zone 56	Datum GDA94	Glenthorne	P10	MB
Easting 649840	Northing 6466741	**IBRA region**		**Photo #**
		Plot Dimensions	m	**Zone ID**
				Orientation of midline from the 0 m point. Magnetic °
Likely Vegetation Class	V28			Confidence: H M L
Plant Community Type	PCT 1262		**EEC:**	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		**Sum values**
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	5
	Forbs	3
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	10.6
	Forbs	0.3
	Ferns	0
	Other	0
High Threat Weed cover %		85.4

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	**Stem Classes and Hollows**	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	0
50 – 79 cm	nil	
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	nil	0
10 – 19 cm	nil	
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0 Tally space	total 0

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	**Litter cover (%)**					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	10	5	5	15	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	8																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

m^2 plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 21/02/20	Glenthorne	P10	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.		N, E or HTE	Cover	Abund	stratum	voucher
	1 Oxalis corniculata		E	0.3	300		
	2 Xanthium occidentale	𝍷𝍷	HTE	0.1	20		
	3 Paspalum dilatatum		HTE	60	3000		
	4 Digitaria sanguinalis		E	5	500		
	5 Sporobolus africanus	𝍷𝍷𝍷𝍷 𝍸 𝍸 𝍸 𝍸	E	1	50		
F	6 Dysphania pumilo	𝍷 𝍸 𝍸	N	0.1	70		
G	7 Dichanthium sericeum		N	5	400		
	8 Axonopus fissifolius		HTE	25	2000		
	9 Cenchrus clandestinus		HTE	0.1	10		
*	10 Physalis ixocarpa	100	E	0.3	100		
G	11 Cynodon dactylon		N	5	2000		
	12 Setaria pumila		E	0.1	20		
	13 Senecio madagascariensis	𝍷𝍷𝍷 𝍸 𝍸 𝍸 𝍸	HTE	0.2	30		
	14 Sonchus oleraceus	𝍷𝍷𝍷	E	0.1	3		
	15 Verbena bonariensis	𝍷𝍷𝍷	E	0.1	3		
R	16 Fimbristylis dichotoma	𝍸	N	0.3	400		
	17 Cyperus brevifolius	6	E	0.1	6		
F	18 Einadia trigonos	4	N	0.1	4		
G	19 Microlaena stipoides 10+	𝍷𝍷𝍷	N	0.2	20		
	20 Conyza bonariensis	𝍷 𝍸	E	0.1	6		
	21 Rumex crispus	𝍷𝍷𝍷𝍷	E	0.1	4		
V	22 Carex inversa	𝍷𝍷𝍷𝍷 𝍸	N	0.1	9		
F	23 Desmodium varians	𝍷𝍷𝍷	N	0.1	4		
	24 Digitaria violascens		E	10	1000		
	25						
	26						
	27						
	28						
	29						
	30						
	31						
	32						
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	40						

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, …, 10, 15, 20, 25, …100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier	Recorders	
Date	22 02 20	Glenthorne	PIP	MB	
Zone 56	Datum	IBRA region		Photo #	
				Zone ID	
Easting 449836	Northing 6466813	Plot Dimensions	25x16 40x25	Orientation of midline from the 0 m point.	71 °E Magnetic °

Likely Vegetation Class	V27		Confidence: H M L
Plant Community Type	1262	EEC:	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	6
	Shrubs	1
	Grasses etc.	7
	Forbs	8
	Ferns	0
	Other	4
Sum of Cover of native vascular plants by growth form group	Trees	51.2
	Shrubs	0.1
	Grasses etc.	6.5
	Forbs	32.1
	Ferns	0
	Other	0.7
High Threat Weed cover %		16.6

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	✓ |	|
50 – 79 cm	✓ |||	
30 – 49 cm	✓ || 卌 卌	Hollows 20cm+
20 – 29 cm	✓ ||||	nil
10 – 19 cm	✓ ||	
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	9 Tally space	total 9

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

8m

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	100	90	80	40	95	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	81																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

12 21 30 37

5 10 15

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Live tereticornis dom patch with 3 large Tallowoods. Grazed regularly

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Form version designed 15 September 2017

Printed 18 February 2020

_ m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 22.02.20	Glenthorne	P10	MB

GF Code		Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1	Araujia sericifera |||	HTE	0.2	4		
	2	Sida rhombifolia	E	25	4000		
L	3	Glycine microphylla	N	0.2	5		
F	4	Einadia trigonos	N	10	3000		
F	5	Commelina cyanea	N	20	3000		
G	6	Cynodon dactylon	N	0.5	200		
F	7	Dichondra repens	N	1	400		
G	8	Oplismenus aemulus	N	2	700		
	9	Ehrharta erecta	HTE	6	1000		
	10	Amaranthus viridis	E	1	500		
	11	Asparagus plumosus ||||	HTE	0.1	4		
F	12	Dysphania pumilio	N	0.3	60		
G	13	Entolasia marginata	N	0.3	40		
	14	Leonurus japonicus	E	5	2000		
G	15	Oplismenus imbecillis	N	3	700		
G	16	Microlaena stipoides |||| 𝍸 𝍸	N	0.5	50		
	17	Solanum mauritianum ||||	E	0.2	4		
	18	Camphor laurel || 𝍸	HTE	10	7	C, G	
T	19	Corymbia intermedia 𝍸	N	8	5		
T	20	Eucalyptus pilularis |	N	10	1		
	21	Sporobolus africanus 𝍸	E	0.2	5		
other	22	Dendrobium speciosum ||	N	0.3	2		
T	23	Eucalyptus tereticornis (? maybe seeana ?) |||	N	18	3		
T	24	Eucalyptus microcorys |	N	15	1		
	25	Phyllanthus tenellus	E	1	600		
F	26	Pseuderanthemum variabile || 𝍸	N	0.1	7		
S	27	Breynia oblongifolia ||	N	0.1	2		
F	28	Geranium homeanum |||| 𝍸 𝍸	N	0.1	20		
	29	Cirsium vulgare |	E	0.1	1		
	30	Tagetes minuta 20+30 | 10	E	1	300		
F	31	Alternanthera denticulata |||| 𝍸	N	0.3	9		
V	32	Cyperus imbecillis | 𝍸	N	0.1	6		
F	33	Rumex brownii ||	N	0.1	2		
	34	Bromus catharticus 𝍸	E	0.1	5		
T	35	Melia azedarach |||	N	0.1	3		
L	36	Eustrephus latifolius ||	N	0.1	2		
	37	Lantana camara ||||	HTE	0.1	4		
	38	Digitaria sanguinalis	E	0.5	70		
L	39	Polymeria calycina |||	N	0.1	3		
T	40	Acacia melanoxylon |	N	0.1	1		

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.

Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*

Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

	Galinsoga parviflora	E	0.1	80

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Form version designed 15 September 2017

Printed 18 February 2020

R	Lomandra filiformis	N	0.1	1
	Solanum seaforthianum – climber	HTE	0.2	7

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier		Recorders	
Date	22.02.20	Glenthorne	P12		MB	
Zone 56	Datum	**IBRA region**		**Photo #**		**Zone ID**
Easting 449876	Northing 6466943	**Plot Dimensions**	m	**Orientation of midline from the 0 m point.**	271W Magnetic°	
Likely Vegetation Class		V210				Confidence: H M L
Plant Community Type		1737		EEC:		Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified. magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	4
	Forbs	4
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	85.7
	Forbs	4.7
	Ferns	0
	Other	0
High Threat Weed cover %		0.5

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	0	
50 – 79 cm	0	6
30 – 49 cm	0	Hollows 20cm+
20 – 29 cm	0	
10 – 19 cm	0	0
5 – 9 cm	0	
< 5 cm	0	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	0 Tally space	total 0

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	50	50	50	50	50	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	50																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

2 Shallow pond areas (artificial)
Both Typha dominated but Eastern most
pond in Eastern half has high proportion
of Bolboschoenus

Dense litter but also dense stems (living)

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 22:02:20	Glenthorne	PR	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
V	1 Bolboschoenus Caldwellii	N	65	10000		
R	2 Typha orientalis	N	20	3000		
	3 Saggittaria montevidensis	HTE	0.5	40		
F	4 Persicaria Strigosa	N	2	300		
F	5 Persicaria decipiens	N	0.5	40		
G	6 Paspalum distichum	N	0.4	60		
	7 Myriophyllum aquaticum	E	2	400		
F	8 Ludwigia peploides	N	2	200		
F	9 Alternanthera denticulata	N	0.2	20		
V	10 Eleocharis	N	0.3	30		
	11					
	12					
	13					
	14					
	15					
	16					
	17					
	18					
	19					
	20					
	21					
	22					
	23					
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	25					
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	32					
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	34					
	35					
	36					
	37					
	38					
	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, …, 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, …, 10, 20, 30, … 100, 200, …, 1000, …

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Form version designed 15 September 2017 Printed 18 February 2020

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	Plot Identifier	Recorders			
Date	22.02.20	Glenthorne	P13	MB			
Zone 56	Datum	**IBRA region**		**Photo #**		**Zone ID**	
Easting 449808	Northing 6462060	**Plot Dimensions** (eg. 20 x 50 or 20 x 20)	m	**Orientation of midline from the 0 m point.**	82° E Magnetic		
Likely Vegetation Class		WP1855 V2LP				Confidence: H M L	
Plant Community Type		1262		**EEC:**		Confidence: H M L	

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	2
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	0
	Grasses etc.	0.4
	Forbs	0.2
	Ferns	0
	Other	0
High Threat Weed cover %		85.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows	
dbh	Number Tree Stem count	Hollows†
80 + cm	nil	nil
50 – 79 cm	nil	
30 – 49 cm	nil	Hollows 20cm+
20 – 29 cm	nil	nil
10 – 19 cm	nil	
5 – 9 cm	nil	
< 5 cm	nil	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	nil Tally space	total nil

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	1	40	2	1	25	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	13.8																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Free Text Section for brief site description

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

00 m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 22/02/20	Glenthorne	P13	MB

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1 Paspalum dilatatum	HTE	45	4000		
	2 Axonopus fissifolius	HTE	30	3000		
	3 Senecio madagascariensis ||||	HTE	0.2	200		
	4 Verbena bonariensis	E				
F	5 Centella asiatica |||| ~~||||~~ ~~||||~~ ~~||||~~	N	0.2	60		
	6 Cenchrus clandestinus	HTE	10	800		
	7 Sporobolus africanus	E	0.5	80		
	8 Oxalis corniculata	E	0.5	300		
	9 Sida rhombifolia	E	0.2	30		
	10 Verbena officianalis	E	0.5	400		
	11 Digitaria violascens	E	5	800		
R	12 Juncus usitatus	N	0.1	3		
	13 Amaranthus viridus ||	E	0.1	2		
	14 Juncus cognatus +7 ~~||||~~ 16	E	0.2	30		
G	15 Cynodon dactylon	N	0.3	40		
	16 Plantago lanceolata ~~||||~~	E	0.1	5		
	17					
	18					
	19					
	20					
	21					
	22					
	23					
	24					
	25					
	26					
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	31					
	32					
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	38					
	39					
	40					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

BAM Plot – Field Survey Form

Site Sheet no: 1 of

		Survey Name	**Plot Identifier**	**Recorders**	
Date	22 02 20	Glenthorne	P14	MB	
Zone 56	Datum GDA94	**IBRA region**		**Photo #**	**Zone ID**
Easting 449814	Northing 6467203	**Plot Dimensions**	m	**Orientation of midline from the 0 m point.**	310 NW
Likely Vegetation Class		V24			Confidence: H M L
Plant Community Type		1264		**EEC:**	Confidence: H M L

Record easting and northing from 0m on the centre line. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m² plot)		**Sum values**
Count of **Native Richness**	**Trees**	0
	Shrubs	0
	Grasses etc.	2
	Forbs	4
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	**Trees**	0
	Shrubs	0
	Grasses etc.	0.7
	Forbs	0.9
	Ferns	0
	Other	0
High Threat Weed cover %		78.2

This table may be completed after entering data into available tools. It is not required while in the field.

BAM Attribute (20 x 50 m plot)	**Stem Classes and Hollows**	
dbh	Number Tree Stem count	Hollows†
80 + cm	0	0
50 – 79 cm	0	
30 – 49 cm	0	Hollows 20cm+
20 – 29 cm	0	0
10 – 19 cm	0	
5 – 9 cm	0	
< 5 cm	0	This size class records tree regeneration
Length of logs (m) (≥10 cm diameter, >50 cm in length)	✓ Tally space	total 0

*Counts apply when the number of tree stems within a size class is< or equal to 10. Estimates can be used when greater than 10 (eg 10,20,30,100,200) for a multi stemmed tree only the largest living stem is included in the count/estimate. Tree stems must be living.

† For **hollows** count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem or shrub.

Each size class is noted as present by the **living tree stems** only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species

BAM Attribute (1 x 1 m plots)	**Litter cover (%)**					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	5	5	10	10	20	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	10																			

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type		Landform Element		Landform Pattern		Microrelief	
Lithology		Soil Surface Texture		Soil Colour		Soil Depth	
Slope		Aspect		Site Drainage		Distance to nearest water and type	

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Free Text Section for brief site description

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

m² plot: Sheet _ of _	Survey Name	Plot Identifier	Recorders
Date 22 02 20	Glenthorne	P14	MR

GF Code		Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
	1	Cenchrus clandestinus	HTE	18	2000		
	2	Verbena officinalis	E	0.2	200		
	3	Paspalum dilatatum	HTE	35	3000		
	4	Axonopus fissifolius	HTE	25	2000		
F	5	Ranunculus inundatus	N	0.3	400		
R	6	Juncus usitatus ‖ ‖‖‖ ‖‖‖‖	N	0.2	80		
	7	Sporobolus africanus	E	5	300		
	8	Senecio madagascariensis	HTE	0.2	600		
F	9	Pratia purpurascens	N	0.4	300		
G	10	Cynodon dactylon	N	0.5	50		
	11	Bahai grass - Paspalum notatum ‖ ‖‖‖‖ ‖‖‖‖	E	0.2	20		
	12	Juncus cognatus ‖ ‖‖‖‖	E	0.1	7		
	13	Paspalum urvillei ‖ ‖‖‖‖ ‖‖‖‖ ‖‖‖‖	E	0.5	30		
F	14	Centella asiatica ‖‖	N	0.1	3		
	15	Digitaria violascens ‖	E	0.3	40		
F	16	Centella asiatica ‖‖	N	0.1	3		
	17						
	18						
	19						
	20						
	21						
	22						
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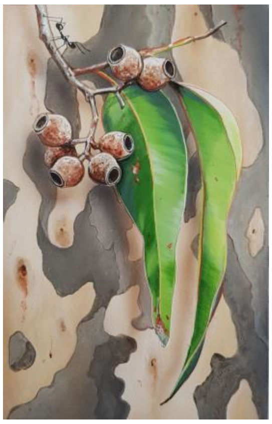
GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); ***Note:*** *0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m*
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

APPENDIX 6: MICROBAT CALL IDENTIFICATION REPORT



CORYMBIA ECOLOGY

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Email: amy@corymbiaecology.com.au
ABN 61854031078

BAT CALL ANALYSIS RESULTS

Jason Berrigan – J2019-31 Glenthorne Industrial BDAR

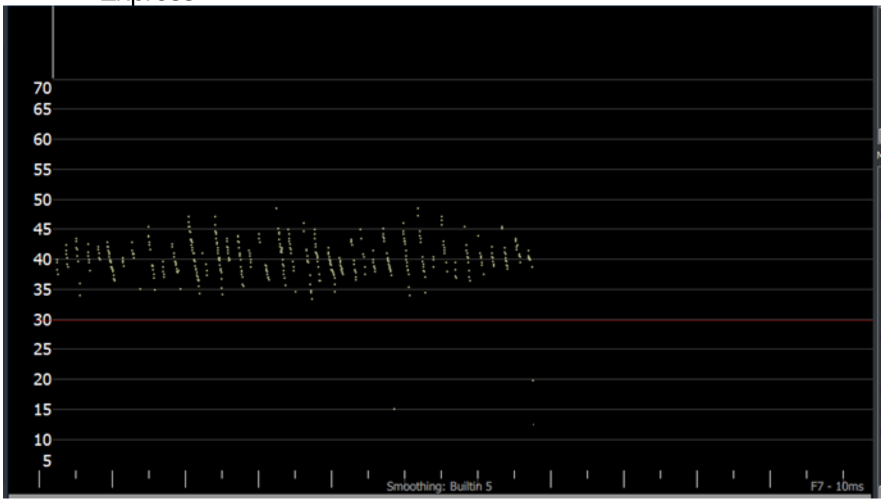
Species	Overall ID Confidence	Express 5/12/19 – 15/02/20	Swift 15/02/20-25/02/20	Notes
Myotis macropus	D	D	D	
Austronomus australis	D	D		
Chalinolobus gouldi	D	D		
Chalinolobus morio	D	D	Pr	
Miniopterus australis	D	D	D	
Miniopterus schreibersii oceanensis	Pr	Pr	Pr	Only short passes.
Vespadelus pumilus	D	D	D	
Vespadelus vulturnus / V. pumilus/ V. troughtoni	E	E		Calls not of high quality and difficult to distinguish between these species at 53khz.
Vespadelus darlingtoni	Po	Po		
Mormopterus (Ozimops) ridei	Po	Po		
Mormopterus norfolkensis	D	D	D	
Scotorepens orion / Scoteanax rueppellii	E	E	E	Difficult to differentiate between *Scoteanax rueppellii, Scotorepens orion*
Scotorepens sp.	Po		Po	If present in the Taree area, this species would be at the southern end of its range. Difficult to distinguish this species from others.

- D – definite; Pr – probable; Po – possible; E-either.
- Calls were analysed using Analook and Insight
- Example calls presented below are displayed in this report at F8.
- Analysis was completed on the 11th March 2020
- The following resources were consulted during analysis:
    - Pennay M., Law B., and Reinhold L. (2004) Bat Calls of NSW. DEC of NSW.
    - Corben C. (2009) Anabat Techniques Workshop, Titley Scientific.
    - Bat Call Identification Workshop (2019), Titley Scientific and Balance Environmental.
    - Personal experience analysing calls and collection of reference calls in NSW

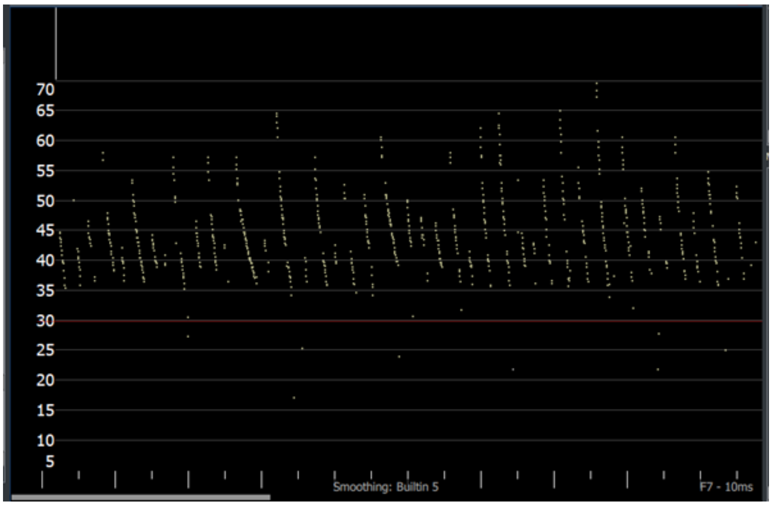
Examples of calls for definite and probable identified species

Myotis Macropus

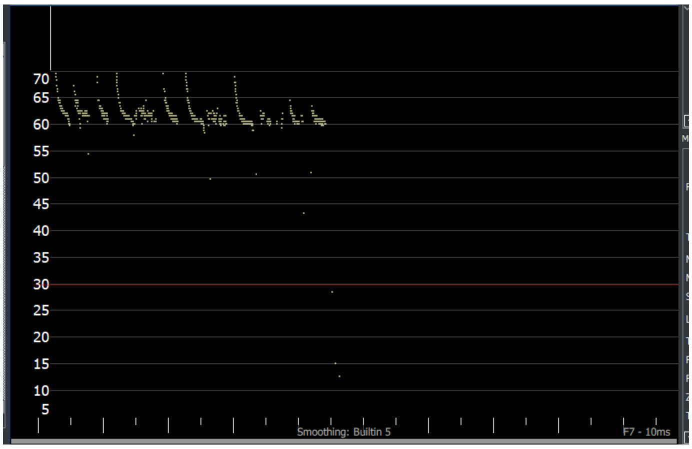
Express



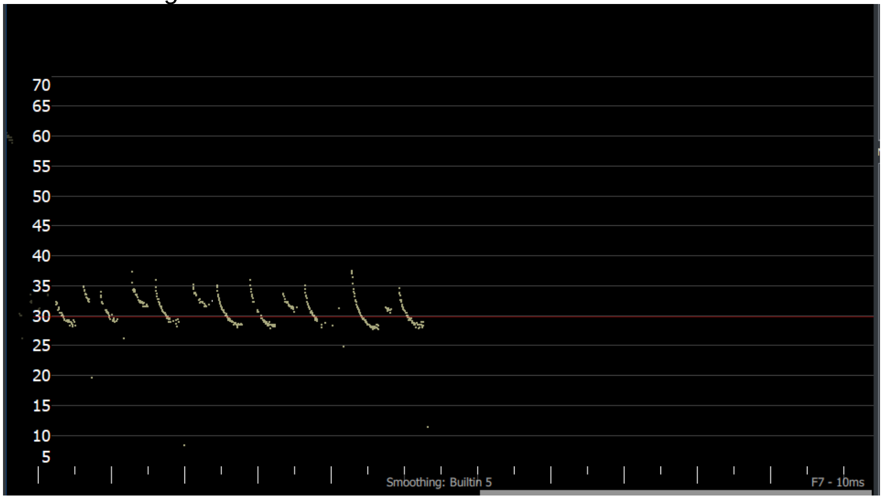
Swift



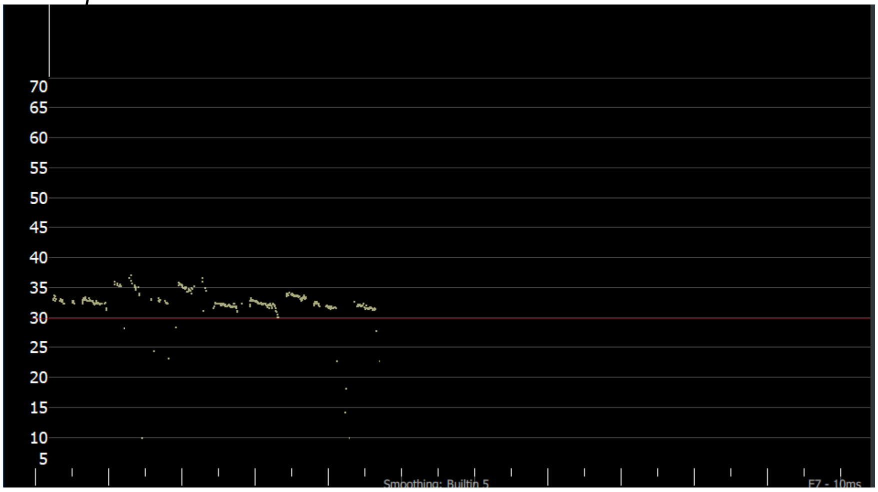
Miniopterus australis



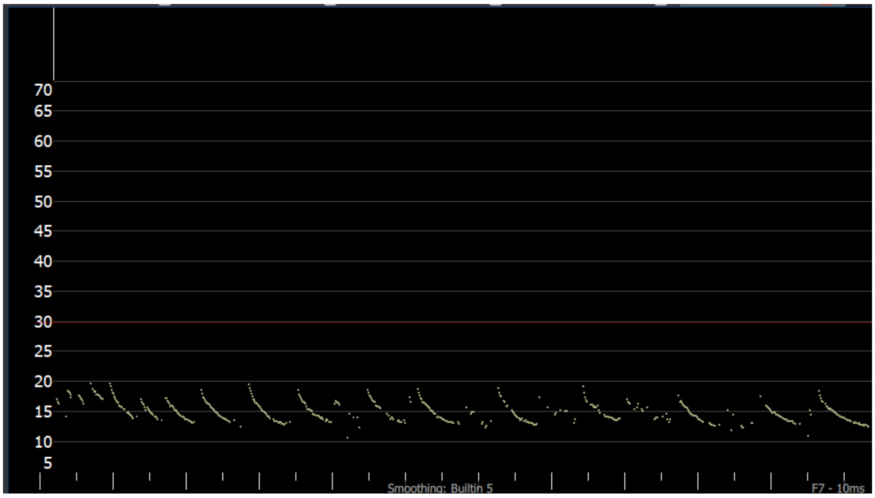
Chalinolobus gouldi



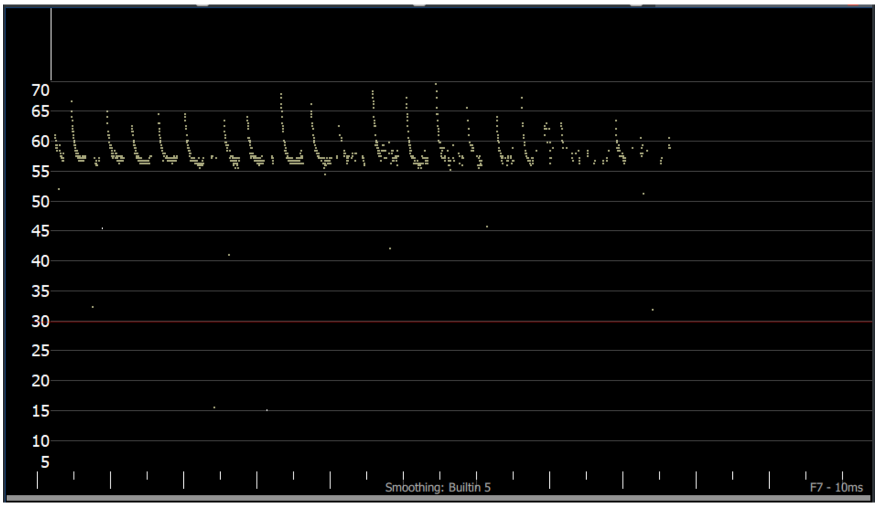
Mormopterus norfolkensis



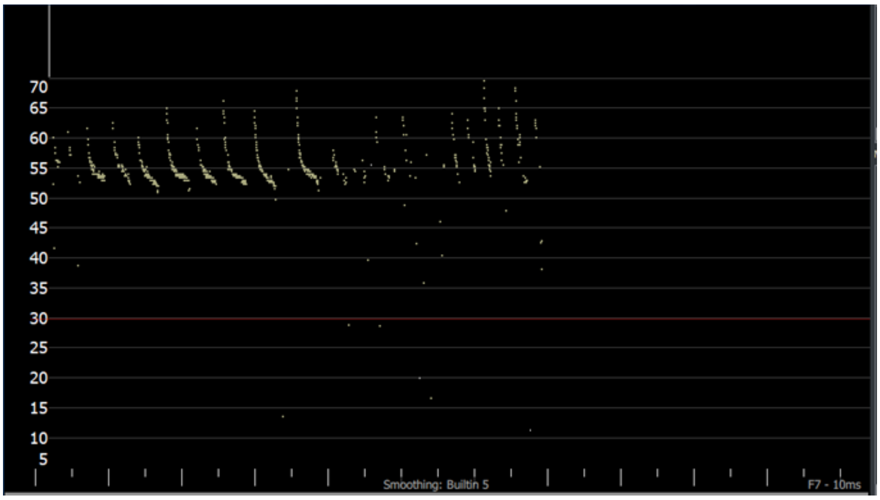
Austronomus australis



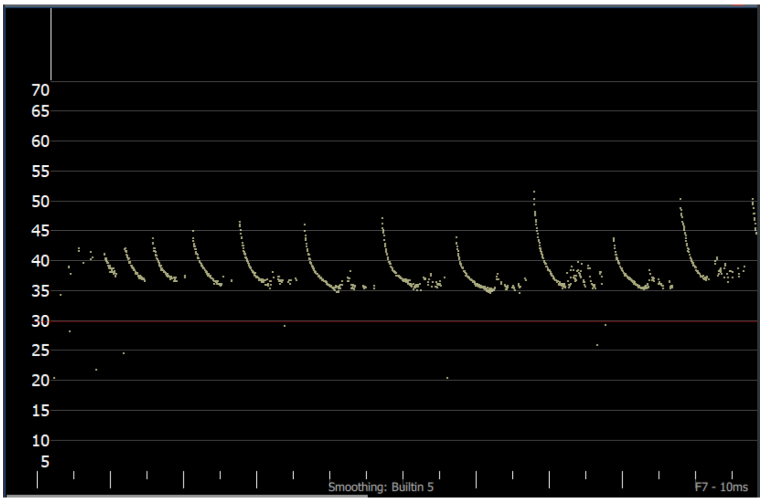
Vespadelus pumilus



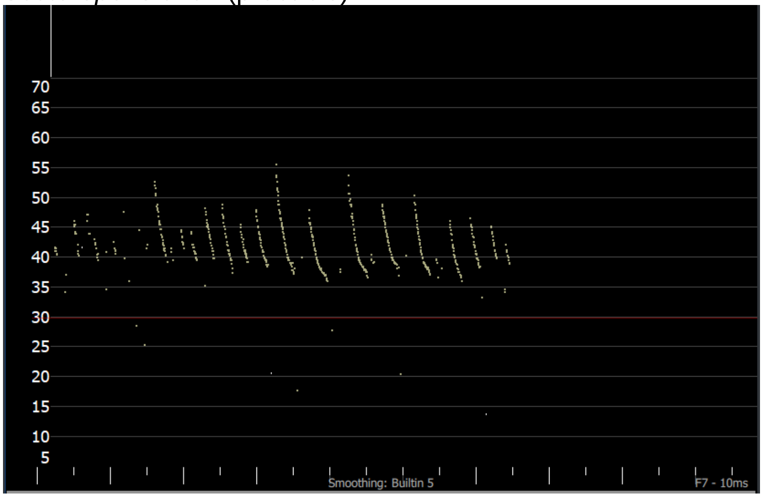
Chalinolobus morio



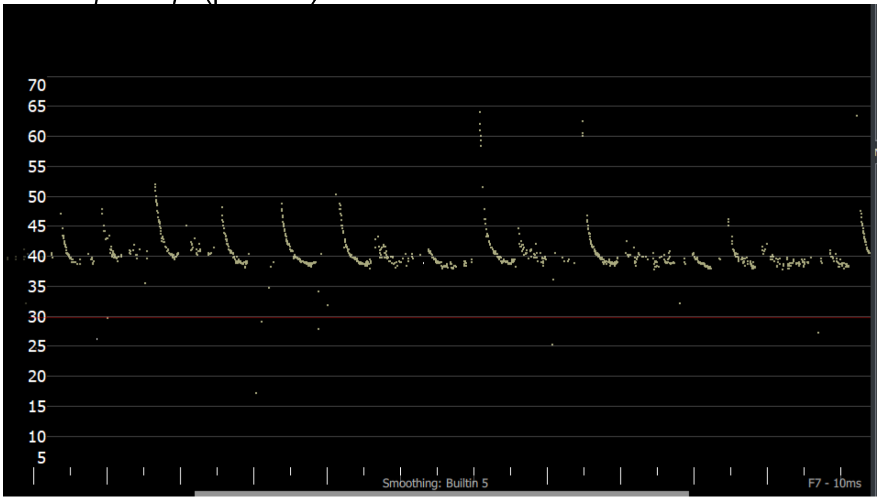
Scoteanax rueppellii (Possible)



Scotorepens orion (probable)



Scotorepens sp. (possible)



Appendix E – Stormwater Strategy

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Established 1981

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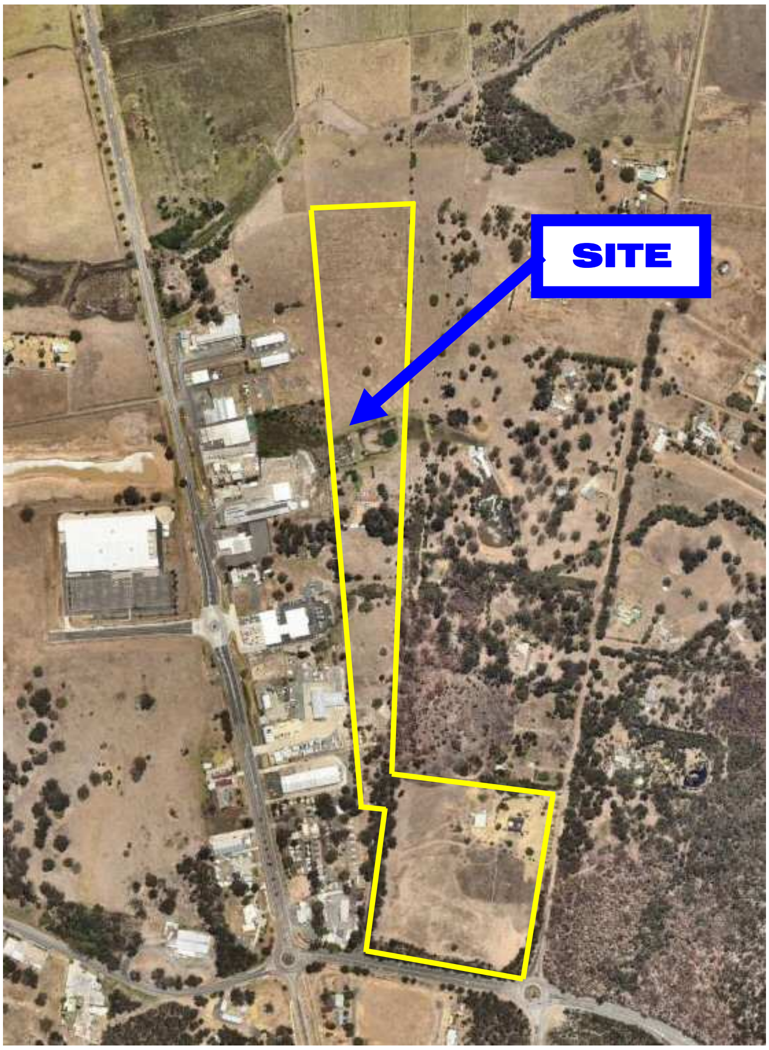
LSW
SURVEYORS, PLANNERS & ENGINEERS

Registered Surveyors
S. P. Whiteman B. Surv. M.I.S.
P. J. Lidbury B.Surv.(Hons.) B.Civ.Eng.(Hons.) M.I.S.

Civil Engineers
P. J. Lidbury B.Surv.(Hons.) B.Civ.Eng.(Hons.) M.I.S. MIEAust.
S. Hull B.Civ.Eng.(Hons.) GradIEAust

Your Ref:
Our Ref: 12013
Document Ref: 12013 SW Strategy
Date: 24th April 2020

STORMWATER STRATEGY FOR



PROPOSED REZONING & SUBDIVISION OF LOT 50 DP863972, LOT 2 DP827097 & LOT 20 DP836884 GLENTHORNE ROAD, TAREE SOUTH

April 2020
Issue 2

The Institution of Surveyors NSW

The Institution of Engineers Australia

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&

Jasbe Glenthorne

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1 INTRODUCTION

This document has been prepared to address stormwater quality and water quantity management in support of a re-zoning for a proposed subdivision of Lot 50 DP863972, Lot 2 DP827097 and Lot 20 DP836884, Glenthorne Road, Taree. This strategy will conceptually size stormwater water quality measures to comply with Mid-Coast Council's stormwater quality management objectives. Stormwater will be treated by a combination of traditional drainage measures, as well as water sensitive urban design (WSUD) techniques.

The 19.36ha site is located on the Eastern side of Manning River Drive and is bordered by existing rural land to the east and north, and existing industrial development to the west. The site is currently accessed by Eriksson Lane and Glenthorne Road off Manning River Drive.

The proposed development site is predominantly cleared with isolated vegetation throughout with an existing dwelling and associated shed on each of the lots. Lot 50 DP 863972 generally falls in a north-easterly direction towards Glenthorne Road at slopes between 3-10%. Within Lot 2 DP827097 there are two distinct water courses that drain in an easterly direction towards the Manning River. The northern-most is commonly known as Stitts Creek. This portion of the site generally exhibits steady grade of between 1-2%. Lot 20 DP836884 is known as Eriksson Lane.

The development proposes to create a staged industrial subdivision consisting of 12 lots, associated drainage reserves including water quality bioretention basins, as well as public roadway infrastructure.

This strategy is subject to final detailed design in accordance with final conditions of consent relating to any future development applications.

1.1 STORMWATER MANAGEMENT PERFORMANCE TARGETS

The objectives for water quality adopted for this Water Sensitive Design Strategy are based on *Greater Taree City Council Development Control Plan 2010* and discussion with council. The objective for water quality adopted is:

- Post development loads of Gross Pollutants are to be reduced to 90%, and TSS, TN and TP are to be reduced to less than or equal to pre-developed pollutant loads (i.e. “neutral or beneficial effect on water quality”).

Additionally, given the location of the site and the catchment, the objectives for water quantity are:

- Attenuate post-development peak discharges to maintain existing flows for all storm events up to and including the 100-year ARI rainfall event.

Council have confirmed each future lot is to provide their own treatment/detention measures.

1.2 PROPOSED STORMWATER QUALITY MANAGEMENT STRATEGY

This Water Sensitive Design Strategy proposes to incorporate a Water Sensitive Urban Design (WSUD) “treatment train” approach, consisting of control measures at source and end-of-line measures to manage the discharge of nutrients and pollutants leaving the site to be reduced to meet the objectives proposed above. These measures will also assist in reducing the post-developed peak flows exiting the site.

As mentioned previously each future lot is to provide its own water quality and detention to bring the future lot development back to 'Rural' pre-developed conditions. Therefore only the road reserve requires modelling for the subdivision. In order to treat the hardstand road surface, all flows captured in the underground stormwater system from the subject site will enter an end-of-line low flow inlet control (splitter pit), directing the three-month event to the respective water quality bioretention basins at the time of construction. Any flows exceeding the three-month event will be piped to the adjacent drainage corridor. If the capacities of the bioretention basins are exceeded, flows will be discharged via a weir or surcharge pit and into am adjacent detention basin, where overland flows will be conveyed to the existing water courses.

Geotechnical investigation has not yet been undertaken, however data sourced from *'Espade' - NSW Office of Environment & Heritage* site suggests that medium clay is predominant in the locality. As such it is proposed that no infiltration measures be utilised for proposed bio-retention basin.

Water quality during the construction stage will be addressed by a Stormwater Management plan prepared in accordance with NSW Department of Housing “Blue Book” 2004, and form part of the final detailed design drawings.

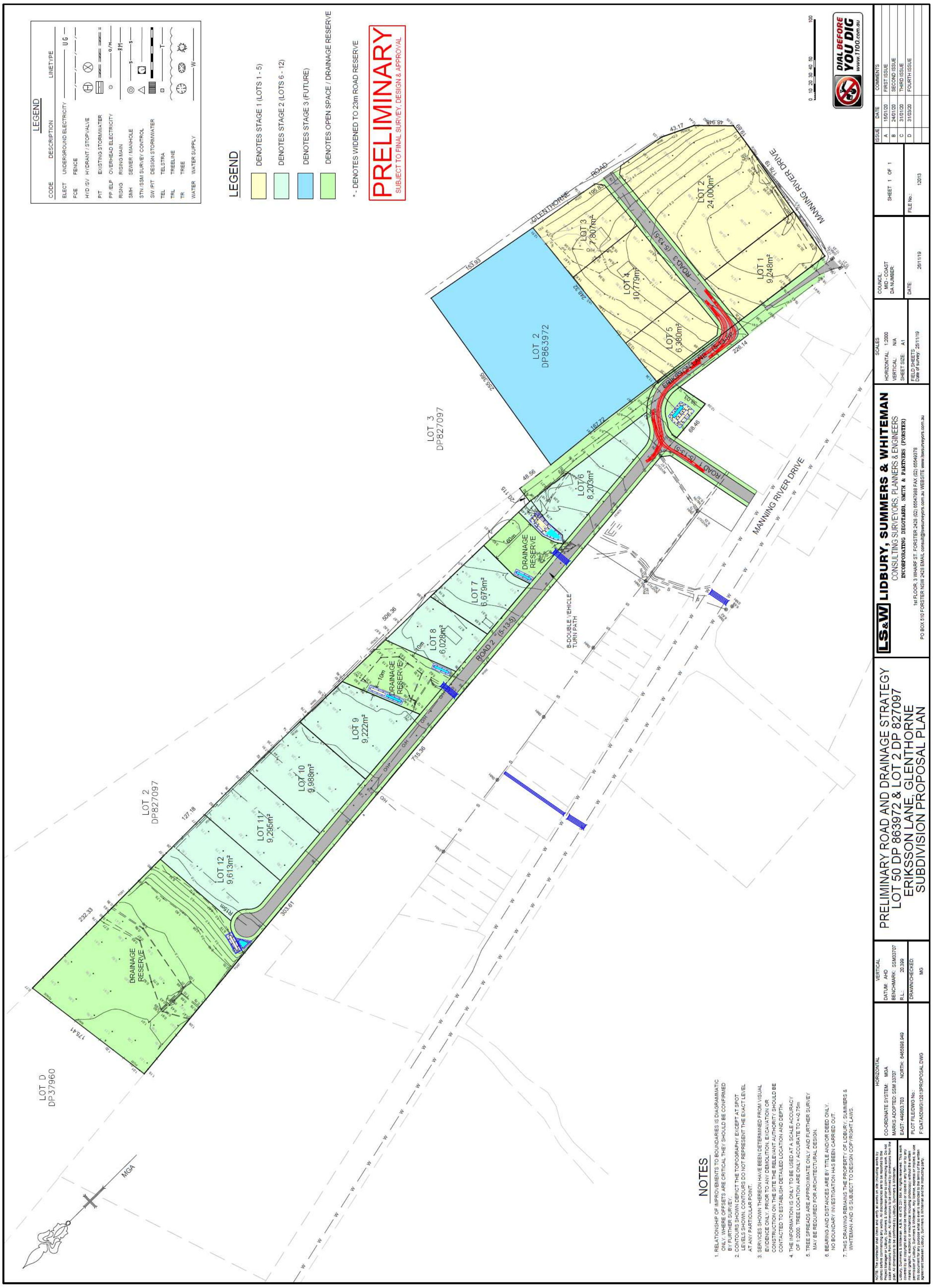


Figure 1 – Proposed Development

2 MUSIC WATER QUALITY MODEL

MUSIC (Model for Stormwater Improvement Conceptualisation) Version 6.2.1 was developed by the *Cooperative Research Centre for Catchment Hydrology (CRCCH).* MUSIC is a conceptual continuous simulation water quality assessment design tool that estimates stormwater pollutant generation from different land uses and routes the stormwater pollutants through a user defined network of stormwater treatment measures ('treatment train') to estimate the performance of a proposed water quality strategy in meeting specified water quality objectives.

As the name suggests, MUSIC is a conceptual tool that simplifies a complex system. MUSIC is based on observed average water quality data, and while all effort has been made to accurately model the proposed scenario, there should be some recognition of the variability in the final performance of the proposed water quality treatment measures to the estimated average results modelled in MUSIC.

To undertake the water quality assessment, a MUSIC model was established for the subject site with a pre and post development scenario. The results from the pre-development modelling were compared to the post development (with and without water quality treatment measures) modelling to assess the performance of the proposed stormwater quality controls to meet the water quality objectives stated above.

2.1 RAINFALL AND EVAPORATION

In order to establish a MUSIC model, rainfall and evaporation records in the vicinity of South Taree were sought.

Bureau of Meteorology records from the nearest Station 060030 (Patanga Close, Taree) were reviewed to determine that the average annual rainfall depth is approximately 1,177mm. *Bureau of Meteorology* records at this station provide complete 6 -minute pluviograph data. A 9-year consecutive period of data was required which included both wet and dry years with an average annual rainfall over the period being close to the historic average. Mid-Coast Council have provided a rainfall template to be adopted within the LGA with an average of 1326mm rainfall.

A 6-minute rainfall time step was considered necessary to more accurately model the performance of rainwater tanks and biofiltration devices. It should be noted that this water quality modelling exercise is a comparative assessment (i.e. pre-development versus post development with treatment). Therefore the actual rainfall year selected is not significant to the final outcome provided a reasonable correlation to the average rainfall depth is achieved.

Areal potential evapotranspiration values have also been provided in the template to be adopted within the LGA.

2.2 SOIL DATA AND MODEL CALIBRATION

A rainfall-runoff calibration was undertaken to match the predicted runoff to expected values. The model was calibrated in accordance with the *Guidelines for Water Sensitive Design Strategies - Mid-Coast Council October 2019* for a Soil Hydrologic Group 'D', which broadly corresponds to a Clay soil. The volumetric runoff coefficient for a free draining, 100% pervious site was 0.37 which is within the acceptable range for Rural (*'Managing Urban Stormwater', NSW EPA, 1997* and *Fletcher, 2004*). The adopted parameters are summarised below;

Table 1 – MUSIC Rainfall-Runoff parameters

Impervious Properties	Pervious properties	Groundwater Properties
Rainfall threshold: 1mm (roofs with first flush) and 1.5mm (roads and Impervious areas) Pervious areas 1mm	Soil storage:90 Initial Storage:25 Field Capacity: 65 Infiltration coefficient A: 135 Infiltration coefficient B: 4.0	Initial Depth: 10mm Daily recharge rate: 10% Daily baseflow rate: 10% Daily deep seepage rate: 0%

2.3 POLLUTANT CONCENTRATIONS

The pollutant concentrations adopted for existing-state and developed state modelling are shown in Table 2. The event mean concentrations (EMC's) for each of these land uses were derived from *Fletcher et al (2004)* and *Draft NSW MUSIC Modelling Guidelines.*

Table 2 – Pollutant Concentrations

Land use/ Surface Type	Storm flow Concentration Log_{10} mg/l	Std. Dev. Log_{10} mg/l	Baseflow Concentration Log_{10} mg/l	Std. Dev. Log_{10} mg/l
Rural				
Suspended Solids	1.95	0.32	1.15	0.17
Total Phosphorous	-0.66	0.25	-1.22	0.19
Total Nitrogen	0.30	0.19	-0.05	0.12
Roofs				
Suspended Solids	1.30	0.32	-	-
Total Phosphorous	-0.89	0.25	-	-
Total Nitrogen	0.30	0.19	-	-
Urban/Industrial				
Suspended Solids	2.15	0.32	1.20	0.17
Total Phosphorous	-0.60	0.25	-0.85	0.19
Total Nitrogen	0.30	0.19	0.11	0.12
Sealed Roads				
Suspended Solids	2.43	0.32	1.20	0.17
Total Phosphorous	-0.30	0.25	-0.85	0.19
Total Nitrogen	0.34	0.19	0.11	0.12
Unsealed Roads				
Suspended Solids	3.00	0.32	1.20	0.17
Total Phosphorous	-0.30	0.25	-0.85	0.19
Total Nitrogen	0.34	0.19	0.11	0.12

Forest				
Suspended Solids	1.60	0.20	0.78	0.13
Total Phosphorous	-1.10	0.22	-1.52	0.13
Total Nitrogen	-0.05	0.24	-0.52	0.13

As the site is currently maintained in an underscrubbed state, the pre-developed model for the subject site was determined as Rural. this has been confirmed by council.

2.4 CATCHMENT DEFINITION

For the purpose of the water quality modelling, the site was separated into Roadway (Impervious area) and pervious areas.

A small roadway catchment (denoted ‘Catchment B’) has no prior opportunity for water quality treatment as it grades to the existing Glenthorne Road. Catchment B will therefore be modelled as bypass. The eastern portion of proposed lot 2 and 3 will also grade in an eastward direction but will be accounted for within the future lot to achieve neutral or beneficial pollutant loadings. A proposed entry road to Manning River Drive denoted Catchment 'D' will also bypass treatment.

Large upstream catchments currently drain through the aforementioned watercourse's, which are equivalent in both pre and post developed scenario's. Hence they have not been accounted for within the water quality modelling.

Table 3 – Contributing Catchment Details

PRE-DEVELOPED Sub-Catchments	Area (m^2)	% Imperviousness
1 Cat A - Existing Roofs (Roofs)	360	100%
2 Cat A - Rural Pervious (Rural)	38500	0%
3 Cat A - Existing Driveway (Unsealed Roads)	710	50%
4 Cat A - Forested Area (Forest)	3840	0%
5 Cat B - Rural Pervious (Rural)	2620	0%
6 Cat C&E - Existing Roofs (Roofs)	570	100%
7 Cat C&E - Existing Driveway (Unsealed Roads)	370	50%
8 Cat C&E - Rural Pervious (Rural)	50860	0%
9 Cat C&E - Forested Area (Forest)	7010	0%
10 Cat D - Rural Pervious (Rural)	570	0%
11 Cat D - Existing Roofs (Roofs)	190	100%
12 Cat D – Existing Roadway (Sealed Roads)	1880	100%
13 Cat F - Existing Roofs (Roofs)	220	100%
14 Cat F - Rural Pervious (Rural)	9690	0%
15 Cat G - Rural Pervious (Rural)	7180	0%
16 Cat G - Existing Roofs (Roofs)	430	100%
17 Cat G - Existing Driveway (Unsealed Roads)	300	50%
18 Cat H - Rural Pervious (Rural)	25540	0%
19 Cat J - Rural Pervious (Rural)	22740	0%
TOTAL	**173,580**	**2.5%**

POST-DEVELOPED Sub-Catchment	Area (m^2)	% Imperviousness
1 Cat A - Existing Roofs (Roofs)	360	100%
2 Cat A - Rural Pervious (Rural)	37400	0%
3 Cat A - Existing Driveway (Unsealed Roads)	380	50%
4 Cat A – Roadway (Sealed Roads)	5240	100%

5 Cat B – Existing Rural Pervious (Rural)	1140	0%
6 Cat B – Roadway (Sealed Roads)	1480	100%
7 Cat C&E - Existing Roofs (Roofs)	570	100%
8 Cat C&E - Existing Driveway (Unsealed Roads)	370	50%
9 Cat C&E - Rural Pervious (Rural)	45490	0%
10 Cat C&E - Forested Area (Forest)	7000	0%
11 Cat C&E – Roadway (Sealed Roads)	5360	100%
12 Cat D – Existing Rural Pervious (Rural)	1140	0%
13 Cat D – Roadway (Sealed Roads)	1490	100%
14 Cat F - Existing Roofs (Roofs)	220	100%
15 Cat F – Existing Rural Pervious (Rural)	7870	0%
16 Cat F – Roadway (Sealed Roads)	1820	100%
17 Cat G – Existing Rural Pervious (Rural)	6120	0%
18 Cat G - Existing Roofs (Roofs)	430	100%
19 Cat G - Existing Driveway (Unsealed Roads)	300	50%
20 Cat G – Roadway (Sealed Roads)	1060	100%
21 Cat H – Existing Rural Pervious (Rural)	22040	0%
22 Cat H – Roadway (Sealed Roads)	3500	100%
23 Cat J - Rural Pervious (Rural)	20600	0%
24 Cat J – Roadway (Sealed Roads)	2140	100%
TOTAL	**131,130**	**44% (5% Dev Site)**

2.5 MODELLING STORMWATER MANAGEMENT CONTROLS

The following water quality treatment devices were included in the post-developed state water quality model:

2.5.1 Water Quality Bioretention Basins

Constructed water quality bioretention basins are shallow, extensively vegetated water bodies that use enhanced sedimentation, fine filtration and pollutant uptake processes to remove pollutants from stormwater. These processes are engaged by slowly passing runoff through vegetated areas. Plants filter sediments and pollutants from the water, while bio-films that grow on the plants can absorb nutrients and other associated contaminants.

For this development, it is proposed to construct several end-of-line water quality bioretention basins to serve the developed catchments.

For MUSIC modelling, the following water quality basin parameters were used:

- 0.30m extended detention depth, 1:3 internal side batters.
- Effective vegetation planted
- Filter media 400mm thick (Sandy Loam) with 100mm transition layer and 300mm submerged zone with underlying 350mm drainage layer
- Filter Media Total Nitrogen = 400mg/kg and Orthophosphate = 40mg/kg (*Using MUSIC in Sydney's Drinking Water Catchment* , SCA, Dec 2012)
- Subsoil drain which will drain to adjacent drainage reserves
- Top 100mm ameliorated to provide for plant uptake
- Energy Dissipator & concrete sediment forebay at pipe outlet

A summary of each basins size is shown in table 4.

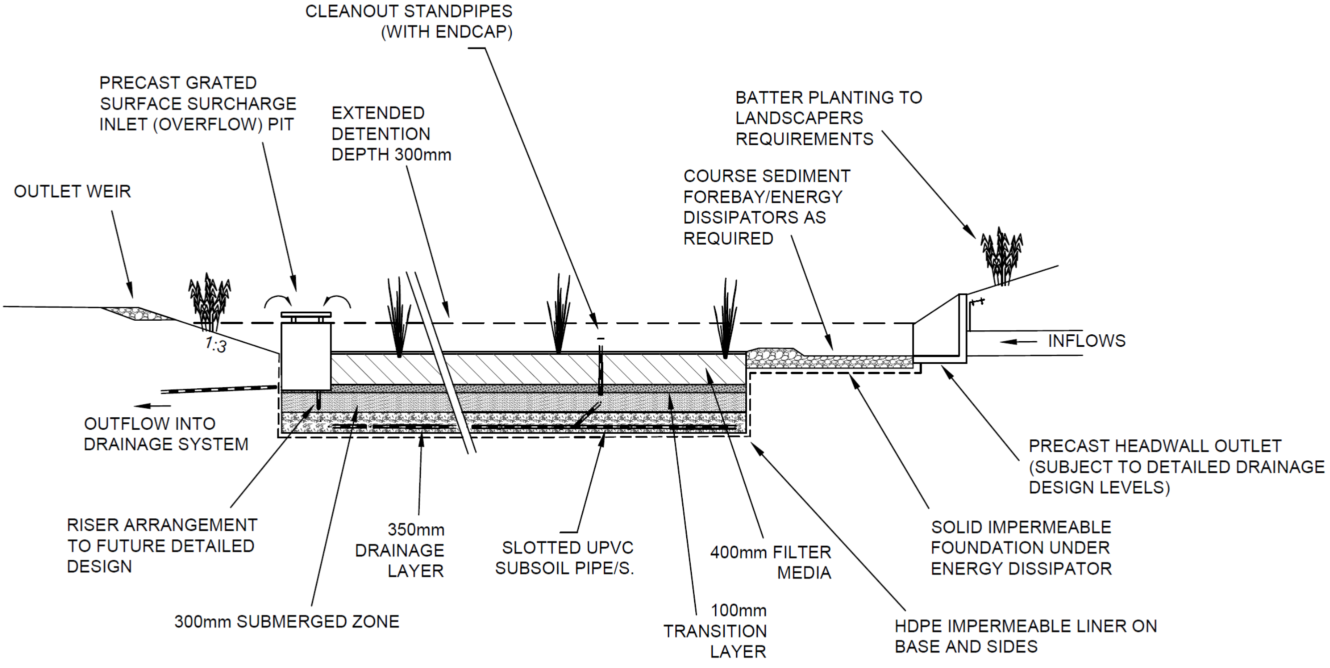
Table 4 – Bioretention Basin Sizing

Bioretention Basin	Filter Area (m^2)	Top Area (m^2)	Volume (m^3)
Catchment A Basin	70	87	47
Catchment C&E Basin	120	141	78
Catchment F Basin	60	76	41
Catchment G Basin	60	76	41
Catchment H Basin	60	76	41
Catchment J Basin	60	76	41
Total	**430**	**532**	**289**

Each basin will have a "splitter pit" arrangement to allow for 3-month ARI inflows only (however they may be inundated in larger events, but at low velocities). Flows exceeding the 3-month event will be conveyed via pipe or overland flow conveyed to the existing water courses.

Due to the large contributing catchments, it is not practical for bioretenion basins to retain the 3-month ARI volume. Despite this, the objective of neutral or beneficial water quality has been achieved.

Each basin is to be dedicated to Council as drainage reserve.



TYPICAL BIORETENTION BASIN DETAIL

Not to Scale

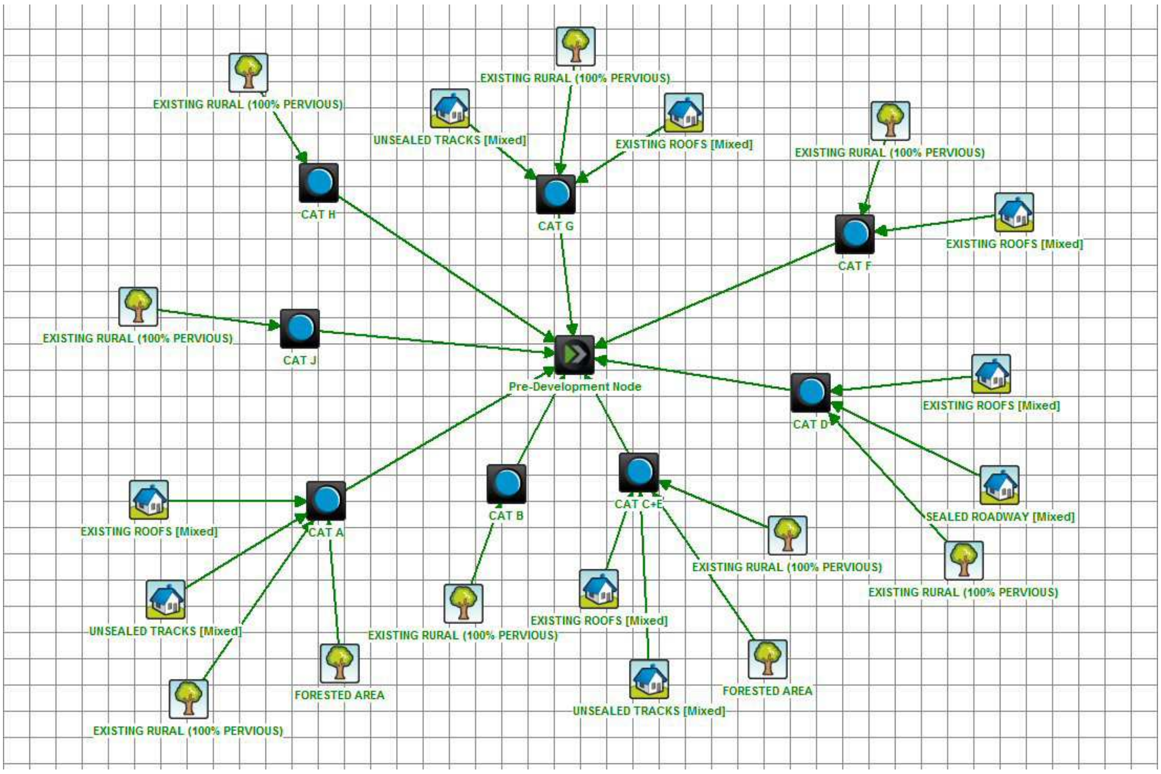


Figure 3: MUSIC Pre-Developed Model

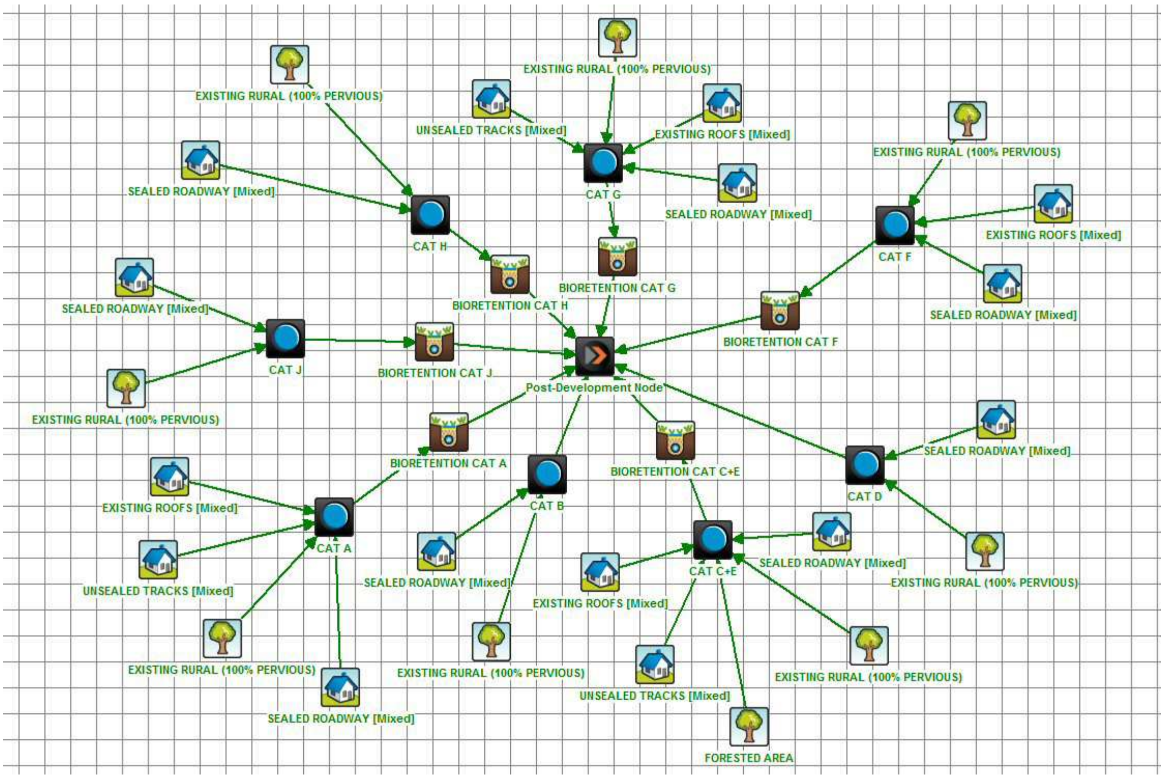


Figure 4: MUSIC Post-Developed Model

2.6 MODEL RESULTS

Table 5 presents the average annual pollutant export loads at the downstream extent of the contributing catchment under both pre-developed and post developed conditions (with and without treatment).

Table 5 - Annual Average Pollutant Export Loads

Pollutant	**Proposed Development Catchment**			
	Existing Site Load (kg/yr)	**Developed Site Load (without treatment) (kg/yr)**	**Developed Site Load (with treatment) (kg/yr)**	**% Reduction**
Gross Pollutants	**123**	635	88.1	**86.1***
TSS	**10,000**	16,300	**6,830**	58.2
TP	**19.8**	30.2	**19.6**	35.3
TN	**168**	202	**148**	26.9

*Note that the Gross Pollutant loading (>5mm particle) size did not quite achieve the 90% reduction objective. This is due to conservatively not modelling the coarse sediment forebays within the bioretention basins.

The results in Table 5 indicate that the proposed Water Sensitive Design Strategy would meet or exceed the water quality objectives for the site, which were:

- Post development loads of Gross Pollutants are to be reduced to 90%, and TSS, TN and TP are to be reduced to less than or equal to pre-developed pollutant loads (i.e. “neutral or beneficial effect on water quality”).

Refer to the Plan of Proposed Development for the locality, size and details of the proposed stormwater treatment measures.

2.7 Construction Stage

Water quality during the construction stage will be addressed by a Stormwater Management plan prepared in accordance with NSW Department of Housing “Blue Book” 2004. Construction methods will be detailed in designs for the construction certificate.

3 HYDROLOGIC ANALYSIS

3.1 Overview

The peak flow modelling criteria is to attenuate post-development peak discharges to maintain existing flows for all storm events up to and including the 100-year ARI peak rainfall event.

Hydrological modelling for this strategy has been undertaken using DRAINS software, incorporating both RAFTS and ILSAX models. Hydraulic analysis of the watercourses has also been undertaken utilising HEC-RAS software.

The roadway within the proposed development site crosses two riparian corridors, and as such this stormwater strategy will hydraulically assess the impact of the proposed culvert crossings.

The proposed culvert crossings will be sized to convey the expected upstream 1% AEP peak flows. The hydraulic arrangement of the future culverts will set future filling and internal road levels. Detailed design of culverts and stormwater outlets will be undertaken at Construction Certificate stage in accordance with the DA consent conditions.

3.1.1 Calibration

A local 5.88ha catchment (0% Impervious) was calibrated using the rational method to form the basis of the ILSAX model to be used for the proposed development site. A relatively good relationship was achieved as shown below.

Table 6 - Catchment Calibration

	Q_5	Q_5	Q_{100}	Q_{100}
	ILSAX	**RATIONAL METHOD**	**ILSAX**	**RATIONAL METHOD**
5.88ha Catchment (0% Impervious)	**0.69m^3/s**	**0.72m^3/s**	**1.65m^3/s**	**1.48m^3/s**

The following parameters were adopted for the DRAINS ILSAX catchments:

- Paved (Impervious) Depression Storage – 1mm
- Supplementary Depression Storage – 1mm
- Grassed (Pervious) Depression Storage – 1mm
- Soil Type – 2.5 (medium runoff potential, relatively slow infiltration rates)
- Q5 Antecedent Moisture Condition – 2.4 (indicates rather wet starting condition for storm event)
- Q100 Antecedent Moisture Condition – 2.4 (indicates rather wet starting condition for storm event)

Additionally the large upstream catchments which drain through the respective riparian corridors have been modelled using a RAFTS model, again calibrated to the Rational Method.

XP-Rafts parameters were adopted to provide a correlation with the *Rational Method (AR&R 1987)* for each upstream catchment. Parameters adopted for the catchment were a slope of between 2-2.5%% and a Manning's 'n' value of 0.05. The Storage Coefficient Multiplication Factor (Bx) was adjusted to 0.82, which corresponded to a higher peak flow hence being conservative. A relatively good relationship for the major event was achieved as shown below.

Table 7 - Rational Method v XP-Rafts

	Q_5	**Q_5**	**Q_{100}**	**Q_{100}**
	RM	**XP-Rafts**	**RM**	**XP-Rafts**
Northern Catchment (44.3ha)	**3.44m^3/s**	**4.13m^3/s**	**8.02m^3/s**	**8.05m^3/s**
Southern Catchment (60.6ha)	**4.70m^3/s**	**5.86m^3/s**	**10.97m^3/s**	**11.30m^3/s**

3.2 Catchment Definition

Refer to Appendix C for catchment plan.

Table 8 – Hydrologic Catchment Details

PRE-DEVELOPED Sub-Catchments	**Area (ha)**	**% Imperviousness**
1 Upstream North Catchment	44.3	0%
2 Upstream South Catchment	60.6	0%
3 Cat A	4.34	2.5%
4 Cat B	0.26	0%
5 Cat C & E	5.88	1.6%
6 Cat D	0.26	78.4%
7 Cat F	0.99	2.2%
8 Cat G	0.79	9.2%
9 Cat H	2.55	0%
10 Cat J	2.27	0%
11 Cat Existing Industrial North	6.19	63.2%
12 Cat Existing Industrial South	9.78	83.9%
TOTAL	**138.21ha**	**9.2% (Dev. Site 2.9%)**

POST-DEVELOPED Sub-Catchment	**Area (m^2)**	**% Imperviousness**
1 Upstream North Catchment	44.3	0%
2 Upstream South Catchment	60.6	0%
3 Cat A	4.34	13.8%
4 Cat B	0.26	56%
5 Cat C & E	5.88	10.4%
6 Cat D	0.26	56.6%
7 Cat F	0.99	20.5%
8 Cat G	0.79	22.7%
9 Cat H	2.55	13.7%
10 Cat J	2.27	9.4%
11 Cat Existing Industrial North	6.19	63.2%
12 Cat Existing Industrial South	9.78	83.9%
TOTAL	**138.21ha**	**10.5% (Dev. Site 14.1%)**

3.3 Hydraulic Analysis of Riparian Corridors

Expected flows have been hydraulically modelled using HEC-RAS software. The extents of the existing upstream 1% AEP peak flow is shown below in red.

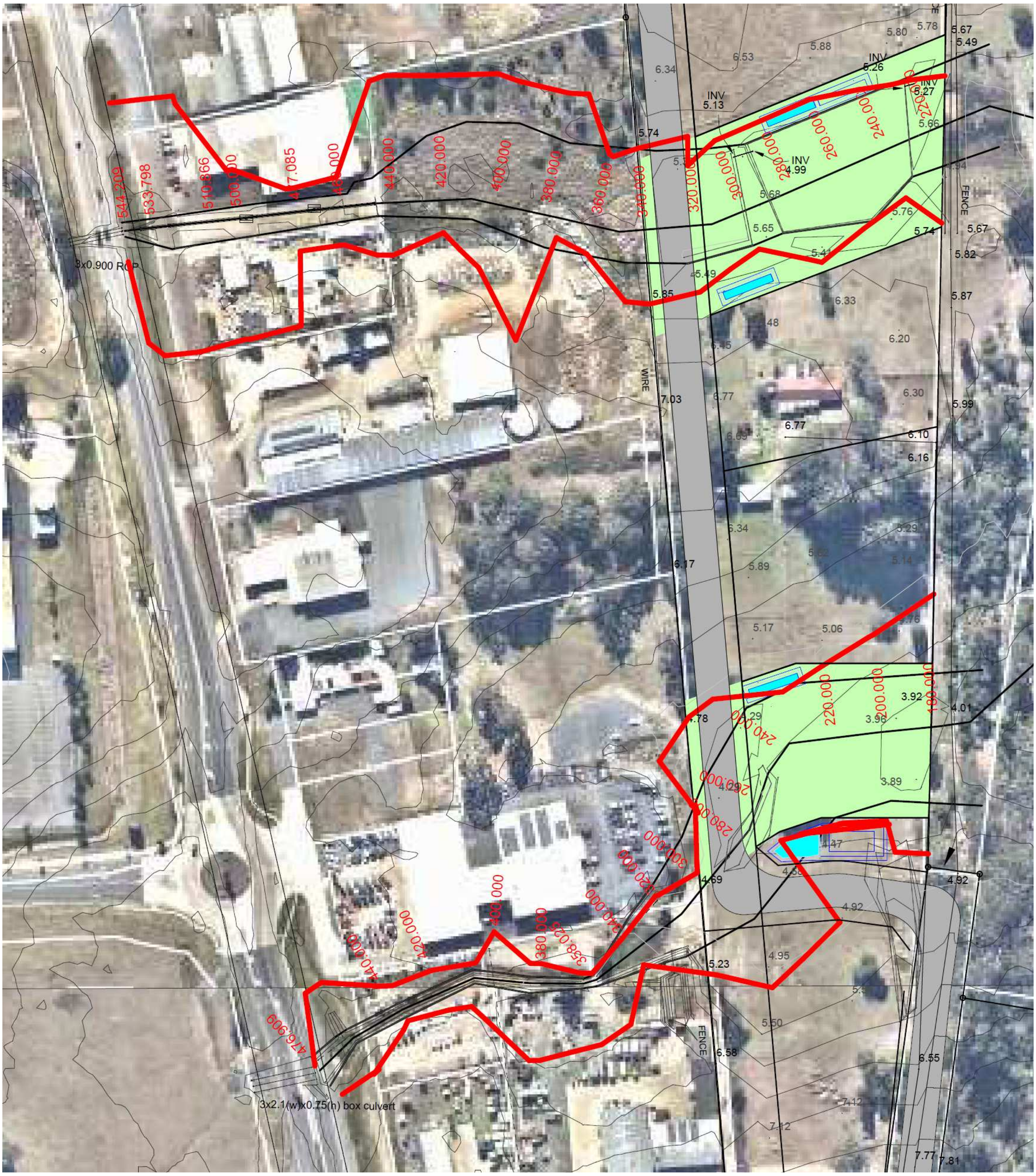


Figure 5 - HEC-RAS Plan

A Manning's 'n' value of 0.08 was adopted for the pervious portion of the existing riparian corridor channels, as well as the overbank areas. The impervious areas were denoted a Manning's 'n' of 0.012. The downstream tailwater levels have been conservatively adopted as the 1% AEP Flood Level in the year 2100 of RL.5.1m (*MCC Flood Level Certificate 35/2020/FL shown in Appendix B*).

The proposed road crossings and culverts (to be sized at detailed design stage) within the development has been modelled and it is intended to design the culverts to convey the 20-year ARI without afflux in accordance with AUS-SPEC.

It is expected that minor filling may be required on the lots immediately adjacent to the southern riparian corridor.

The results of the HEC-RAS analysis are provided in Figures 6, 7 and 8 below.

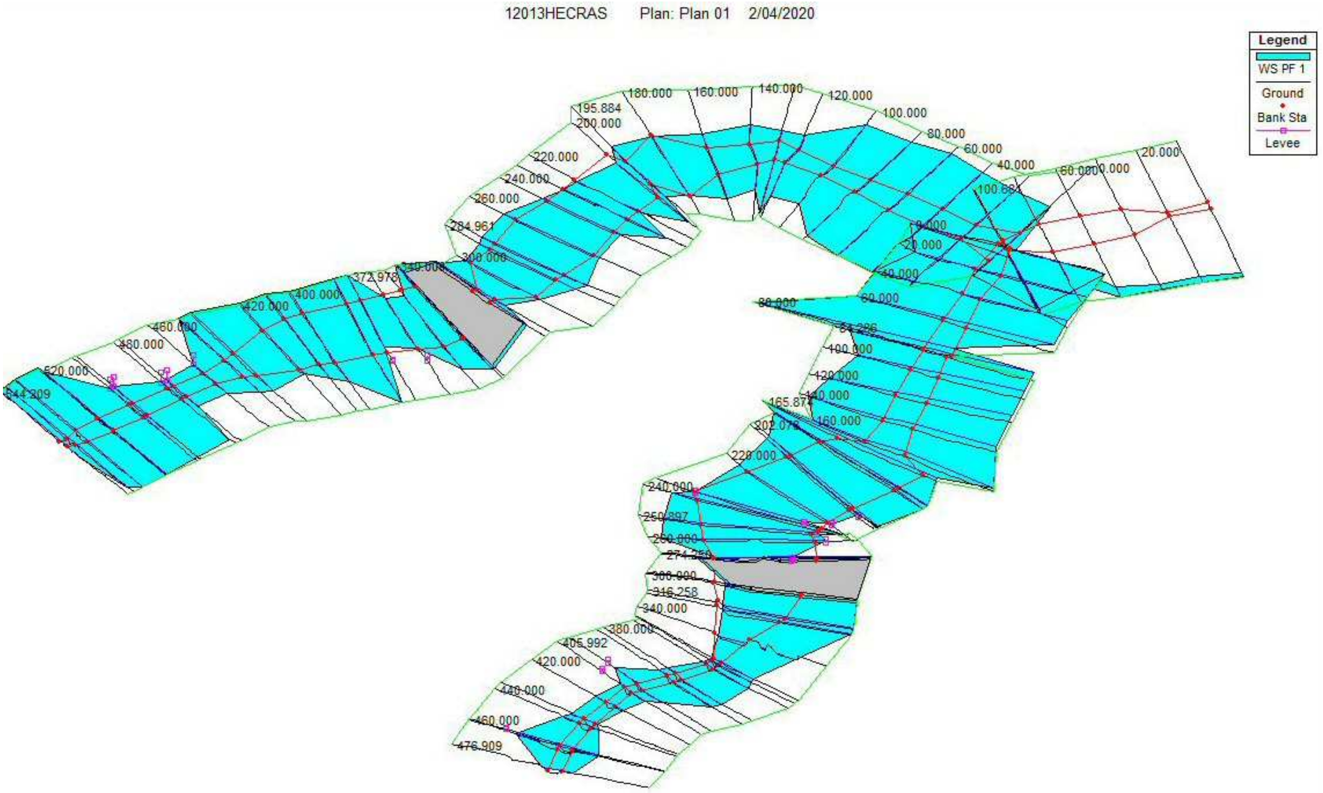


Figure 6 - HEC-RAS Analysis

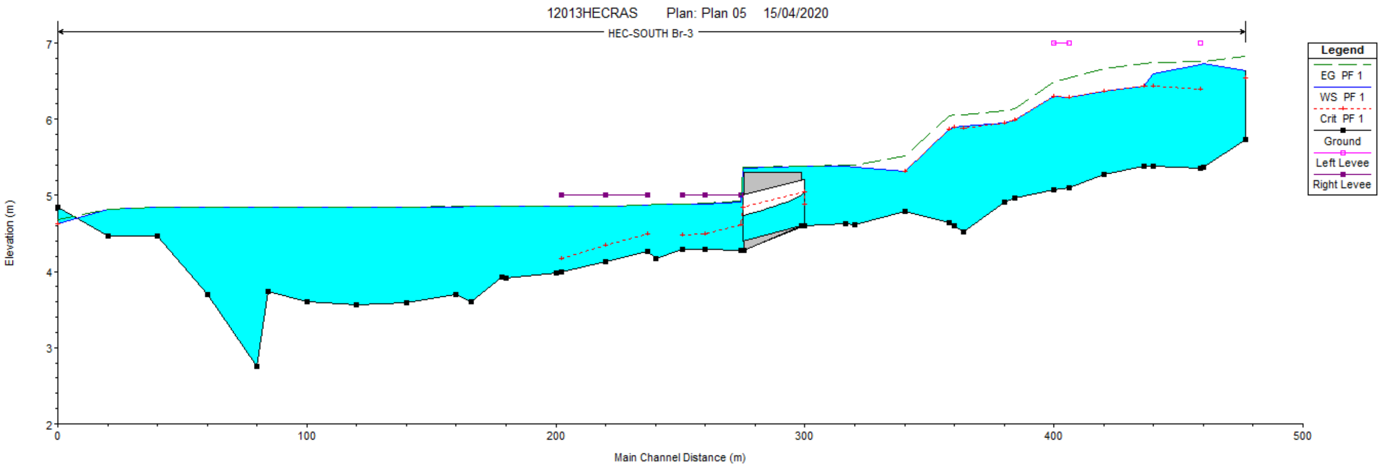


Figure 7 - HEC-RAS Q100 Results - East A

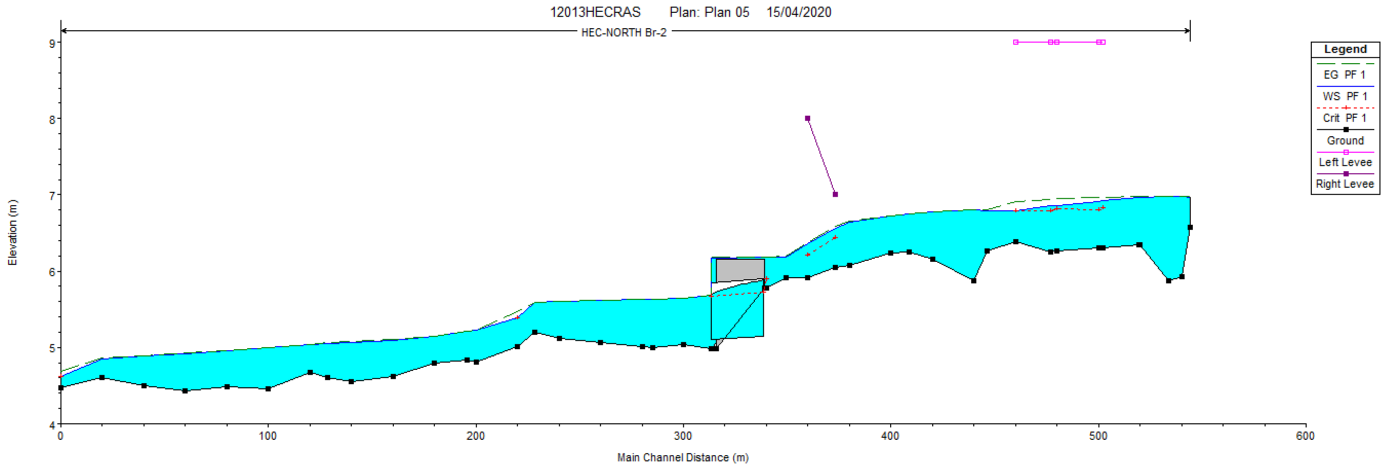


Figure 8 - HEC-RAS Q100 Results - East B

As shown in figures 6, 7 and 8, the expected 1% AEP peak flow has only very minor afflux over the proposed roadway (less than 100mm). The proposed culvert arrangements (sizes to be confirmed in detailed design) convey the 5% AEP peak flow with no afflux, which is deemed sufficient for the future land use.

3.3 Peak Flow Assessment

As mentioned previously each future lot is to provide its own water quality and detention to bring the future lot development back to 'Rural' pre-developed conditions. Therefore only the road reserve requires modelling for the subdivision. In order to treat the hardstand road surface, all flows captured in the underground stormwater system from the subject site will enter an end-of-line low flow inlet control (splitter pit), directing the three-month event to the respective water quality bioretention basins at the time of construction. Any flows exceeding the three-month event will be piped to the adjacent drainage corridor. If the capacities of the bioretention basins are exceeded, flows will be discharged via a weir or surcharge pit and into am adjacent detention basin, where overland flows will be conveyed to the existing water courses.

The future internal stormwater system is to be designed for the 10% AEP event in accordance with AUS-SPEC (The 5-year and 100-year ARI modelling has been undertaken to demonstrate compliance across the spectrum of events).

The total peak discharge from the 100-year ARI peak storm event for the catchment has been reduced to less than the pre-developed. Refer to Table 9 below for a summary of pre and post developed discharges.

Table 9 – Summary of Stormwater Quantity

NODE	**Q_5 Pre-Developed**	**Q_5 Post-Developed**	**Q_{100} Pre-Developed**	**Q_{100} Post-Developed**
	(m^3/s)	(m^3/s)	(m^3/s)	(m^3/s)
Outlet East A	**8.12**	**8.00**	**16.6**	**16.5**
Outlet East B	**4.90**	**4.90**	**9.50**	**9.50**
Outlet North	**0.37**	**0.29**	**0.81**	**0.80**

**Refer to Catchment Plans in AppendixC for Outlet locations*

Overall it is expected that the local internal catchment peak is at the outlet before the upstream peak flow, hence the very similar peak flows between the pre and post developed scenarios.

3.4 Climate Change

The current minimum site level is 3.9m AHD (invert of existing southern riparian corridor). The majority of the existing natural surface within the developable subject site is above the 1% annual exceedence probability (AEP) flood level for 2100 of 5.1m AHD (*Flood Level Certificate - Appendix B*). This is consistent with a small portion of lower-lying area being mapped in the “Flood Planning Area” in *Greater Taree City Council’s* current flood planning LEP mapping.

Some regrading/partial filling will be required on the lots adjoining the drainage corridors to raise them above the minimum 2100 Flood Level of RL 5.1m AHD and/or for providing services.

4 SUMMARY

A combination of measures discussed above including end-of-line water quality Bioretention Basins have been proposed to manage the discharge of nutrients and pollutants leaving the site.

The modelling shows that the proposed Water Sensitive Design Strategy would meet the water quality objectives for the site, which were post development loads of Gross Pollutants are to be reduced to 90%, and TSS, TN and TP are to be reduced to less than or equal to pre-developed pollutant loads (i.e. “neutral or beneficial effect on water quality”).

Additionally, the utilisation of traditional stormwater capture measures will attenuate captured stormwater runoff. The criteria is to attenuate post-development peak discharges to maintain existing flows for all storm events up to and including the 100 year ARI peak rainfall event.

The modelling shows that the total post-developed peak discharges from the 5 year and 100 year ARI's peak storm event for the catchment are less than the pre-developed peak discharges.

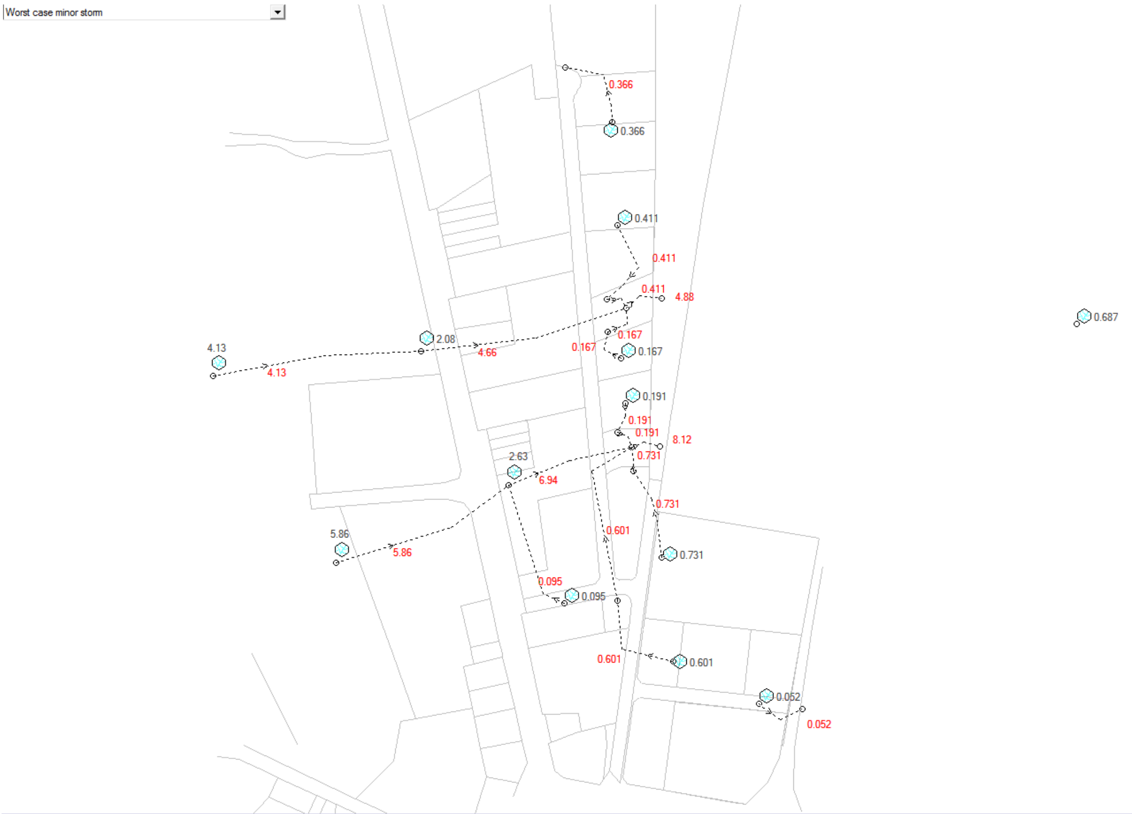
Refer to the Stormwater Strategy Plan (Appendix C) for the locality, size and details of the proposed stormwater treatment measures.

SAM HULL
B.Civ. Eng. (Hons.) MIEAUST
LIDBURY, SUMMERS & WHITEMAN

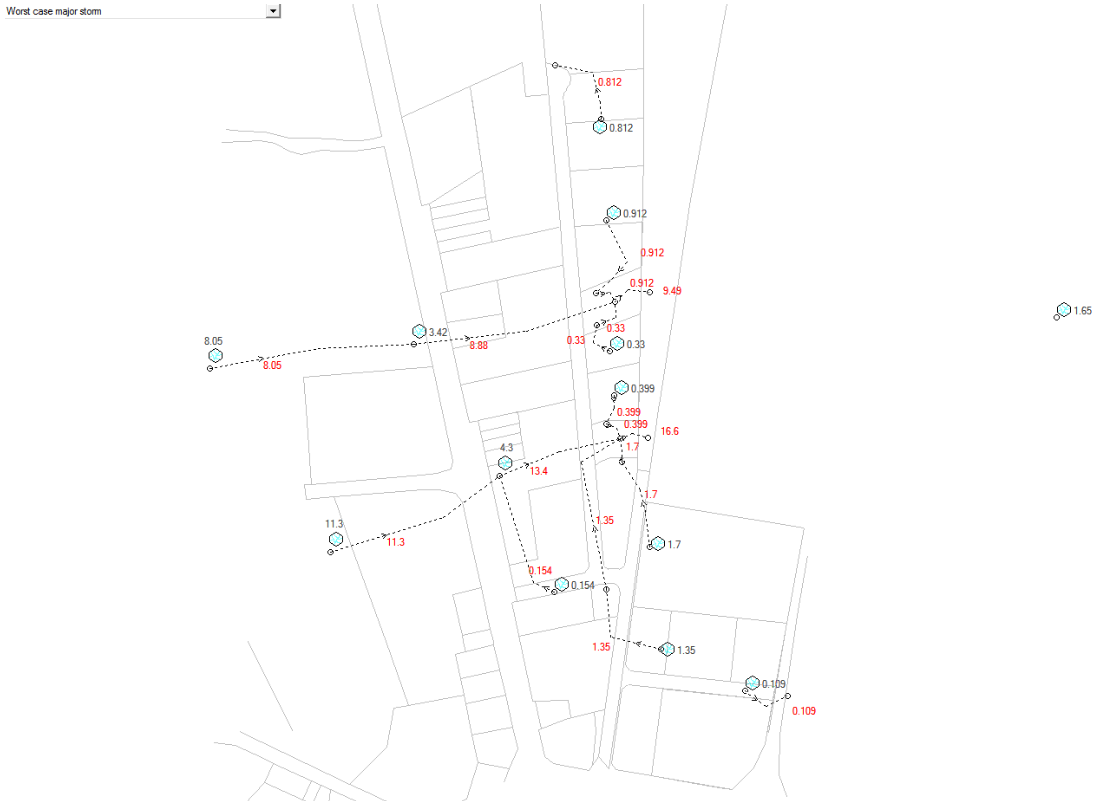
A HYDRAULIC OUTPUT FILES

A.1 DRAINS Pre-Developed Model Schematic Layout

A.2 DRAINS Pre-Developed Model Schematic Layout (Q_5 Peak Flows)

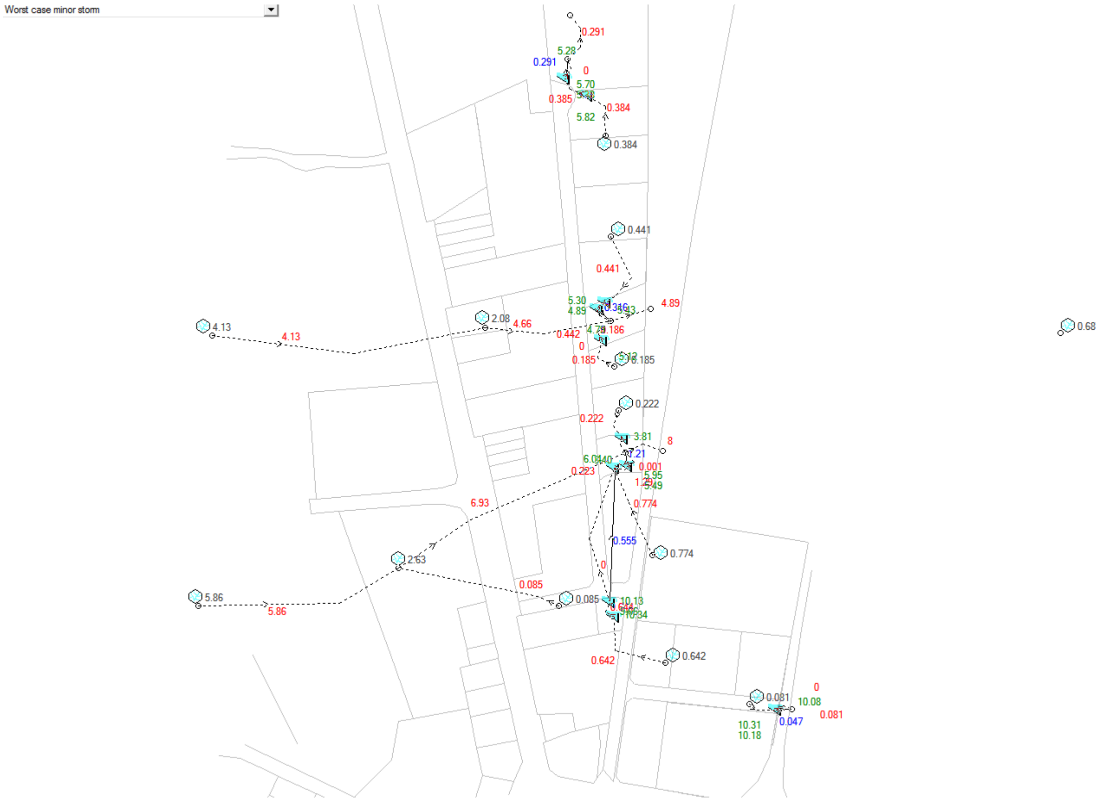


A.3 DRAINS Pre-Developed Model Schematic Layout (Q_{100} Peak Flows)

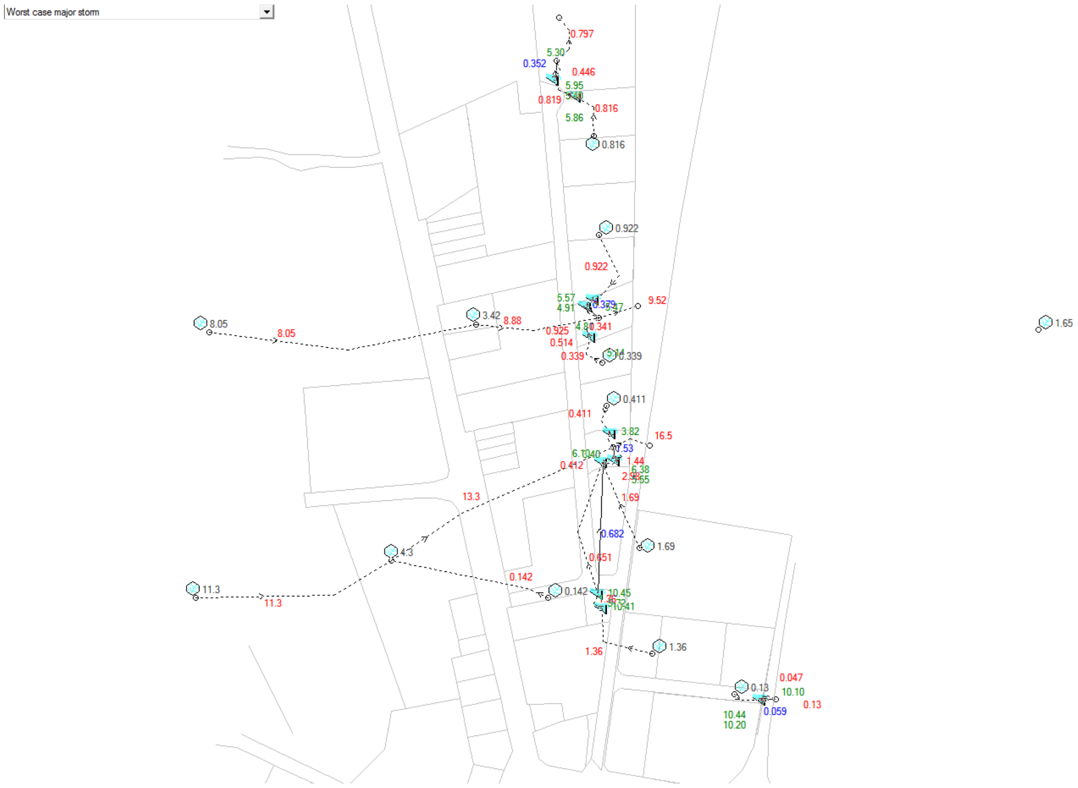


A.4 DRAINS Post-Developed Model Schematic Layout

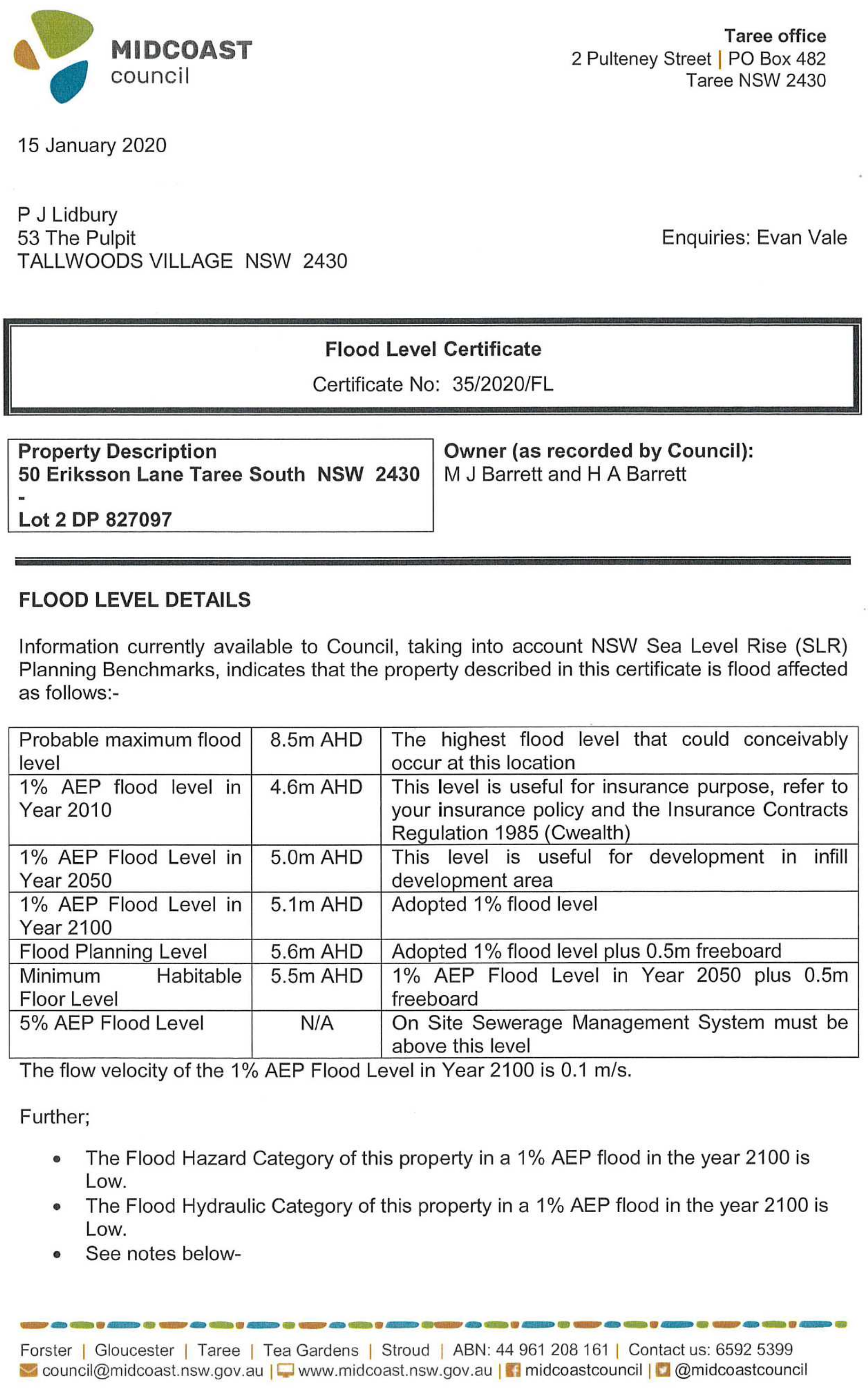
A.5 DRAINS Post-Developed Model Schematic Layout (Q_5 Peak Flows)



A.6 DRAINS Post-Developed Model Schematic Layout (Q_{100} Peak Flows)



B Flood Level Certificate



MIDCOAST
council

Taree office
2 Pulteney Street | PO Box 482
Taree NSW 2430

15 January 2020

P J Lidbury
53 The Pulpit
TALLWOODS VILLAGE NSW 2430

Enquiries: Evan Vale

Flood Level Certificate

Certificate No: 35/2020/FL

Property Description
50 Eriksson Lane Taree South NSW 2430
-
Lot 2 DP 827097

Owner (as recorded by Council):
M J Barrett and H A Barrett

FLOOD LEVEL DETAILS

Information currently available to Council, taking into account NSW Sea Level Rise (SLR) Planning Benchmarks, indicates that the property described in this certificate is flood affected as follows:-

Probable maximum flood level	8.5m AHD	The highest flood level that could conceivably occur at this location
1% AEP flood level in Year 2010	4.6m AHD	This level is useful for insurance purpose, refer to your insurance policy and the Insurance Contracts Regulation 1985 (Cwealth)
1% AEP Flood Level in Year 2050	5.0m AHD	This level is useful for development in infill development area
1% AEP Flood Level in Year 2100	5.1m AHD	Adopted 1% flood level
Flood Planning Level	5.6m AHD	Adopted 1% flood level plus 0.5m freeboard
Minimum Habitable Floor Level	5.5m AHD	1% AEP Flood Level in Year 2050 plus 0.5m freeboard
5% AEP Flood Level	N/A	On Site Sewerage Management System must be above this level

The flow velocity of the 1% AEP Flood Level in Year 2100 is 0.1 m/s.

Further;

- The Flood Hazard Category of this property in a 1% AEP flood in the year 2100 is Low.
- The Flood Hydraulic Category of this property in a 1% AEP flood in the year 2100 is Low.
- See notes below-

Forster | Gloucester | Taree | Tea Gardens | Stroud | ABN: 44 961 208 161 | Contact us: 6592 5399
council@midcoast.nsw.gov.au | www.midcoast.nsw.gov.au | midcoastcouncil | @midcoastcouncil

C.1 Pre-Developed Catchment Plan

LEGEND

CODE	DESCRIPTION	LINETYPE
ELECT	UNDERGROUND ELECTRICITY	UG
FCE	FENCE	/
HYD /SV	HYDRANT / STOPVALVE	
PIT	EXISTING STORMWATER	
PP /ELP	OVERHEAD ELECTRICITY	O/H
RISNG	RISING MAIN	RM
SMH	SEWER / MANHOLE	S
STN /SSM	SURVEY CONTROL	
SW /PIT	DESIGN STORMWATER	
TEL	TELSTRA	T
TRL	TREELINE	
TR	TREE	
WATER	WATER SUPPLY	W

🟩	DENOTES AREA MODELLED AS FOREST IN PRE-DEVELOPED MUSIC MODEL
🟥	DENOTES PRE-DEVELOPED DRAINAGE CATCHMENTS
←	REPRESENTS CATCHMENT FLOW PATHS
←	REPRESENTS EXTERNAL CATCHMENT FLOW PATHS

PRELIMINARY
SUBJECT TO FINAL SURVEY, DESIGN & APPROVAL

DIAL BEFORE YOU DIG
www.1100.com.au

NOTE: The contractor shall check and verify all works on site (including works by others) before commencing any works. All discrepancies are to be reported to the Project Manager or Lidbury, Summers & Whiteman prior to commencing work. Do not scale dimensions from the plan. All dimensions to be confirmed by dimensions from the plan. All dimensions to be confirmed by Lidbury, Summers & Whiteman.

HORIZONTAL
CO-ORDINATE SYSTEM: MGA
MARKS ADOPTED: SSM 33707
EAST: 449803.703 NORTH: 6465898.949
PLOT FILE/DWG No.:
F:\DATA5DWG\12013PROPOSAL.DWG

VERTICAL
DATUM: AHD
BENCHMARK: SSM33707
R.L.: 20.399
DRAWN/CHECKED:
MG

PRELIMINARY ROAD AND DRAINAGE STRATEGY
LOT 50 DP 863972, LOT 2 DP 827097 &
LOT 20 DP836884 ERIKSSON LANE, GLENTHORNE
PRE-DEVELOPED CATCHMENT PLAN

LS&W LIDBURY, SUMMERS & WHITEMAN
CONSULTING SURVEYORS, PLANNERS & ENGINEERS
INCORPORATING DEGOTARDI, SMITH & PARTNERS (FORSTER)
1st FLOOR, 3 WHARF ST. FORSTER 2428 (02) 65547988 FAX (02) 65549378
PO BOX 510 FORSTER NSW 2428 EMAIL consult@lswsurveyors.com.au WEBSITE www.lswsurveyors.com.au

SCALES
HORIZONTAL: 1:2000
VERTICAL: N/A
SHEET SIZE: A1
FIELD SHEETS
Date of survey: 25/11/19

COUNCIL:
MID - COAST
DA NUMBER:
DATE:
31/03/20

SHEET 1 OF 1
FILE No.:
12013

ISSUE	DATE	COMMENTS
A	31/03/20	FIRST ISSUE

C.2 Water Sensitive Design Strategy Plan

TYPICAL ROADWAY SECTION A-A

LEGEND

CODE	DESCRIPTION	LINETYPE
ELECT	UNDERGROUND ELECTRICITY	UG
FCE	FENCE	/ / / /
HYD /SV	HYDRANT / STOPVALVE	Ⓗ ⊗
PIT	EXISTING STORMWATER	▤ =
PP /ELP	OVERHEAD ELECTRICITY	⊙ O/H
RISNG	RISING MAIN	RM
SMH	SEWER / MANHOLE	◎ S S
STN /SSM	SURVEY CONTROL	△
SW /PIT	DESIGN STORMWATER	▥
TEL	TELSTRA	⊡ T
TRL	TREELINE	
TR	TREE	
WATER	WATER SUPPLY	W

🟩 DENOTES AREA MODELLED AS FOREST IN POST-DEVELOPED MUSIC MODEL

🟥 DENOTES POST-DEVELOPED DRAINAGE CATCHMENTS

← REPRESENTS CATCHMENT FLOW PATHS

PRELIMINARY
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NOTE: The contractor shall check and verify all works on site (including works by others) before commencing any works. All discrepancies are to be reported to the Project Manager or Lidbury, Summers & Whiteman prior to commencing work. Do not scale dimensions from the plan. All dimensions to be confirmed by dimensions from the plan. All dimensions to be confirmed by Lidbury, Summers & Whiteman.

HORIZONTAL
CO-ORDINATE SYSTEM: MGA
MARKS ADOPTED: SSM 33707
EAST: 449803.703 NORTH: 6465898.949

PLOT FILE/DWG No.:
F:\DATA5DWG\12013PROPOSAL.DWG

VERTICAL
DATUM: AHD
BENCHMARK: SSM33707
R.L.: 20.399

DRAWN/CHECKED:
MG

PRELIMINARY ROAD AND DRAINAGE STRATEGY
LOT 50 DP 863972, LOT 2 DP 827097 &
LOT 20 DP836884 ERIKSSON LANE, GLENTHORNE
POST-DEVELOPED CATCHMENTS/ WSD STRATEGY PLAN

LS&W LIDBURY, SUMMERS & WHITEMAN
CONSULTING SURVEYORS, PLANNERS & ENGINEERS
INCORPORATING DEGOTARDI, SMITH & PARTNERS (FORSTER)
1st FLOOR, 3 WHARF ST. FORSTER 2428 (02) 65547988 FAX (02) 65549378
PO BOX 510 FORSTER NSW 2428 EMAIL consult@lswsurveyors.com.au WEBSITE www.lswsurveyors.com.au

SCALES
HORIZONTAL: 1:2000
VERTICAL: N/A
SHEET SIZE: A1

FIELD SHEETS
Date of survey: 25/11/19

COUNCIL:
MID - COAST
DA NUMBER:

DATE:
31/03/2020

SHEET 1 OF 1

FILE No.:
12013

ISSUE	DATE	COMMENTS
A	31/03/20	FIRST ISSUE

Appendix F – Preliminary Site Contamination Assessment Report

Jasbe Glenthorne Pty Ltd & Mulgrave Trust

Geotechnical and Stage 1 Site Contamination Assessments

Proposed Rezoning

Off Manning River Drive, Glenthorne

Report No. RGS02324.1-AB

19 May 2020

REGIONAL
GEOTECHNICAL
SOLUTIONS

REGIONAL
GEOTECHNICAL
SOLUTIONS

Manning-Great Lakes
Port Macquarie
Coffs Harbour

RGS02324.1-AB

7 May 2020

Jasbe Glenthorne Pty Ltd & Mulgrave Trust
C/o Blue Sky Planning & Environment
PO Box 65
CUNDLETOWN NSW 2430

Attention: Lisa Proctor

Dear Lisa,

RE: Proposed Rezoning – Off Manning River Drive, Glenthorne Geotechnical and Stage 1 Site Contamination Assessment

As requested, Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical assessment for the proposed rezoning of a parcel of land located off Manning River Drive, Glenthorne, NSW.

The results of assessment are presented in this report, together with comments and recommendations regarding site earthworks, excavation conditions, foundation conditions, and pavement thickness design and construction.

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	Reviewed by
Andrew Hills	**Steven Morton**
Senior Environmental Engineer	Principal Geotechnical Engineer

Table of Contents

Figures

Appendices

1 INTRODUCTION

Regional Geotechnical Solutions Pty Ltd (RGS) has undertaken a geotechnical and Stage 1 site contamination assessment for the proposed rezoning of a parcel of land located off Manning River Drive, Glenthorne, NSW. The site location is shown on Figure 1.

The site occupies approximately 23.5 hectares in area and comprises the following as shown on Plate 1:

- Lot 2 DP827097;
- Lot 50 DP863972; and
- Lot 2 DP573214.

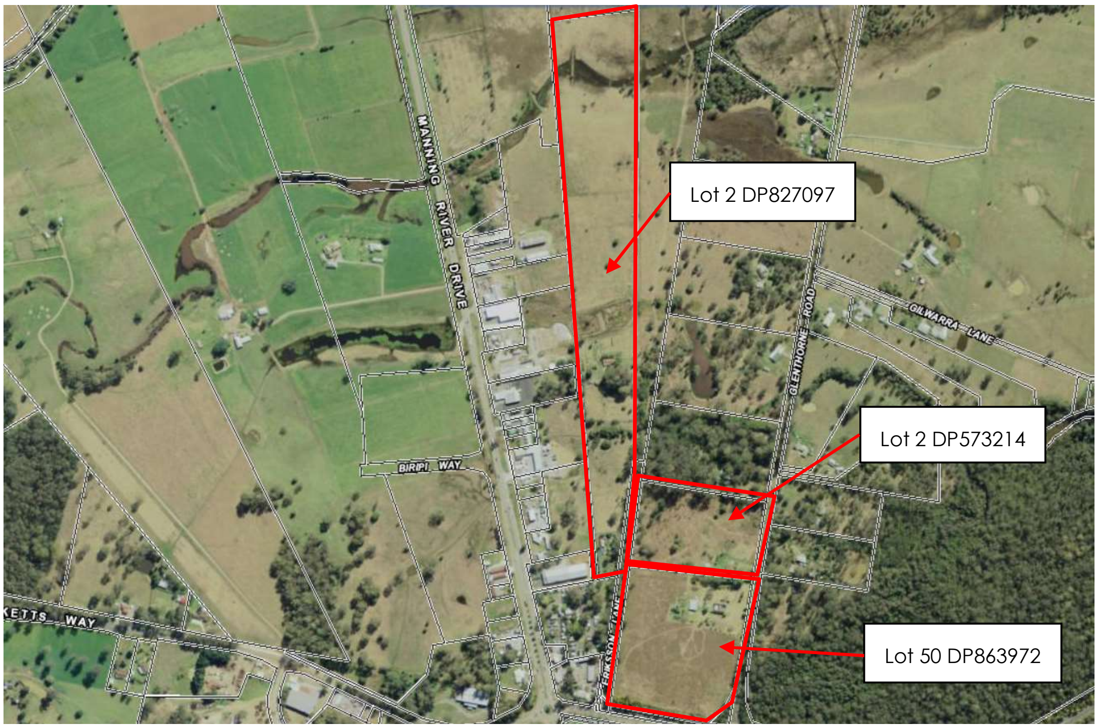


***Plate 1**: Aerial image obtained from NSW 'Six Maps' website that illustrates the site layout. The lots comprising the subject site are marked by the dashed red lines.*

It is understood a rezoning of the site is proposed from RU1 (primary Production) to IN1 (Industrial), B6 (Enterprise Corridor) and E2 (Environmental Management).

As part of the rezoning application(s), a geotechnical and Stage 1 site contamination assessment is required. The purpose of the work documented herein is to satisfy the requirement for a geotechnical and Stage 1 site contamination assessment to support a re-zoning.

At the time of the field investigations, RGS was instructed that access to Lot 2 DP573214 was not permitted. As such, investigations regarding Lot 2 DP573214 were constrained to a desktop study only.

Based on the above, in order to support a rezoning application, the geotechnical assessment herein provides comments and recommendations on the following:

- Review of relevant existing subsurface information and reports, where available;
- Assessment of shrink/swell characteristics and moisture reactivity classification of site soils;
- Subsurface profile including the presence and extent of fill (if any) and the presence of groundwater (if encountered within the depths of the investigation);
- Preliminary indication of earthworks requirements and earthworks management plans;
- Preliminary assessment of soil erodibility;
- Preliminary indication of foundation conditions and road pavement subgrade conditions and
- Presence of acid sulfate soils within the soils (ASS) and the need for an ASS management plan.

2 GEOTECHNICAL ASSESSMENT

2.1 Methodology

Field work for the assessment was undertaken by an Engineer from RGS and included:

- A walkover assessment to map the geotechnical conditions including identifying geotechnical hazards, geotechnical terrains, and identification of geotechnical materials;
- Drilling of ten boreholes (designated BH1 to BH10) across the site to 2.0m or prior refusal using 4WD mounted rig. One borehole was deepened to a depth of 4m to assess the presence of groundwater within 4m of ground surface level;
- Collection of samples for subsequent laboratory testing.

Engineering logs of the borehole are presented in Appendix A. The test locations are shown on Figure 2.

2.2 Site Conditions

2.2.1 Surface Conditions

The site is irregular in shape and is bounded by a broad alluvial floodplain to the north, by rural residential and undeveloped land to the east, by industrial premises, Eriksson Lane and Manning River Drive to the south and by industrial premises and undeveloped land to the west.

A satellite image that shows the site boundary and the site setting is reproduced below.

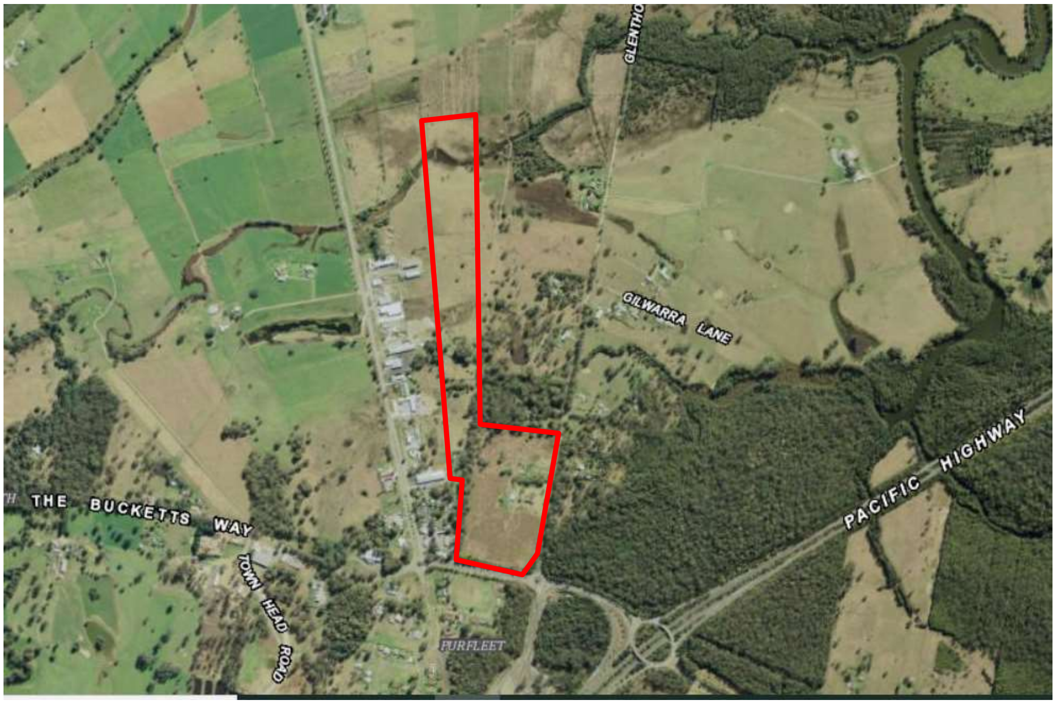


***Plate 2**: Aerial image obtained from NSW 'Six Maps' website that illustrates the site location and setting. The subject site boundary is marked by the dashed red line.*

The site can be separated into two broad terrain zones as outlined below. The inferred boundary between the two terrain zones is illustrated on Figure 2.

Terrain Zone 1 – Alluvial Deposits

The northern and central portions of the site are situated on an alluvial floodplain and site elevations range from between about RL8m AHD in the south and RL1m AHD in the north. With the exception of the far northern end of the site, Terrain Zone 1 is gently undulating and contains grades of less than 2 to 3°. The far northern end of the site grades down towards a low lying swampy area at about 8 to 10°.

The site is primarily used for cattle grazing and a single storey brick house with several detached sheds and an old chicken coop in the central part of Lot 2 DP827097.

Two fill stockpiles were identified in the southern part of Lot 2 DP827097 close to the inferred terrain zone boundary. One larger stockpile located along the eastern boundary fence and another smaller stockpile located near the western boundary fence. The stockpiles appeared to contain excavated residual clay soils and weathered rock.

Drainage of the site will be via overland flow and minor infiltration into the topsoil. A large swampy area containing a dam with water present was located to the north of the existing residence in the central part of Lot 2 DP827097. Another small dam containing water was located along the western boundary to the south of the same residence described above.

Vegetation was predominantly comprised of grass with scattered areas of shrubs and stands of large Eucalypt trees up to 25m in height mainly located around lot boundaries, fence lines and the residences.

Trafficability was good via 4WD vehicle.

Typical site photographs are presented below.

 *Looking north west in the northern part of the site showing grazing land on alluvial terrain.*	 *Looking south west in the central part of the site showing the existing swampy area filled with water located to the north of the existing residence.*
 *Looking south east in the central part of the site showing a paddock with fill stockpiles in the foreground and background.*	 *Looking west in the central part of the site showing a small dam located along the western property boundary.*

Terrain Zone 2 – Residual Soil

The southern portion of the site is underlain by gently to moderately sloping residual soils that are derived from the underlying weathered rock. Surface elevations range between about RL21m AHD in the south of the terrain zone, to RL8m AHD at the inferred boundary between the residual and alluvial terrain zones in the north. The site grades down to the north and northeast at up to about 5°.

The majority of the site is used primarily for cattle grazing with some rural residential properties also present. Existing structures include a single storey brick house and detached shed on Lot 50, a house and at least one shed on Lot 2 DP573214 (from aerial photograph review only) and an abandoned single storey house and a number of small sheds in the southern part of Lot 2 DP827097.

A fill stockpile about 1.8m high is present along the southern site boundary within Lot 50. Drainage of the site will be via overland flow and minor infiltration into the topsoil. Trafficability was good via 4WD vehicle.

Vegetation was predominantly comprised of grass for cattle grazing with scattered areas of shrubs and stands of large Eucalypt trees up to 25m in height mainly located around lot boundaries, fence lines and the residences.

Typical site photographs from Terrain Zone 2 are presented below.

 *Looking north in the southern part of the site showing grazing land on residual terrain.*	 *Looking south in the southern part of the site showing residual clay soils.*

2.2.2 Subsurface Conditions

The Taree 1:100,000 Coastal Quaternary Geology Map indicates that the northern part of the site (Terrain Zone 1) is underlain by Pleistocene aged undifferentiated plain deposits comprising clay, silt, fluvial sand and marine sand, and a Holocene alluvial palaeochannel fill and inter-levee swale is located in the north of the site that comprises organic mud, peat, clay, silt and fluvial sand.

The Hastings 1:250,000 Geology Map indicates that the southern portion of the site (Terrain Zone 2) is underlain by the Belbora Beds that comprise tuff, agglomerate and sandstone.

The materials encountered during the investigation are summarised in Table 1 and Table 2. Further details are presented on the attached engineering logs.

Table 1: Summary of Geotechnical Units

Unit	Material	Terrain Zone	Material Description
Unit 1	Topsoil	Terrain Zones 1 & 2	Silty CLAY, low plasticity, trace gravel
Unit 2	Alluvial Soil	Terrain Zone 1	CLAY, medium to high plasticity, stiff to very stiff, traces of gravel. Firm material was encountered within BH1 to 1.2m and BH6 to 0.75m.
UNIT 3	Residual Soil	Terrain Zone 2	CLAY, high plasticity, ranging from stiff to hard. Gravelly CLAY was encountered in BH8, high plasticity, coarse grained ironstone gravel
UNIT 4	EW-Siltstone	Terrain Zone 2	Silty CLAY, low plasticity, friable

Table 2: Summary of Subsurface Profile

Borehole	Depth of Material Layer (m)			
	UNIT 1 Topsoil	UNIT 2 Alluvial Soil (Terrain Zone 1)	UNIT 3 Residual Soil (Terrain Zone 2)	UNIT 4 EW-Siltstone (Terrain Zone 2)
BH1	0.0 – 0.2	0.2 – ≥4.0	--	--
BH2	0.0 – 0.2	0.2 – ≥2.1	--	
BH3	0.0 – 0.15	0.15 – ≥2.1	--	--
BH4	0.0 – 0.2	0.15 – ≥2.0	--	--
BH5	0.0 – 0.2	0.2 – 0.75	0.75 – ≥2.1	--
BH6	0.0 – 0.2	0.2 – 2.5	--	2.5 - ≥2.8*
BH7	0.0 – 0.15	--	0.15 – 1.9	1.9 - ≥2.0*
BH8	0.0 – 0.2		0.2 – 1.7	1.7 - ≥2.0*
BH9	0.0 – 0.15	--	0.15 – 1.9	1.9 - ≥2.0*
BH10	0.0 – 0.2	--	0.2 – 1.7	1.7 - ≥2.0*

Note: ≥ Indicates that base of material layer was not encountered
* Indicates that the borehole was terminated due to practical refusal on rock
-- Indicates that the material was not encountered at the test location

Groundwater was not encountered within any of the boreholes during the limited time they remained open on the day of the field investigations. It should be noted that fluctuations in groundwater levels can occur as a result of seasonal variations, temperature, rainfall, and other similar factors, the influence of which may not have been apparent at the time of the assessment.

A summary of the laboratory shrink-swell and CBR test results is presented in Table 3. Laboratory test result sheets are presented in Appendix B.

Table 3: Laboratory Test Results Summary – Shrink/Swell and CBR

Test Location	Depth	Material & Terrain Zone	Shrink-Swell Index (%)	Maximum Dry Density (t/m³)	Optimum Moisture Content (%)	CBR Swell (%)	CBR (%)
BH1	0.55 – 0.70	Alluvial Soil (Terrain Zone 1)	4.5	--	--	--	--
BH2	0.3 – 0.6		--	1.57	22.9	1.9	5
BH4	0.60 – 0.88		4.0	--	--	--	--
BH7	0.55 – 0.88	Residual Soil (Terrain Zone 2)	2.2	--	--	--	--
BH8	0.55 – 0.75		2.5	1.51	27.1	0.3	11

2.3 SOIL CAPABILITY

2.3.1 Presence of Fill

Three fill stockpiles were observed during the site investigation at the locations shown on Figure 2 and comprised clay and silty clay materials that appear to be of residual origins.

2.3.2 Nature of Site Soils & Suitability for Reuse as Engineered Fill

With the exception of the fill stockpiles observed at the site as summarised above, the subsurface profile at the site comprises:

- Topsoil; overlying
- Alluvial Soil (Terrain Zone 1) comprising medium to high plasticity stiff to very stiff CLAY; or
- Residual Soil (Terrain Zone 2) comprising high plasticity stiff to hard CLAY; overlying
- Extremely weathered siltstone.

A summary of the suitability of the site materials for reuse as controlled fill is presented below:

- The existing fill stockpiles will require further individual assessment to determine the suitability of the material for reuse as controlled fill at the site, or to determine the requirements for offsite disposal;
- Topsoil will not be suitable for reuse as controlled fill at the site, however, the material may be reused for landscaping purposes;
- The alluvial soil encountered within Terrain Zone 1 will be suitable for reuse as controlled fill at the site, however, the material is highly reactive and consideration is required for future foundation designs as discussed in Section 2.3.4. Firm material was encountered within BH1 and BH6 which will require drying back before the material will be suitable for reuse; and
- The residual soil within Terrain Zone 2 will be suitable for reuse as controlled fill at the site, however, the material is highly reactive and consideration is required for future foundation designs as discussed in Section 2.3.4.

2.3.3 Preliminary Earthworks Requirements including Soil Erodibility

The boreholes were drilled with a Toyota Landcruiser mounted drill rig and practical auger refusal was encountered within Terrain Zone 2 at four locations within extremely weathered siltstone at depths of between 2m and 2.8m. Auger refusal was not encountered within Terrain Zone 1.

Excavation of the alluvial soils within Terrain Zone 1 and the residual soils within Terrain Zone 2 will be achievable with a small to medium size excavator. Excavation of the weathered siltstone will require a medium to large excavator (i.e. >20T) potentially with a single tyne ripper or hydraulic rock breaker if higher strength or less fractured material is encountered. If bulk excavation is required to depths deeper than achieved during this preliminary assessment then further investigations are recommended.

Groundwater was not encountered within the investigation, however, no long term groundwater monitoring was undertaken as part of the assessment.

Existing dams and swampy ground were observed at three locations in Terrain Zone 1, however, the locations are all within portions of the site that the provided plans indicate are to be 'Drainage Reserves". If site levels are required to be raised within these areas then it is likely ground treatments involving remove and replacement works or rock bridging layers or select working platform, layers will be required.

Laboratory testing indicates that both the alluvial soil from Terrain Zone 1 and the residual soil from Terrain Zone 2 disperse in water (Emerson Class 3). Further details regarding the erodibility of the residual soil is presented in Tables 4 and 5. Laboratory test result sheets are presented in Appendix B.

It is recommended that an earthworks management plan be implemented at the site that as a minimum controls or limits the flow of surface waters at the site and includes the installation of silt fences or other similar measures on the downslope side of the site.

Table 4: Summary of Laboratory Test Results for Erodibility & Stormwater Design

Sample Location	Sample Depth (m)	Material & Terrain Zone	Organic Content (%)	K Factor	Emerson Class
BH3	0.8 – 1.1	Alluvial Soil (Terrain Zone 1)	0.77	0.020	3
BH10	0.45 – 0.55	Residual Soil (Terrain Zone 2)	1.41	0.039	3

Table 5: Particle Size Analysis

Sample	Moisture Content	Gravel	Coarse Sand	Fine Sand	V. Fine Sand	Silt	Clay	Dispersion Percent
		(>2mm)	(0.2-2.0mm)	(0.1-0.2mm)	(0.02-0.1mm)	(2-20µm)	<2µm	
BH3 (0.8-1.1)	2.8%	58.3%	58.3%	1.2%	0.5%	10.2%	22.7%	40.0%
BH10 (0.45-0.55)	1.2%	58.3%	14.1%	2.3%	12.8%	40.2%	30.6%	25.0%

2.3.4 Preliminary Foundation Conditions

Based on the conditions encountered within the investigation, shallow footing systems are likely to be suitable for the support of structures at the site, providing the footings extend through the topsoil and any firm materials to found within the stiff to hard alluvial clay, residual clay or underlying weathered siltstone.

For conceptual purposes, for structures that meet the performance requirements detailed within AS2870-2011 '*Residential slabs and footings*', areas of the site that are not underlain by fill or firm clay are likely to be classified in accordance with AS2870-2011 as:

- Class 'H1' (highly reactive) within Terrain Zone 1 (alluvial soil); and
- Class 'M' (moderately reactive within Terrain Zone 2 (residual soil).

Further assessment must be undertaken during the design stage of the development.

2.3.5 Preliminary Pavement Subgrade Conditions

Laboratory 4 day soaked CBR testing was undertaken on a sample of alluvial clay from Terrain Zone 1 and a sample of residual soil from Terrain Zone 2 and the test results are summarised in Table 3.

The test results indicate that the alluvial clay has a CBR of 5% and a swell in the CBR mould of 1.9% is moderately expansive as defined by Table 5.2 of Austroads Part 2 (2017). The alluvial clay will therefore be highly susceptible to moisture and on exposure the reactive clay subgrade will soften rapidly and site trafficability will become an issue during and following prolonged or heavy rainfall. The use of construction platforms comprising durable crushed rock or recycled concrete should be allowed for during construction, particularly in high traffic areas such as site access points and site compounds.

The residual clay within Terrain Zone 2 has a CBR of 11% and a swell in the CBR mould of 0.3% and is therefore considered to have a low expansive nature as defined by Table 5.2 of Austroads Part 2 (2017).

Pavement construction on alluvial clay subgrades will likely require the use of select layers.

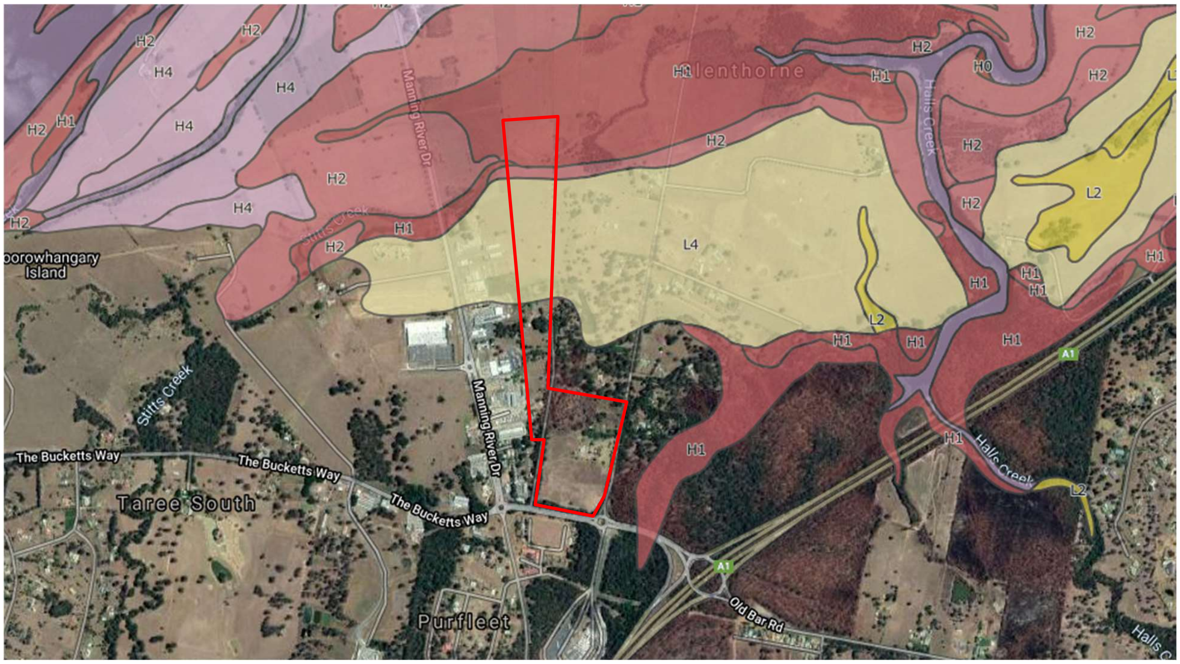
2.4 Site Suitability

Based on the results of the assessment as outlined herein the site is considered suitable for industrial and/or commercial development from a geotechnical perspective.

Further geotechnical assessment will be required for the purpose of specific earthworks, road pavement, and foundation design.

2.5 ACID SULFATE SOILS

Reference to the NSW eSPADE online mapping indicates that the site contains areas of no known occurrence of Acid Suflate Soils (ASS), areas of low probability of occurrence of ASS, and areas of high probability of occurrence of ASS. The extents of each area are illustrated below.



A satellite photo from NSW Government 'eSPADE' website that illustrates the site location. The site boundaries are shown by a red box. The map indicates that Terrain Zone 2 (residual soil) and the southern portion of Terrain Zone 1 (alluvial soil) are located within an area of no known occurrence of ASS materials. The central portion of Terrain Zone 1 (shaded yellow) has a low probability of occurrence of ASS materials at depths of greater than 4m below the ground surface. The northern portion of Terrain Zone 1 (shaded red) where a drainage reserve is proposed has a high probability of occurrence of ASS at depths of between the ground surface and 3m depth.

Acid Sulfate Soils (ASS) produce sulphuric acid when exposed to oxygen due to the presence of iron sulphides in the form of pyrite within the soil matrix. These soils form when iron-rich sediments are deposited in saltwater or brackish water environments. Prior to oxidation, these pyritic soils are referred to as Potential ASS. ASS that have produced acid as a result of oxidation are referred to as Actual ASS. They typically occur in natural, low-lying coastal depositional environments below approximately 5m AHD. In the field ASS are generally identified as saline sediments such as alluvial or estuarine soils or bottom sediments in creeks and estuaries.

In environments such as that which exists at the site, the pyrite and resultant acidity (if any) would exist within the fine grained fraction of the sediment profile.

Thirty-two samples obtained from the boreholes were screened for the presence of actual or potential ASS using methods 23Af and 22Bf of the ASSMAC Acid Sulfate Soils Manual. The test results are attached. The results indicated:

- The samples revealed pH_f values of 3.87 to 7.98 in distilled water. In this test, pH <4 can be an indicator of Actual ASS; and
- The samples revealed pH_{FOX} values of 2.93 to 5.99 in hydrogen peroxide. Values of less than 3 can be an indicator of Potential ASS.

To provide a more comprehensive assessment, five samples were submitted for Net Acidity analysis, to differentiate between potential organic or inorganic sources of sulfur. A summary of the test results is presented in Table 6.

Table 6: Summary of Net Acidity Test Results

Borehole	Depth (m)	Texture	Potential Sulfidic Acidity (mol H+/tonne)	Titratable Actual Acidity (mol H+/tonne)	Net Acidity (mol H+/tonne)
BH1	0.3 – 0.5	Fine	3	**35**	**38**
BH2	0.8 – 1.0	Fine	0	**126**	**129**
BH5	0.8 – 1.0	Fine	0	**173**	**175**
BH5	1.3 – 1.5	Fine	0	**178**	**189**
BH7	0.3 – 0.5	Fine	0	**35**	**35**

Note: Values that are bold and underlined exceed the adopted action criteria of 18 mol H+/tonne which assumes that >1000t of material is to be disturbed.

All five of the samples recorded Titratable Actual Acidity (TAA) concentrations above the adopted action criteria and are therefore considered to be acidic. The potential sulfidic acidity in all five samples is less than the adopted action criteria and the samples are therefore not considered to be potential acid sulfate soils.

The net acidity in all five samples is greater than the adopted action criteria and therefore in accordance with the '*National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual*' (2018) an Acid Sulfate Soil Management Plan is required for Terrain Zone 1 (alluvial soils).

It is recommended that additional sampling and testing be undertaken within Terrain Zone 1 to further assess the source of the acidity and to potentially delineate areas where treatment is required before preparation of an acid sulfate soil management plan.

3 STAGE 1 SITE CONTAMINATION ASSESSMENT

3.1 Objectives

The objectives of the Stage 1 site contamination assessment were to provide a preliminary assessment of the potential for soil contamination to be present on the site.

3.2 Scope of Works

In accordance with the relevant sections of the *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (Amended 2013*), the assessment involved the following process:

- Site walkover to assess visible surface conditions and identify evidence of contamination, or past activities that may cause contamination;
- Review of recent and historical aerial photography dating back as far as 50 years;
- A search of NSW DECCW records for contaminated land notifications on the site;
- A search of government records of groundwater bores in the area;
- Land title search of the respective lots available from the Land Titles Office;

- Using the above information, characterise the site into Areas of Environmental Concern, in which the potential for contamination has been identified, and nominate Chemicals of Concern that might be associated with those activities;
- Undertake targeted sampling and analysis at the selected Areas of Environmental Concern to allow some preliminary analysis of the presence of contamination;
- Analyse samples for a suite of potential contaminants associated with the past activities; and
- Evaluate the results against industry accepted criteria for the proposed industrial land use.

Based on the results of the site history study judgemental sampling at selected locations was undertaken to assist in identifying potential contamination and assessing the requirement for further investigation or site management with regard to contamination.

3.3 Site Identification

General site information is provided below in Table. The site location is shown in Figure 1.

Table 7: Summary of Site Details

Site location:	Off Manning River Drive, Glenthorne
Approximate site area:	23.5 hectares (ha)
Title Identification Details:	• Lot 2 DP827097; • Lot 50 DP863972; and • Lot 2 DP573214.
Current Ownership:	The title documents show Lot 2 DP827097 and Lot 50 are owned by Michael John Barrett and Heather Anne Barrett. Lot 2 573214 is owned by Edward Gerard Gersbach.
Current Landuse:	Predominately grazing land with some rural residential properties.
Proposed Landuse:	Industrial.
Adjoining Site Uses:	• Broad alluvial floodplain to the north; • Rural residential and undeveloped land to the east; • Industrial premises, Eriksson Lane and Manning River Drive to the south; and • Industrial premises and undeveloped land to the west.
Government Area:	Midcoast Council

3.4 Hydrogeology

A groundwater bore search on the NSW Water Information website, http://waterinfo.nsw.gov.au/gw/ indicates that there is a licenced groundwater bore (with available work summary) located approximately 260m to the north west of the northern site boundary as shown below.

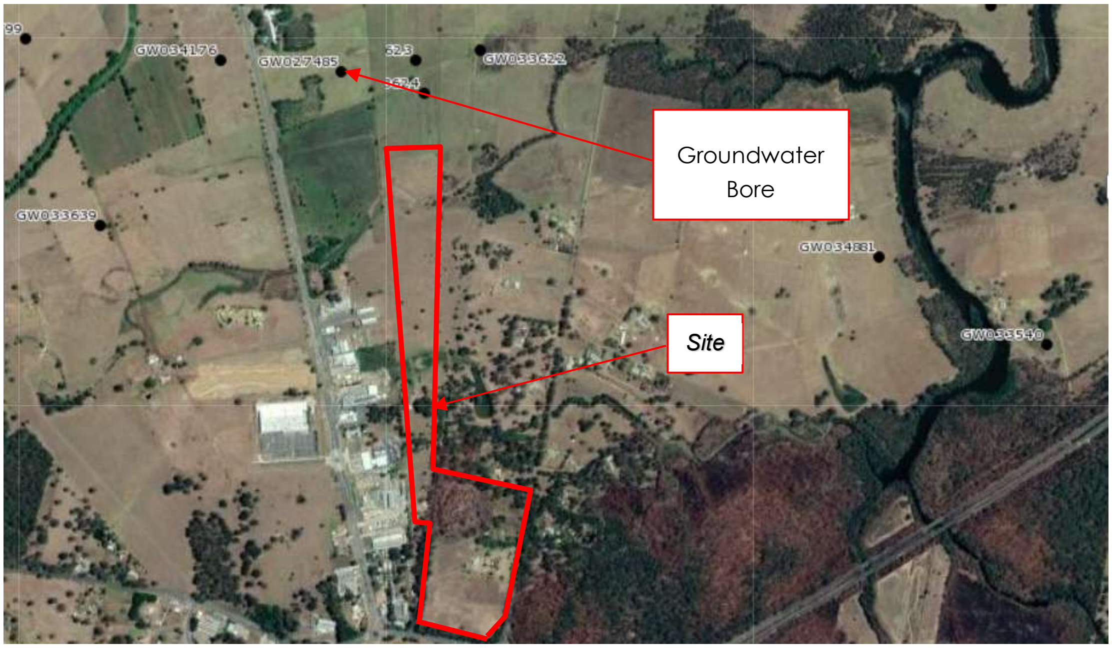


Plate 3: *Approximate site boundary outlined in red. Nearest off-site licensed groundwater bore is located approximately 260m to the north west of the northern site boundary.*

Groundwater bore GW027485 was drilled to a depth of 6.10m on 1 July 1964, is licenced for irrigation purposes with a standing water level of 4.60m; the current status is unknown.

3.5 Site History

3.5.1 Historical Aerial Photography

Aerial photographs and satellite imagery of the site were purchased from the NSW Spatial Services and reviewed to assist in identifying past land uses that may contribute to site contamination. The results of the review are summarised in Table 8.

Table 8 - Aerial Photograph and Satellite Imagery Summary

Year	Site	Surrounding Land
1965	Site appears to have been cleared and used as grazing land. There no structures visible. Some scattered trees present.	Predominantly surrounded by cleared grazing land with some industrial premises visible on Manning River Drive to the west of the site.
1979	No structures visible however, vegetation on Lot 50 and Lot 2 DP DP573214 appears to have increased.	There has been increased industrial development to west of the site on Manning River Drive.
1989	A house, large shed and two access tracks are visible on Lot 50. Vegetation has also been cleared. The remainder of the site is unchanged from the previous photograph.	No visible changes from previous photograph.
1997	A house and detached shed are visible on Lot 2 DP573214. There appears to be some disturbed terrain or possibly stockpiles present in the southern part of Lot 50. A house and several small sheds are visible on Lot 2 DP827097 in the central part of the site.	The new Pacific Highway is visible to the east and south of the site. Industrial development has continued to the west along Manning River Drive. Some rural residential development has occurred to the north and north east.
2005 (Google Earth)	A small shed is visible in the southern part of Lot 2 DP827097. The remainder of the site is unchanged from the previous photograph.	Some clearing of land rural residential development to the east has taken place.
2013 (Google Earth)	No visible changes from previous photograph.	No visible changes from previous photograph.
2018 (Google Earth)	No visible changes from previous photograph.	Further industrial development to the west of the site along Manning River Drive.

3.5.2 Site Observations

Fieldwork was undertaken on 9 April 2020. Observations made during the site visit are summarised below:

- The vast majority of the site was occupied by cleared grazing land with a small number of cattle, in some areas;

Lot 2 DP827097:

- The northern part of the lot is comprised mainly of grazing land with a large number of fences separating paddocks;
- A single storey house with several farm sheds of aluminium construction and an old chicken coop are present in the central part of the lot. One of the sheds contained a large amount of woodern planks, lattice, particle board and pipes. Another shed with a concrete slab floor contained a number of drums and containers of unknown liquids, however it is anticipated that these are used for agricultural purposes. Metal sheeting, bricks, roof tiles, tyres and various other items were scattered around the perimeter of the back yard of the house;
- Two stockpiles of fill were present in the central part of the site. The stockpiles appeared to be composed of residual clay and weathered rock; and
- A small single storey house and shed is present in the southern part of the lot;

Lot 2 DP573214:

- Access to the lot was not permitted as such site observations with regard to site contamination have been made from aerial photographs only;
- A house and shed are present in the south eastern part of the lot;
- There is a gravel access road from Glenthorne Road which leads to the house; and
- The reminder of the lot appears to be used as grazing land.

Lot 50 DP863972:

- The majority of the lot is used for cattle grazing;
- A large single storey brick house and large fibro/weatherboard shed are present in the north eastern part of the lot;
- A small orchard is located to the west of the shed;
- Two gravel access roads lead from Glenthorne Road to the house and shed respectively;
- A pile of firewoods, bricks, roof tiles, sheet metal, wooden planks, and several old drums were present to the north of the house;
- Metal sheeting and lengths of PVC pipe were stored undercover at the rear of the shed;
- Large concrete slabs, culverts and metal grates were stored outside the shed on the western side;
- Some fragments of fibro-cement suspected of being Asbestos Containing Materials (ACM) were present on the northern side of the shed; and
- A stockpile of fill was located to the north west of the site which was primarily comprised of residual clay soil with some wood and metal pieces also present.

A selection of images of the site is presented below.

Looking southwest showing a shed with stored drums and containers of unknown liquids located on the southern side of the house in the central part of Lot 2 DP827097.

Looking south east to the south of the house in the central part of Lot 2 DP827097 showing a fill stockpile.

Looking north showing a stockpile of wood, bricks, metal sheeting, roof tiles and an old drum in the background located to the north of the house on Lot 50.

Fragments of fibro-cement sheeting suspected as being ACM on the ground surface up against the northern side of the shed on lot 50. ACM sample ACM1 was collected from this location.

3.5.3 NSW EPA Records

A check with the NSW Office of Environment and Heritage website (www.environment.nsw.gov.au) revealed that no notices have been issued on the site under the Contaminated Land Management Act (1997).

3.5.4 Land Title Search

A list of past registered proprietors and lessors of the site was obtained from the Land Titles Office. A summary of the title details is included in Appendix A.

The title history search revealed the following:

Lot 2 DP827097:

1878 – 1944	Angus McKay, farmer John McKay, farmer
1944 – 1983	Ronald Samuel Stewart McKay, farmer
1983 – 1988	Audrey Margaret Muldoon, married woman / devisee Patrick Allen McCaffrey, farmer / executor Robert Muldoon, farmer / executor Ronald Samuel Stewart McKay, estate
1988 – 1991	Norman James Eriksson, grazier Joan Eriksson, his wife
1991 – 2004	Peter James Eriksson Sandra Eriksson
2004 – 2017	Richard Nicholas Wirth Robin Joy Wirth
2017 – to date	Michael John Barrett Heather Anne Barrett

Lot 50 DP863972:

1919 - 1972	Annie Sarah Rutherford Northam, wife of Alfred Northam, farmer
1972 - 1972	Clarence Victor Northam / executor Eric Walwyn Ormsby, solicitor Annie Sarah Rutherford Northam, estate
1862 – 1972	Mabel Rutherford Bird, wife of William Allen Bird, farmer
1972 – 1975	Vendul International Pty. Limited.
1975 – 1978	Mabel Rutherford Bird, married woman
1978 – 1980	Vendul International Pty. Limited.
1980 – 2015	George Harry Davey, builder
2015 – 2016	Philip Anthony Davey Ian George Davey
2016 – to date	Michael John Barrett Heather Anne Barrett

Lot 2 DP573214:

1919 - 1962	Annie Sarah Rutherford Northam, wife of Alfred Northam, farmer
1962 - 1962	Clarence Victor Northam / executor Eric Walwyn Ormsby, solicitor Annie Sarah Rutherford Northam, estate
1962 – 1972	Mabel Rutherford Bird, wife of William Allen Bird, farmer
1972 – 1975	Vendul International Pty. Limited.
1975 – 1978	Mabel Rutherford Bird, married woman
1978 – 1982	Edward Gerard Gersbach, bricklayer Janice Phyliss Gersbach, his wife
1982 – to date	Edward Gerard Gersbach, bricklayer

3.5.5 Site History Summary

Based on available data the chronological development of the site is summarised below:

- The lots comprising the site have been owned by various people and companies. The vast majority of the land has predominantly been used for farming and grazing activities;
- Aerial photographs indicate that the first developments were likely to be a house and farm shed on Lot 50 between the late 1970's and late 1980's. This was followed by a house and shed on Lot 2 DP573214 between the late 1980's and late 1990's. There appears to have been no significant change to the existing layout of the properties since 2013;
- Between 1989 and 1997 aerial photographs indicate there may have been some disturbed terrain or possibly stockpiles present in the southern part of Lot 50;
- The lots are comprised generally of paddocks with some cattle grazing at the time of the assessment with a number of rural residential dwellings and sheds; and
- Access to Lot 2 DP573214 was not permitted.

3.6 Field and Laboratory Investigations

3.6.1 Sampling Plan

The NSW EPA (1995) Sampling Design Guidelines recommend a minimum of 55 sampling locations to characterise a site of 5 hectares. This would equate to approximately 250 sampling locations for the subject site.

Due to the preliminary nature of the assessment, at this stage ten sampling locations were selected using a judgemental approach based on the identification of Areas of Environmental Concern.

Surface soil samples (SS1 to SS10) were collected from around existing structures such as farm sheds, and from stockpiles of fill or waste items, such as building materials and old drums.

One sample of ACM (ACM1), a fragment of fibro-cement sheeting, was collected from the ground surface on the northern side of the shed on Lot 50.

3.6.2 Field Work

Field work for the assessment was undertaken on 9 April 2020 and included:

- Site walkover to assess visible surface conditions and identify evidence of contamination, or past activities that may cause contamination (if any); and
- Collection of ten surface soil samples and one suspect ACM sample by an Environmental Engineer.

The locations of the sampling points are shown on Figures 3, 4 and 5. They were obtained on site and located by measurement relative to existing site features.

Soil samples were taken from topsoil and fill using disposable gloves and hand tools which were decontaminated between sampling points using Decon90 detergent and deionised water. The samples were collected in acid-rinsed 250mL glass jars and placed in an ice-chilled cooler box.

3.6.3 Laboratory Analysis

Samples were transported under chain-of-custody conditions to ALS Laboratory Group, a NATA accredited specialist chemical testing laboratory, to be analysed for the following suite of contaminants;

- Polycyclic Aromatic Hydrocarbons (PAH);
- Total Recoverable Hydrocarbons (TRH);
- Benzene, Toluene, Ethyl-benzene, Xylenes (BTEX);
- Organochlorine Pesticides (OC/OPs);
- Heavy metals (arsenic, cadmium, chromium, cobalt, copper, lead, mercury, and zinc);
- Polychlorinated Biphenyls (PCB); and
- Presence of asbestos.

The results are presented in Appendix B.

3.7 Data Quality Objectives

The Data Quality Objectives (DQOs) are presented in Table 9.

Table 9 – Data Quality Objectives

DQO	Details of Process
State the Problem	A Stage 1 site contamination assessment is required to support a re-zoning application for the land from RU1 (primary Production) to IN1 (Industrial), B6 (Enterprise Corridor) and E2 (Environmental Management).
Identify the Decision	The principal study questions that are: • What is the nature and extent of soil contamination on the subject land (if any)?; and • Is the land suitable for the proposed rezoning application from a contamination viewpoint?
Identify Inputs to the Decision	The primary inputs are: • Site history study; • Site walkover assessment; • Chemical analysis of soil; and • Results summary.
Define the Boundary of the Assessment	• The spatial boundaries are limited to the property boundaries of the subject lots as shown on Figure 1; • The investigation and screening levels for a commercial / industrial land use scenario.
Develop a Decision Rule	The decision rules for the investigation are: • If concentrations of contaminants in soil exceed the adopted investigation and screening levels for a commercial / industrial land use scenario, the further assessment may be required; Decision criteria for QA/QC measures are defied in Section 3.9. A decision on the acceptance of analytical data will be made on the basis of the data quality indicators (DQIs) in the context of precision, accuracy, representativeness, completeness and comparability (PARCC) parameters as follows: • **Precision:** NATA registered laboratories were used following NATA endorsed methods. An appropriate number of intra-laboratory samples were collected and analysed (following ASC NEPM guidance), the results of which are considered to be satisfactory; • **Accuracy:** The laboratory limit or reporting (LOR) was appropriate for the screening criteria utilised. NATA registered laboratories were used following NATA endorsed methods including appropriate method blanks, laboratory control

	samples, laboratory spikes and duplicates the results of which are considered to be satisfactory. • **Representativeness –** The samples were received by the laboratories in good condition. The data obtained is considered to be representative of the soils and ACM present on site; • **Completeness –** Experienced field staff were utilised to undertake the sampling and keep appropriate documentation. Samples were in proper custody between the field and reaching the laboratory. The laboratories performed the tests requested. The data obtained from the field investigations is considered to be relevant and usable; and • **Comparability –** Sample holding times were met and samples were properly and adequately preserved. Field sampling and handling procedures were followed. The data collected is considered to be comparable.
Specify Acceptable Limits on Decision Errors	• Acceptable limits for QA/QC measures are defined in Section 3.9; • Acceptable investigation and screening levels are those for a commercial / industrial land use scenario; and • Specific limits are in accordance with the appropriate NSW EPA guidelines including indicators of data quality and standard procedures for field sampling and handling.
Optimise the Design for Obtaining Data	Based on the above steps of the DQO process. The design for obtaining the required data (i.e proposed field and laboratory investigations) is presented in Section 3.6.1 to 3.6.3.

3.8 Guidelines and Assessment Criteria

The assessment was conducted in accordance with the requirements of a Stage 1 Contaminated Site Assessment as outlined in NSW EPA *Guidelines for Consultants Reporting on Contaminated Land (2020)*.

To evaluate results, and for guidance on assessment requirements, the assessment adopted the guidelines provided in the *National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM 2013)*. The ASC NEPM document provides a range of guidelines for assessment of contaminants for various land use scenarios. It is understood that the future land use for the site is industrial. As such, comparison with the ASC NEPM guideline Health Investigation Levels (HIL) for Commercial / Industrial D land use is considered appropriate for the site. In accordance with the NEPM guideline the following criteria were adopted for this assessment:

- Health Investigation Levels (HILs) for commercial/industrial 'D' land use (HIL-D) were used to assess the potential human health impact of heavy metals and polycyclic aromatic hydrocarbons (PAHs);
- Health Screening Levels (HSLs) for coarse textured (sand) or fine textured (silt and clay) soils on a commercial/industrial site were adopted as appropriate for the soils encountered to

assess the potential human health impact of petroleum hydrocarbons and benzene, toluene, ethylbenzene and xylene (BTEX compounds); and

- Ecological Screening Levels (ESLs) for coarse textured (sand) soils or fine textured (silt and clay) soils on a commercial/industrial land use site were adopted as appropriate for the soils encountered, to assess the potential ecological / environmental impact of petroleum hydrocarbons and BTEX compounds.

In accordance with ASC NEPM 2013, exceedance of the respective criteria does not necessarily deem that remediation or clean-up is required but is a trigger for further assessment of the extent of contamination and associated risks. The adopted criteria are presented in results summary tables in Appendix B.

3.9 Quality Assurance / Quality Control

Samples were obtained using industry accepted protocols for sample treatment, preservation, and equipment decontamination. Sampling equipment was decontaminated between sample locations and a clean pair of nitrile gloves used for the collection of each sample into laboratory supplied glass sampling jars.

Samples were placed on ice on-site and maintained on ice during transport to the testing laboratories. One duplicate soil sample identified as D1 (duplicate of primary sample SS6) was submitted to the laboratory for analysis for quality control purposes. Comparison between the primary and duplicate samples are presented in the results summary tables in Appendix B.

The Relative Percent Differences (RPDs) were calculated for the duplicate sample and presented in the results summary table in Appendix D. The RPDs were within the control limit of 30% (with the exception of Copper, Lead, Nickel and Zinc) and indicated generally good correlation between the primary and duplicate samples. It is noted that low analyte concentrations exaggerate the percentage differences with respect to small total concentration differences, therefore where results for the primary and duplicate samples were less than 10 times the laboratory limit of reporting (LOR), the RPDs have been disregarded. The RPDs for Copper, Lead, Nickel and Zinc were disregarded on this basis.

In addition to the field quality control procedures, the laboratory conducted internal quality control testing including surrogates, blanks, and laboratory duplicate samples. The results are presented with the laboratory test results in Appendix B.

All laboratory quality control data is within acceptable limits for the tests carried out. Therefore, on the basis of the results of the field and laboratory quality control procedures and testing, the data is considered to reasonably represent the concentrations of contaminants in the soils at the sample locations at the time of sampling and the results can be adopted for this assessment.

3.10 Results

3.10.1 Subsurface Conditions

The soil types recorded in surface samples are summarised below in Table 10.

Table 10: Summary of Subsurface Conditions (Surface Samples)

Sample ID	Description
SS1, SS2, SS3, SS4 AS1, AS2, AS3, AS4,	Topsoil (Alluvial Terrain) – Silty Clay, low plasticity, brown / dark brown / pale brown, gravel coarse grained, lots of grass roots
SS5, SS6, SS9, AS5, AS6	Fill (Stockpile) – Gravelly CLAY, medium to high plasticity, brown / orange / red, gravel (ironstone), coarse grained, some grass roots. Some extremely weathered siltstone cobbles and boulders.
SS7, SS8, SS10, AS7, AS8, AS10	Topsoil (Residual Terrain) – Silty Clay, low plasticity, brown / dark brown / pale brown, gravel coarse grained, lots of grass roots
ACM1	Fragment of fibro-cement sheeting present on ground surface within Lot 50.

3.10.2 Laboratory Results

An appraisal of the laboratory test results presented in Appendix B is provided below with reference to the adopted soil investigation and screening levels discussed in Section 2.

- Concentrations of heavy metals were either below the laboratory detection limit or below the adopted health investigation criteria for a Commercial/Industrial D site in each of the samples analysed;
- Concentrations of BTEX and PAH contaminants were below the laboratory detection limit in each of the samples analysed;
- Concentrations of volatile C_6-C_{10} TRH hydrocarbons were below the laboratory detection limit in each of the samples analysed;
- Concentrations of C_{10}-C_{16}, C_{16}-C_{34} and C_{34}-C_{40} TRH hydrocarbons were either below the laboratory detection limit or below the adopted ecological screening level for a Commercial/Industrial D site in each of the samples analysed. Notable concentrations of 'heavy' fraction petroleum hydrocarbons were detected in sample SS2/AS1 adjacent to the Lot 2 DP8227097 storage building (within AEC3) which were possibly indicative of a lubricating oil spill in this vicinity;
- Concentrations of PCB and OC/OP pesticides were below the laboratory detection limit in each of the samples analysed, with the exception of sample SS7 which exceeded the laboratory detection limit for OC pesticides but was below the adopted health investigation criteria for a Commercial/Industrial D site;
- Asbestos was not detected in each of the soil samples analysed; and
- Chrysotile (white) asbestos was detected in sample ACM1 (a fragment of fibro-cement).

3.11 Conceptual Site Model

Based on the site observations and knowledge obtained about site activities as outlined above, a conceptual site model (CSM) has been developed.

3.11.1 Potential Sources of Contamination

Potential Areas of Environmental Concern (AECs) and Chemicals of Concern (COCs) identified for the assessment are outlined in Table 11.

Table 11: Potential AECs and COCs

AEC	Mode of Potential Contamination	Potential COCs	Likelihood of Contamination	Sampling Undertaken
AEC1: Soils in vicinity of the existing houses /sheds/structures	Potential spillage or leaks of chemicals from stored containers including cleaning fluids, fuels/oils, agrochemicals. Potential hazardous building materials	Heavy Metals, TPH, BTEX, PAH, PCB, and OC/OPP and asbestos	Moderate	SS2, SS3, SS4, SS7, SS8, AS1, AS2, AS3, AS4, AS7
AEC2: Stockpiles of fill of unknown origin	Importation of potentially contaminated fill	Heavy Metals, TPH, BTEX, PAH, PCB, OC/OPP and asbestos	Moderate	SS5, SS6, SS9, AS5, AS6, AS8
AEC3: Stored or discarded building materials and drums	Potential hazardous building materials. Potential spillage or leaks of chemicals from stored /discarded containers including cleaning fluids, fuels/oils, agrochemicals	Heavy Metals, TPH, BTEX, PAH, PCB, OC/OPP and asbestos	Moderate	SS10, AS10, ACM1
AEC4: Unidentified waste from illegal dumping	Potential spillage or leaks of fuels/oils and/or presence of potential hazardous building materials	Heavy Metals, TPH, BTEX, PAH, PCB, OC/OPP and asbestos	Low	--
AEC5: Unidentified disturbed areas	Presence of stockpiles of imported fill of unknown origin	Heavy Metals, TPH, BTEX, PAH, PCB, OC/OPP and asbestos	Low	--
Heavy Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc *BTEX - Benzene, Toluene, Ethylbenzene and Xylene* *TPH - Total Petroleum Hydrocarbons* *PAH – Polycyclic Aromatic Hydrocarbons* *PCB – Polychlorinated Biphenyls*				

OC/OPP – Organochlorine and Organophophorus Pesticides		

The approximate locations of the AEC's are shown on Figures 3, 4 and 5.

3.11.2 Potential Exposure Pathways and Receptors

Based on the site observations and knowledge obtained about site activities as outlined above, potential exposure pathways and receptors identified for the assessment are summarised in Table in Table 12.

Table 12: Potential Exposure Pathways and Receptors

Chemicals of Concern	Key Pathways	Key Receptors
Asbestos, heavy metals	Generation of dust, notably during earthworks or from landscaped areas which is inhaled	Onsite - Construction and site workers, future site users Offsite - Adjacent sites
Heavy metals, TPH, BTEX, PAH, PCB, OC/OPP	Skin contact / ingestion, plant uptake	Onsite - Construction and site workers, future site users, vegetation in landscaped areas
Heavy Metals, TPH, BTEX, PAH, PCB, OC/OPP	Surface runoff and leaching of soils	Offsite - Surface water ecosystems and users of surface water and groundwater
Heavy Metals - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel and Zinc *BTEX - Benzene, Toluene, Ethylbenzene and Xylene* *TPH - Total Petroleum Hydrocarbons* *PAH – Polycyclic Aromatic Hydrocarbons* *PCB – Polychlorinated Biphenyls* *OC/OPP – Organochlorine and Organophophorus Pesticides*		

3.12 Discussion

A Stage 1 site contamination assessment was required to assess past and present potentially contaminating activities and contamination types with regard to the site's suitability for future industrial land use.

The previous and current activities on the site generally appear to have involved low intensity grazing and farming. Identified AEC's were predominantly around existing structures including houses, farm sheds, stored and discarded building materials and old drums, fill stockpiles, and potentially waste from illegal dumping and unidentified disturbed areas or fill stockpiles (in addition to the two stockpiles of fill identified on Lot 2 DP827097, and one stockpile of fill identified on Lot 50 respectively).

Drums of unknown liquids in a shed at the rear of the existing house on Lot 2 DP827097 in the central part of the site were stored on the concrete slab floor of the shed. The drums contained liquids which were anticipated to be associated with agricultural activities.

Two stockpiles of fill were present on Lot 2 DP827097 in the central part of the site and contained residual clay soils and weathered siltstone. Another stockpile of fill was located to the west of the shed on Lot 50 and contained residual clay soils.

An area to the north of the house on Lot 50 contained stockpiled wood, bricks, roof tiles and several old rusted drums. It is not known what the drums contained.

There was no visual or olfactory evidence of soil contamination observed in and around the areas described above.

The results of laboratory analysis of surface soil samples collected from ten targeted locations (AEC's outlined above), revealed concentrations of the chemicals of concern were either below the laboratory detection limit, or below the adopted health investigation criteria for a Commercial/Industrial D site.

Some fragments of fibro-cement were present on the ground surface on the northern side of the shed on Lot 50. The fragments were suspected of being ACM. Analysis of suspect ACM sample ACM1, a fragment of fibro-cement sheeting collected from the ground surface up against the northern side of the shed on Lot 50 in the southern part of the site, contained Chrysotile (white) asbestos.

No other fragments of building materials suspected of being ACM were observed during the walkover assessment across the remainder of the site. However, the presence of unidentified ACM cannot be precluded, particularly on Lot 2 DP573214 where a site walkover and sampling was not undertaken due to access constraints.

Given that the proposed development is likely to cover the majority of the site in the form of structure or pavement, the risk of exposure of site users or occupants to ACM (if any) is considered to be low and no further testing is recommended at this stage.

3.13 Conclusions and Recommendations

It is recommended that an Asbestos Management Plan be prepared by a suitably qualified person in accordance with the NSW WorkCover Code of Practice (How to Manage and Control Asbestos in the Workplace) prior to works commencing onsite, to facilitate the removal of the identified ACM. This is likely to involve visual identification and removal of asbestos fragments from the site by licensed asbestos removal contractors. Additional sampling may be required if a significant proportion of fine asbestos material is detected during the removal works.

It is also recommended that the stored and/or discarded building materials, old drums and fill stockpiles be removed and disposed of at a licenced landfill or recycling facility. Should the preference be for offsite disposal of any of the fill stockpiles, it is recommended that waste classification testing in accordance with NSW EPA (2014) Waste Classification Guidelines be undertaken by a suitable qualified and experienced environmental consultant prior to transportation of the materials.

Given the significant size of the site, the presence of unidentified fill cannot be precluded. As such, should any fill materials be encountered that require removal off site it will require assessment for a *Resource Recovery Exemption under Part 9, Clauses 91 and 92 of the Protection of the Environment Operations (Waste) Regulation 2014* in accordance with the *Resource Recovery Order under Part*

9, Clause 93 of the Protection of the Environment Operations (Waste) Regulation 2014 – the Excavated Natural Material (ENM) Order 2014.

The investigation works undertaken were of limited scope and provide a preliminary assessment of identified AECs. Should any materials suspected of being contaminated (by way of visual or olfactory evidence) be encountered during development of the site, particularly in the vicinity of the existing structures, fill stockpiles or stored building materials and old drums, it is recommended that advice from a suitable qualified and experienced environmental consultant be sought without delay.

Based on the results obtained in this investigation, the site is considered suitable for the proposed rezoning and industrial use with regard to the presence of soil contamination, provided the recommendations and advice of this report are adopted, and site preparation works are conducted in accordance with appropriate site management protocols and legislative requirements.

4 LIMITATIONS

The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical and pavement 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. 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

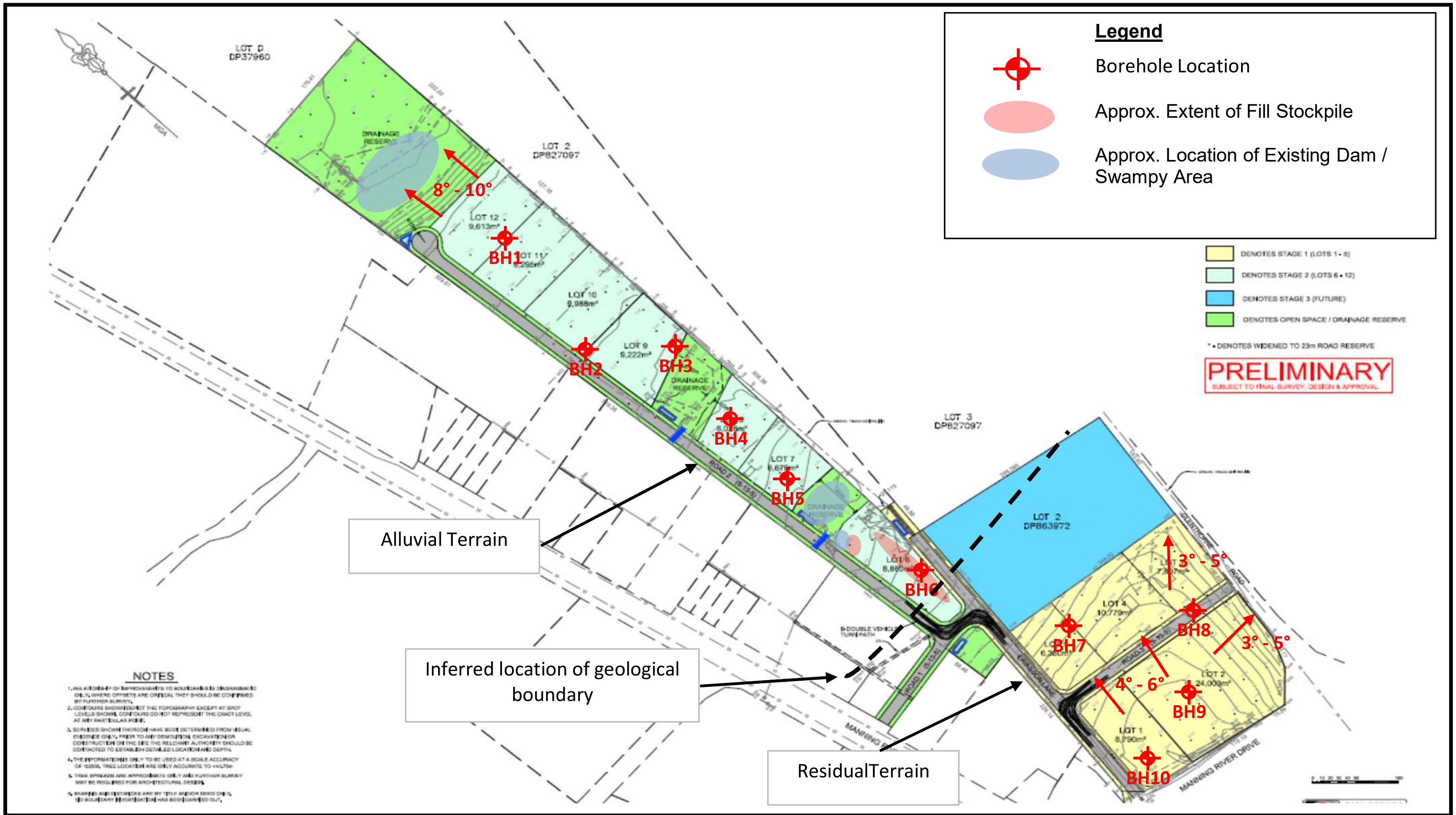
Regional Geotechnical Solutions Pty Ltd

Prepared by	Reviewed by
Andrew Hills	**Steven Morton**
Senior Environmental Engineer	Principal Geotechnical Engineer

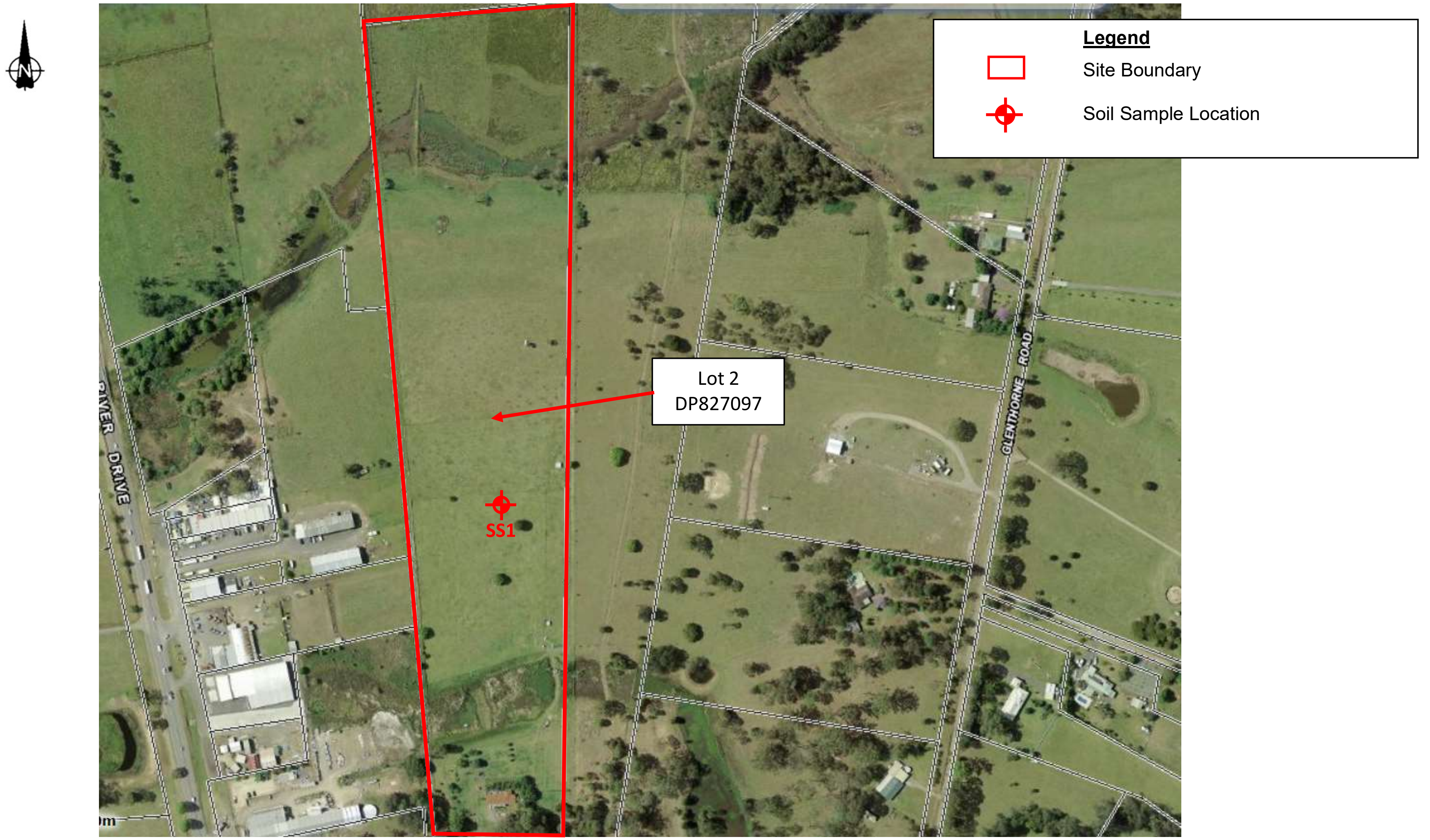
Figures

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Blue Sky Planning & Environment	Job No.	RGS02324.1
Project:	Proposed Rezoning Off Manning River Drive, Glenthorne	Drawn By:	APH
		Scale:	As Shown
		Date:	30-Apr-20
Title:	Site Location Plan	Drawing No.	**Figure 1**



REGIONAL GEOTECHNICAL SOLUTIONS	**Client:**	Blue Sky Planning & Environment	Job No.	RGS02324.1
	Project:	Proposed Rezoning Off Manning River Drive, Glenthorne	Drawn By:	APH
			Scale:	As Shown
			Date:	30-Apr-20
	Title:	Test Location Plan - Geotechnical Assessment	Drawing No.	**Figure 2**



REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Jasbe Glenthorne Pty Ltd & Mulgrave Trust	Job No.	RGS02324.1
Project:	Proposed Rezoning Off Manning River Drive, Glenthorne	Drawn By:	APH
		Scale:	Not Shown
		Date:	6-May-20
Title:	Investigation Location Plan - North	Drawing No.	**Figure 3**

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Jasbe Glenthorne Pty Ltd & Mulgrave Trust	Job No.	RGS02324.1
Project:	Proposed Rezoning Off Manning River Drive, Glenthorne	Drawn By:	APH
		Scale:	Not Shown
		Date:	6-May-20
Title:	Investigation Location Plan - Central	Drawing No.	**Figure 4**

REGIONAL GEOTECHNICAL SOLUTIONS

Client:	Jasbe Glenthorne Pty Ltd & Mulgrave Trust	Job No.	RGS02324.1
Project:	Proposed Rezoning Off Manning River Drive, Glenthorne	Drawn By:	APH
		Scale:	Not Shown
		Date:	6-May-20
Title:	Investigation Location Plan - South	Drawing No.	**Figure 5**

Appendix A

Results of Field Investigations

REGIONAL GEOTECHNICAL SOLUTIONS

ENGINEERING LOG - BOREHOLE

CLIENT:	Blue Sky PLanning and Environment	**BOREHOLE NO:**	**BH1**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	APH
		DATE:	9/4/20

DRILL TYPE: RGS Ute Mounted Drill Rig
EASTING:
SURFACE RL: Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, brown/pale brown, trace gravel coarse grained, lots of grass roots	M				TOPSOIL
						CH	**CLAY:** Medium to high plasticity, pale grey, some gravel coarse grained, some roots	M > w_P	F	HP	80	ALLUVIAL SOIL
		0.30m ASS 0.50m		0.5								
		0.55m U50 0.70m								HP	100	
		0.80m ASS 1.00m		1.0								
									St	HP	150	
		1.30m ASS 1.50m		1.5			Becoming pale brown/pale grey/orange, some sand fine to medium grained appearing					
		1.80m ASS 2.00m							VSt	HP	220	
				2.0			2.00m					
				2.5						HP	320	
				3.0						HP	370	
							Becoming pale grey/pink					
				3.5						HP	350	
										HP	370	
							4.00m					

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 Hole Terminated at 4.00 m

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

CLIENT: Blue Sky Planning and Environment
PROJECT NAME: Proposed Rezoning
SITE LOCATION: Manning River Drive, Taree South
TEST LOCATION: Refer to Figure 1

BOREHOLE NO: BH2
PAGE: 1 of 1
JOB NO: RGS02324.1
LOGGED BY: APH
DATE: 9/4/20

DRILL TYPE: RGS Ute Mounted Drill Rig
BOREHOLE DIAMETER: 100 mm
INCLINATION: 90°
EASTING:
NORTHING:
SURFACE RL: Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown, some gravel coarse grained, lots of grass roots	M				TOPSOIL
		0.30m CBR 0.60m		0.20m 0.5		CH	**CLAY:** Medium to high plasticity, brown/orange, some gravel coarse grained, some roots	M > W_P	VSt	HP	250	ALLUVIAL SOIL
		0.80m ASS 1.00m		0.65m 1.0		CH	**CLAY:** High plasticity, pale grey/pale brown/orange/pink	M > W_P	VSt	HP	250	
		1.30m ASS 1.50m		1.5			Trace sand fine to medium grained appearing			HP	250	
		1.80m ASS 2.00m		2.0						HP	280	
				2.10m			Hole Terminated at 2.10 m					
				2.5 3.0 3.5								

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: BH3

CLIENT: Blue Sky Planning and Environment
PAGE: 1 of 1
PROJECT NAME: Proposed Rezoning
JOB NO: RGS02324.1
SITE LOCATION: Manning River Drive, Taree South
LOGGED BY: APH
TEST LOCATION: Refer to Figure 1
DATE: 9/4/20

DRILL TYPE: RGS Ute Mounted Drill Rig
EASTING:
SURFACE RL: Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown, some gravel coarse grained, lots of grass roots	M				TOPSOIL
							0.15m					
						CH	**CLAY:** High plasticity, brown/orange/pale grey/red, trace gravel coarse grained, trace roots	M > W_P	VSt	HP	220	ALLUVIAL SOIL
		0.30m ASS 0.50m		0.5								
		0.80m ASS D 1.00m		1.0						HP	220	
							Trace sand fine to medium grained appearing, becoming pale brown/pale grey/orange					
		1.30m ASS 1.50m		1.5						HP	220	
		1.80m ASS 2.00m		2.0						HP	280	
							2.10m					
							Hole Terminated at 2.10 m					
				2.5								
				3.0								
				3.5								

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%

ENGINEERING LOG - BOREHOLE

REGIONAL GEOTECHNICAL SOLUTIONS

CLIENT:	Blue Sky Planning and Environment	**BOREHOLE NO:**	**BH4**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
		LOGGED BY:	APH
TEST LOCATION:	Refer to Figure 1	**DATE:**	9/4/20

DRILL TYPE:	RGS Ute Mounted Drill Rig	**EASTING:**		**SURFACE RL:**	Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown, some gravel, coarse grained, lots of grass roots	M				TOPSOIL
				0.20m		CH	**CLAY:** Medium to high plasticity, brown/orange/grey/red, trace gravel coarse grained, trace roots	M > W_P	St	HP	180	ALLUVIAL SOIL
		0.30m ASS 0.50m		0.5								
		0.60m U50 0.88m 0.90m					Becoming pale brown/pale grey/orange/red, trace sand fine to medium grained appearing		VSt	HP	280	
		ASS 1.10m		1.0						HP	280	
		1.40m ASS 1.60m		1.5						HP	220	
										HP	280	
				2.0		2.00m						
							Hole Terminated at 2.00 m					
				2.5								
				3.0								
				3.5								

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

CLIENT:	Blue Sky Planning and Environment	**BOREHOLE NO:**	**BH5**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	APH
		DATE:	9/4/20

DRILL TYPE: RGS Ute Mounted Drill Rig
BOREHOLE DIAMETER: 100 mm **INCLINATION:** 90°
EASTING:
NORTHING:
SURFACE RL: Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown/black, trace gravel coarse grained, lots of grass roots	M				TOPSOIL
		0.30m ASS 0.50m		0.5		CH	0.20m **CLAY:** Medium to high plasticity, brown/orange, trace gravel coarse grained, some roots	M > W_P	St	HP	100	ALLUVIAL SOIL
		0.80m ASS 1.00m 1.30m ASS 1.50m		1.0 1.5		CH	0.75m **CLAY:** High plasticity, brown/orange/red Becoming pale grey/red/pink Some gravel (ironstone) appearing	M > W_P	VSt	HP HP	350 350	RESIDUAL SOIL
				2.0					H	HP	400	
				2.5 3.0 3.5			2.10m Hole Terminated at 2.10 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	

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

CLIENT:	Blue Sky Planning and Environment	**BOREHOLE NO:**	**BH6**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	APH
		DATE:	9/4/20

DRILL TYPE: RGS Ute Mounted Drill Rig **EASTING:** **SURFACE RL:** Not Measured m

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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown, some gravel coarse grained, lots of grass roots	M				TOPSOIL
		0.30m ASS 0.50m		0.5	0.20m	CH	**CLAY:** Medium to high plasticity, pale brown/orange, some gravel coarse grained, some roots	M > W_P	F	HP	100	ALLUVIAL SOIL
		0.80m ASS 1.00m		1.0					St	HP	200	
		1.30m ASS 1.50m		1.5			Becoming pale brown/pale grey		VSt	HP	250	
				2.0						HP	280	
				2.5	2.50m	CL	**Silty CLAY:** Low plasticity, pale grey/pale brown/orange/white		Fb			EXTREMELY WEATHERED SILTSTONE
				3.0	2.80m		Hole Terminated at 2.80 m Practical refusal					
				3.5								

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

CLIENT:	Blue Sky Planning and Environment	**BOREHOLE NO:**	**BH7**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	APH
		DATE:	9/4/20

DRILL TYPE: RGS Ute Mounted Drill Rig
EASTING:
SURFACE RL: Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown, some gravel coarse grained, lots of grass roots	M				TOPSOIL
		0.30m ASS 0.50m				CH	0.15m **CLAY:** Medium to high plasticity, orange, some gravel coarse grained	M > W_P	St	HP	150	RESIDUAL SOIL
		0.55m U50 0.80m 0.90m		0.5			Becoming orange/brown/red					
		ASS 1.10m		1.0					VSt	HP	250	
		1.40m ASS 1.60m		1.5			Lots of gravel (ironstone) appearing			HP	350	
				2.0		CL	1.90m **Silty CLAY:** Low plasticity, pale grey/red/pink/white 2.00m	M < W_P	Fb			EXTREMELY WEATHERED SILTSTONE
				2.5 3.0 3.5			Hole Terminated at 2.00 m Practical refusal					

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

CLIENT:	Blue Sky Planning and Environment	**BOREHOLE NO:**	**BH8**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	APH
		DATE:	9/4/20

DRILL TYPE: RGS Ute Mounted Drill Rig **EASTING:** **SURFACE RL:** Not Measured m

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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, brown, some gravel coarse grained, lots of grass roots	M				TOPSOIL
		0.30m ASS 0.50m		0.20m		CH	**CLAY:** High plasticity, brown/orange/red	M > W_P	F	HP	90	RESIDUAL SOIL
		0.55m CBR 0.75m 0.80m ASS 1.00m 1.30m ASS 1.50m		0.50m 0.5 1.0 1.5		CH	**Gravelly CLAY:** High plasticity, brown/orange/red, gravel (ironstone) coarse grained		VSt	HP HP	350 250	
							Becoming friable		Fb			
				1.70m 2.0		CL	**Silty CLAY:** Pale grey/red/pink/white	M < W_P	Fb			EXTREMELY WEATHERED SILTSTONE
				2.00m 2.5 3.0 3.5			Hole Terminated at 2.00 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	

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

CLIENT:	Blue Sky Planning and Environment	**BOREHOLE NO:**	**BH9**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	APH
		DATE:	9/4/20

DRILL TYPE:	RGS Ute Mounted Drill Rig	**EASTING:**		**SURFACE RL:**	Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown, some gravel coarse grained, lots of grass roots	M				TOPSOIL
				0.15m		CH	**CLAY:** High plasticity, orange/red/brown, some gravel coarse grained	M > W_P	VSt	HP	250	RESIDUAL SOIL
		0.30m ASS 0.50m		0.5								
		0.80m ASS 1.00m		1.0						HP	300	
		1.30m ASS 1.50m		1.5			Gravel content increasing, becoming pale brown/orange/red			HP	300	
				1.90m		CL	**Silty CLAY:** Low plasticity, pale grey/red/pink/white	M < W_P	Fb			EXTREMELY WEATHERED SILTSTONE
				2.0 2.00m			Hole Terminated at 2.00 m					
				2.5								
				3.0								
				3.5								

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

CLIENT:	Blue Sky Planning and Environment	**BOREHOLE NO:**	**BH10**
PROJECT NAME:	Proposed Rezoning	**PAGE:**	1 of 1
SITE LOCATION:	Manning River Drive, Taree South	**JOB NO:**	RGS02324.1
TEST LOCATION:	Refer to Figure 1	**LOGGED BY:**	APH
		DATE:	9/4/20

DRILL TYPE:	RGS Ute Mounted Drill Rig	**EASTING:**		**SURFACE RL:**	Not Measured m
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/T	Not Encountered					CL	**TOPSOIL:** Silty CLAY, low plasticity, dark brown, some gravel, lots of grass roots	M				TOPSOIL
		0.30m ASS D 0.50m		0.5		CH	0.20m **CLAY:** High plasticity, orange/brown/red, some gravel coarse grained, trace roots	$M > W_P$	VSt	HP	250	RESIDUAL SOIL
		0.80m ASS 1.00m		1.0			Gravel content increasing			HP	350	
		1.30m ASS 1.50m		1.5					H	HP	400	
				2.0		CL	1.70m **Silty CLAY:** Low plasticity, pale grey/red/pink/white	$M < W_P$	Fb			EXTREMELY WEATHERED SILTSTONE
				2.5 3.0 3.5			2.00m Hole Terminated at 2.00 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	

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%

Appendix B

Laboratory Test Result Sheets

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW20W-1325--S01
Issue No: 1

Shrink Swell Index Report

Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street
Wingham NSW 2429

Principal:
Project No.: MNC16P-0001
Project Name: Various Testing

Accredited for compliance with ISO/IEC 17025-Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Results provided relate only to the items tested or sampled.
This report shall not be reproduced except in full.

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/04/2020

Sample Details

Sample ID: NEW20W-1325--S01
Client Sample ID:
Test Request No.: RGS02324.1
Sampling Method: Sampled by Engineering Department
Material: Sandy Clay
Date Sampled: 14/04/2020
Source: On Site
Date Submitted: 15/04/2020
Specification: No Specification
Project Location: Manning River Drive, Glenthorne, NSW
Sample Location: BH1 - (0.55 - 0.7m)
Borehole Number: BH1
Borehole Depth (m): 0.55 - 0.7

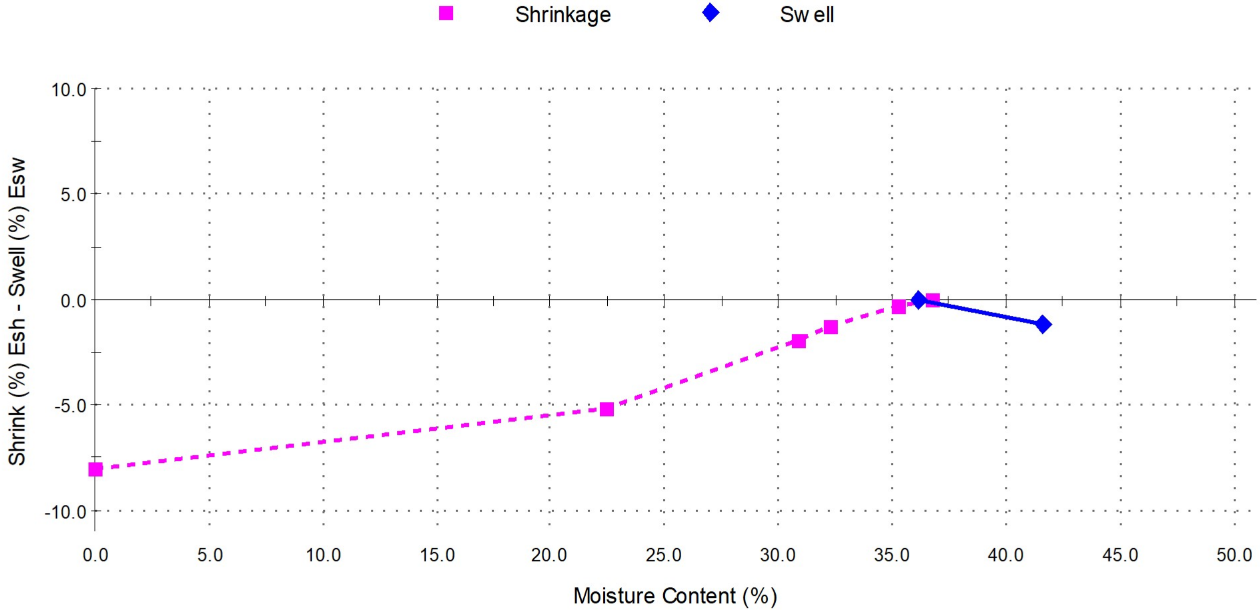
Swell Test AS 1289.7.1.1

Swell on Saturation (%): -1.2
Moisture Content before (%): 36.1
Moisture Content after (%): 41.6
Est. Unc. Comp. Strength before (kPa): 130
Est. Unc. Comp. Strength after (kPa): 110

Shrink Test AS 1289.7.1.1

Shrink on drying (%): 8.0
Shrinkage Moisture Content (%): 36.8
Est. inert material (%): <1
Crumbling during shrinkage: NIL
Cracking during shrinkage: Minor

Shrink Swell



Shrink Swell Index - Iss (%): 4.5

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW20W-1325--S02
Issue No: 1

Shrink Swell Index Report

Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street
Wingham NSW 2429

Principal:
Project No.: MNC16P-0001
Project Name: Various Testing

Accredited for compliance with ISO/IEC 17025-Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Results provided relate only to the items tested or sampled.
This report shall not be reproduced except in full.

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/04/2020

Sample Details

Sample ID: NEW20W-1325--S02
Test Request No.: RGS02324.1
Material: Sandy Clay
Source: On Site
Specification: No Specification
Project Location: Manning River Drive, Glenthorne, NSW
Sample Location: BH4 - (0.6 - 0.88m)
Borehole Number: BH4
Borehole Depth (m): 0.6 - 0.88

Client Sample ID:
Sampling Method: Sampled by Engineering Department
Date Sampled: 14/04/2020
Date Submitted: 15/04/2020

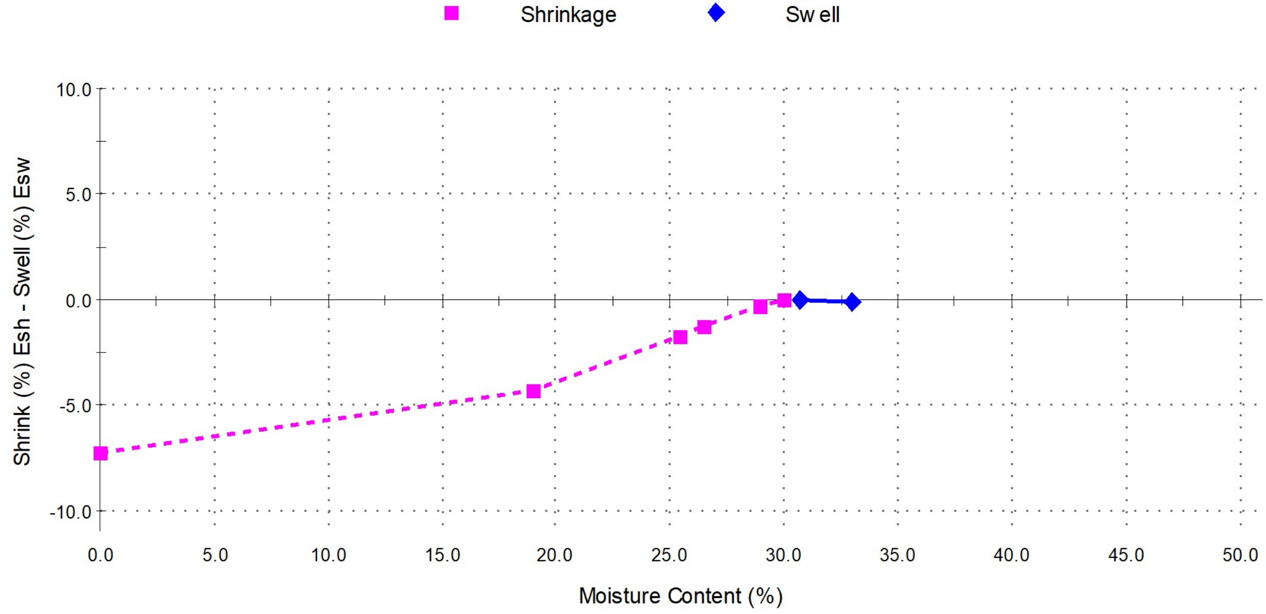
Swell Test AS 1289.7.1.1

Swell on Saturation (%): -0.1
Moisture Content before (%): 30.7
Moisture Content after (%): 33.0
Est. Unc. Comp. Strength before (kPa): 200
Est. Unc. Comp. Strength after (kPa): 130

Shrink Test AS 1289.7.1.1

Shrink on drying (%): 7.3
Shrinkage Moisture Content (%): 30.0
Est. inert material (%): <1
Crumbling during shrinkage: NIL
Cracking during shrinkage: NIL

Shrink Swell



Shrink Swell Index - Iss (%): 4.0

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW20W-1325--S03
Issue No: 1

Shrink Swell Index Report

Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street
Wingham NSW 2429

Principal:
Project No.: MNC16P-0001
Project Name: Various Testing

Accredited for compliance with ISO/IEC 17025-Testing.
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Results provided relate only to the items tested or sampled.
This report shall not be reproduced except in full.

NATA
WORLD RECOGNISED ACCREDITATION

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/04/2020

Sample Details

Sample ID:	NEW20W-1325--S03	**Client Sample ID:**	
Test Request No.:	RGS02324.1	**Sampling Method:**	Sampled by Engineering Department
Material:	Sandy Clay	**Date Sampled:**	14/04/2020
Source:	On Site	**Date Submitted:**	15/04/2020
Specification:	No Specification		
Project Location:	Manning River Drive, Glenthorne, NSW		
Sample Location:	BH7 - (0.55 - 0.89m)		
Borehole Number:	BH7		
Borehole Depth (m):	0.55 - 0.89		

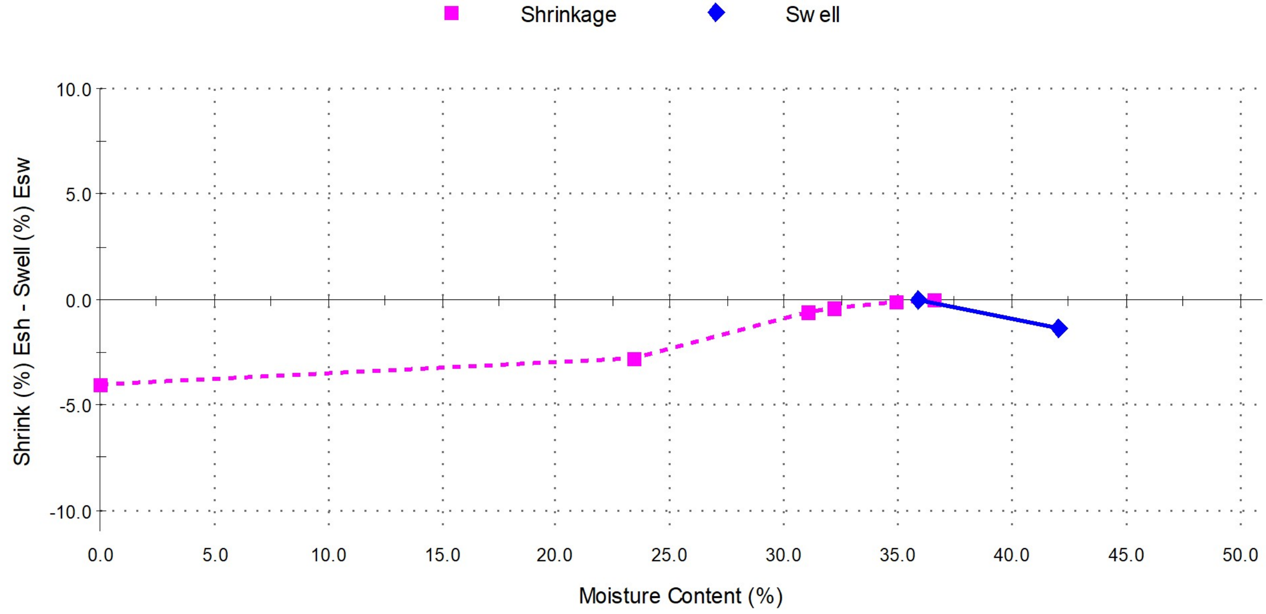
Swell Test AS 1289.7.1.1

Swell on Saturation (%):	-1.3
Moisture Content before (%):	35.9
Moisture Content after (%):	42.1
Est. Unc. Comp. Strength before (kPa):	310
Est. Unc. Comp. Strength after (kPa):	200

Shrink Test AS 1289.7.1.1

Shrink on drying (%):	4.0
Shrinkage Moisture Content (%):	36.6
Est. inert material (%):	<1
Crumbling during shrinkage:	NIL
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 2.2

Comments

The results outlined above apply to the sample as received

Material Test Report

Report Number: **P20233-1**
Issue Number: 1
Date Issued: 29/04/2020
Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street, Wingham NSW 2429
Contact: Steve Morton
Project Number: P20233
Project Name: Proposed Rezoning
Project Location: Manning River Drive, Taree South
Client Reference: RGS2324.1
Work Request: 1591
Sample Number: 20-1591A
Date Sampled: 14/04/2020
Dates Tested: 14/04/2020 - 24/04/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Ch: BH2m, Depth: 0.3-0.6m**
Material: Clay
Material Source: Insitu

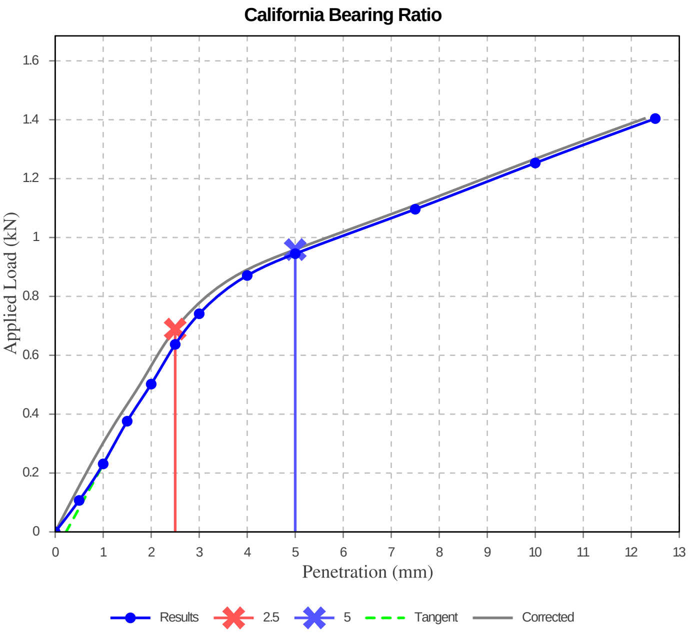
Pacific Blue Metal Pty Ltd
Possum Brush Laboratory
113-116 Possum Brush Road Possum Brush NSW 2430
Phone: (02) 6554 3206
Fax: (02) 6554 3250
Email: labmanager@pacificbluemetal.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Tom Paulsen
Senior Tech

NATA Accredited Laboratory Number: 16993

California Bearing Ratio (RMS T117 & T120)		Min	Max
CBR taken at	2.5 mm		
CBR %	**5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	RMS T111 & T120		
Maximum Dry Density (t/m^3)	1.572		
Optimum Moisture Content (%)	22.9		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	98		
Moisture Content Top 30mm (%)	29.4		
Moisture Content Full Depth (%)	26.3		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	1.9		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



Material Test Report

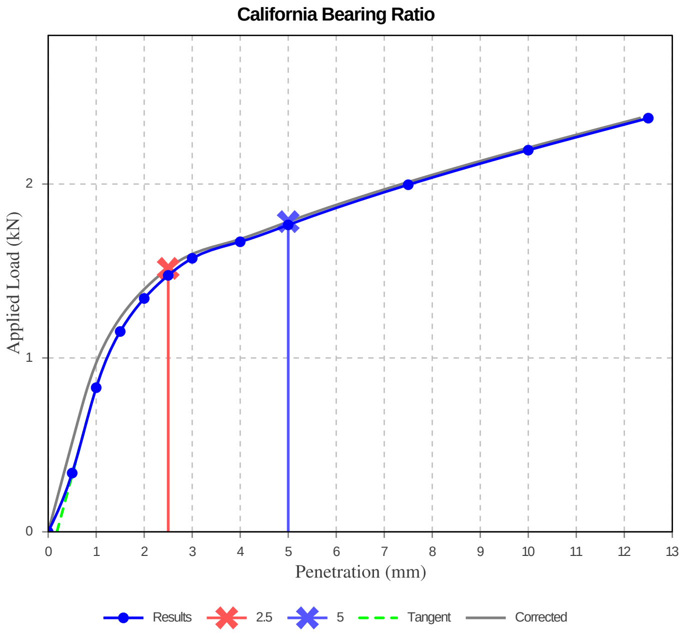
Pacific Blue Metal Pty Ltd
Possum Brush Laboratory
113-116 Possum Brush Road Possum Brush NSW 2430
Phone: (02) 6554 3206
Fax: (02) 6554 3250
Email: labmanager@pacificbluemetal.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Tom Paulsen
Senior Tech
NATA Accredited Laboratory Number: 16993

Report Number: **P20233-1**
Issue Number: 1
Date Issued: 29/04/2020
Client: Regional Geotechnical Solutions Pty Ltd
44 Bent Street, Wingham NSW 2429
Contact: Steve Morton
Project Number: P20233
Project Name: Proposed Rezoning
Project Location: Manning River Drive, Taree South
Client Reference: RGS2324.1
Work Request: 1591
Sample Number: 20-1591B
Date Sampled: 14/04/2020
Dates Tested: 14/04/2020 - 24/04/2020
Sampling Method: Sampled by Client
The results apply to the sample as received
Sample Location: **Ch: BH8m, Depth: 0.55-0.75m**

California Bearing Ratio (RMS T117 & T120)		Min	Max
CBR taken at	2.5 mm		
CBR %	**11**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	RMS T111 & T120		
Maximum Dry Density (t/m^3)	1.506		
Optimum Moisture Content (%)	27.1		
Target Laboratory Density Ratio (%)	100		
Laboratory Density Ratio (%)	100		
Target Laboratory Moisture Ratio (%)	100		
Laboratory Moisture Ratio (%)	101		
Moisture Content Top 30mm (%)	29.8		
Moisture Content Full Depth (%)	28.2		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Swell (%)	0.3		
Material Retained on 19mm (%)	0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		



RESULTS OF SOIL ANALYSIS

2 soil samples supplied by Regional Geotechnical Solutions Pty Ltd on 15 April, 2020 - Lab Job No. J2667
Analysis requested by Champak Nag. Your project: RGS02324.1
(44 Bent Street WINGHAM NSW 2429)

	Method	Sample 1 **BH3 0.8-1.0**	Sample 2 **BH10 0.3-0.5**
	Job No.	*J2667/1*	*J2667/2*
Emerson Dispersion Class	*Emerson Aggregate Test (EAT)*	3	3
Total Organic Carbon (%C)	*HCL treatment- LECO Analyser*	0.45	0.82
Organic Matter (%)	*** Calculation*	0.77	1.41
K Factor	*Revised Universal Soil Loss Equation (RUSLE)*	0.020	0.039

Notes:

1. All results as dry weight DW - samples were dried at 40 °C for 24-48 h prior to crushing and analysis.
2. Methods from Rayment and Lyons, Soil Chemical Methods - Australasia.
3. K Factor determined for RUSLE; Organic matter calculation as per RUSLE; K Factor determined using client provided information:
4. Analysis conducted between sample arrival date and reporting date.
5. ** NATA accreditation does not cover the performance of this service.
6. .. Denotes not requested.
7. This report is not to be reproduced except in full.
8. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
9. Results relate only to the samples tested.
10. This report was issued on X

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

checked: ....
Graham Lancaster
Laboratory Manager

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

2 soil samples supplied by Regional Geotechnical Solutions Pty Ltd on 15 April, 2020 - Lab Job No. J2667
Analysis requested by Champak Nag. Your project: RGS02324.1
(44 Bent Street WINGHAM NSW 2429)

SAMPLE ID	Lab Code	**MOISTURE CONTENT** (% of water in air-dry sample)	**GRAVEL > 2 mm** (% whole sample)	**COARSE SAND 200-2000 µm (0.2-2.0 mm)** (% of total oven-dry equivalent)	**FINE SAND 100-200 µm (0.1-0.2 mm)** (% of total oven-dry equivalent)	**V. FINE SAND 20 - 100 µm (0.02-0.1 mm)** (% of total oven-dry equivalent)	**SILT 2-20 µm ISSS** (% of total oven-dry equivalent)	**CLAY < 2 µm** (% of total oven-dry equivalent)	Total soil fractions	**DISPERSION PER CENT** (%)
BH3 0.8-1.0	J2667/1	2.8%	58.3%	1.2%	0.5%	10.2%	22.7%	65.3%	100.0%	40.0%
BH10 0.3-0.5	J2667/2	1.2%	58.3%	14.1%	2.3%	12.8%	40.2%	30.6%	100.0%	25.0%

Note:

1. The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,

modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986)," &

in Methods of Soil Analysis. Part 1 Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.

2. The texture classification was based on the hydrometer results and the appropriate texture triangle.

3. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (see EAL website: scu.edu.au/eal).

4. This report is not to be reproduced except in full.

5. This report was issued on 24/04/2020

checked: ....
Graham Lancaster (Nata signatory)
Laboratory Manager

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

2 soil samples supplied by Regional Geotechnical Solutions Pty Ltd on 15 April, 2020 - Lab Job No. J2667
Analysis requested by Champak Nag. Your project: RGS02324.1
(44 Bent Street WINGHAM NSW 2429)

SAMPLE ID	Lab Code	**MOISTURE CONTENT** (% of water in air-dry sample)	**COARSE SAND 200-2000 µm (0.2-2.0 mm)** (% of total oven-dry equivalent)	**FINE SAND 100-200 µm (0.1-0.2 mm)** (% of total oven-dry equivalent)	**V. FINE SAND 20 - 100 µm (0.02-0.1 mm)** (% of total oven-dry equivalent)	**SILT 2-20 µm ISSS** (% of total oven-dry equivalent)	**CLAY < 2 µm** (% of total oven-dry equivalent)	Total soil fractions (<2mm)
BH3 0.8-1.0	J2667/1	2.8%	1.2%	0.5%	10.2%	22.7%	65.3%	100.0%
BH10 0.3-0.5	J2667/2	1.2%	14.1%	2.3%	12.8%	40.2%	30.6%	100.0%

Note:

1. The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,

modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986)," &

in Methods of Soil Analysis. Part 1 Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.

2. The texture classification was based on the hydrometer results and the appropriate texture triangle.

3. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (see EAL website: scu.edu.au/eal).

4. This report is not to be reproduced except in full.

5. This report was issued on 24/04/2020

checked: ....
Graham Lancaster (Nata signatory)
Laboratory Manager

RESULTS OF ACID SULFATE SOIL ANALYSIS

32 samples supplied by Regional Geotechnical Solutions Pty Ltd on 15/04/2020. Lab Job No. J2668.
Analysis requested by Andrew Hills. Your Job: RGS02324.1.

44 Bent Street WINGHAM NSW 2429

																Non-treated soil		Non-treated soil	
Sample Identification	**EAL Lab Code**	**Texture**	**Moisture Content**		**pH$_F$ and pH$_{FOX}$**				**Potential Sulfidic Acidity**			**Actual Acidity**	**Retained Acidity**		**Acid Neutralising Capacity**		**Net Acidity**	**Lime Calculation**
									(Chromium Reducible Sulfur - CRS)			**(Titratable Actual Acidity - TAA)**			**(ANC$_{BT}$)**			
			(% moisture of total wet weight)	**(g moisture / g of oven dry soil)**	**pH$_F$**	**pH$_{FOX}$**	**pH change**	**Reaction**	**(% S$_{cr}$)**	**(mol H$^+$/t)**	**pH$_{KCl}$**	**(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 0.3-0.5	*J2668/1*	Fine	22.2	0.29	5.74	3.80	-1.94	Extreme	0.005	3	4.64	35	..	..	..	..	38	3
BH1 0.8-1.0	*J2668/2*	Fine	26.0	0.35	4.15	3.10	-1.05	Medium	..	..	..	..	..	..	..	..	..	..
BH1 1.3-1.5	*J2668/3*	Fine	23.6	0.31	4.17	3.23	-0.94	Medium	..	..	..	..	..	..	..	..	..	..
BH1 1.8-2.0	*J2668/4*	Fine	22.9	0.30	4.18	3.25	-0.93	Medium	..	..	..	..	..	..	..	..	..	..
BH2 0.8-1.0	*J2668/5*	Fine	25.4	0.34	4.28	3.16	-1.12	Extreme	<0.005	0	3.50	126	0.006	3	..	..	129	10
BH2 1.3-1.5	*J2668/6*	Fine	24.4	0.32	4.11	3.03	-1.08	Medium	..	..	..	..	..	..	..	..	..	..
BH2 1.8-2.0	*J2668/7*	Fine	22.9	0.30	4.44	3.19	-1.25	Medium	..	..	..	..	..	..	..	..	..	..
BH3 0.3-0.5	*J2668/8*	Fine	23.5	0.31	4.91	5.31	0.40	Volcanic	..	..	..	..	..	..	..	..	..	..
BH3 0.8-1.0	*J2668/9*	Fine	25.9	0.35	4.27	3.05	-1.23	Medium	..	..	..	..	..	..	..	..	..	..
BH3 1.3-1.5	*J2668/10*	Fine	24.8	0.33	4.09	3.16	-0.93	Low	..	..	..	..	..	..	..	..	..	..
BH3 1.8-2.0	*J2668/11*	Fine	21.6	0.28	4.31	3.26	-1.05	Medium	..	..	..	..	..	..	..	..	..	..
BH4 0.3-0.5	*J2668/12*	Fine	24.5	0.32	4.96	4.78	-0.18	Volcanic	..	..	..	..	..	..	..	..	..	..
BH4 0.9-1.1	*J2668/13*	Fine	23.8	0.31	4.56	3.26	-1.30	Medium	..	..	..	..	..	..	..	..	..	..
BH4 1.4-1.6	*J2668/14*	Fine	23.6	0.31	4.43	3.17	-1.26	Medium	..	..	..	..	..	..	..	..	..	..
BH5 0.3-0.5	*J2668/15*	Fine	25.9	0.35	4.52	3.22	-1.30	Medium	..	..	..	..	..	..	..	..	..	..
BH5 0.8-1.0	*J2668/16*	Fine	27.3	0.38	3.92	2.95	-0.97	Medium	<0.005	0	3.78	173	0.003	1	..	..	175	13
BH5 1.3-1.5	*J2668/17*	Fine	24.1	0.32	3.87	2.93	-0.94	Medium	<0.005	0	3.59	178	0.026	12	..	..	189	14
BH6 0.3-0.5	*J2668/18*	Fine	24.7	0.33	6.92	5.41	-1.51	Medium	..	..	..	..	..	..	..	..	..	..
BH6 0.8-1.0	*J2668/19*	Fine	23.9	0.31	7.98	5.99	-1.99	Low	..	..	..	..	..	..	..	..	..	..
BH6 1.3-1.5	*J2668/20*	Fine	24.0	0.32	7.86	5.75	-2.11	Low	..	..	..	..	..	..	..	..	..	..
BH7 0.3-0.5	*J2668/21*	Fine	20.2	0.25	5.32	4.17	-1.15	Volcanic	<0.005	0	4.81	35	..	..	..	..	35	3
BH7 0.9-1.1	*J2668/22*	Fine	25.2	0.34	5.28	3.88	-1.40	Medium	..	..	..	..	..	..	..	..	..	..
BH7 1.4-1.6	*J2668/23*	Fine	22.7	0.29	5.09	3.71	-1.38	Medium	..	..	..	..	..	..	..	..	..	..
BH8 0.3-0.55	*J2668/24*	Fine	18.3	0.22	5.09	3.54	-1.55	Medium	..	..	..	..	..	..	..	..	..	..
BH8 0.8-1.0	*J2668/25*	Fine	23.2	0.30	4.62	3.29	-1.33	Medium	..	..	..	..	..	..	..	..	..	..
BH8 1.3-1.5	*J2668/26*	Fine	22.8	0.30	4.50	3.29	-1.21	Medium	..	..	..	..	..	..	..	..	..	..
BH9 0.3-0.5	*J2668/27*	Fine	20.3	0.26	4.94	3.71	-1.23	Medium	..	..	..	..	..	..	..	..	..	..
BH9 0.8-1.0	*J2668/28*	Fine	25.7	0.35	4.80	4.39	-0.41	Medium	..	..	..	..	..	..	..	..	..	..
BH9 1.3-1.5	*J2668/29*	Fine	25.8	0.35	4.63	3.22	-1.41	Low	..	..	..	..	..	..	..	..	..	..
BH10 0.3-0.5	*J2668/30*	Fine	16.2	0.19	4.84	3.68	-1.16	Medium	..	..	..	..	..	..	..	..	..	..
BH10 0.8-1.0	*J2668/31*	Fine	22.0	0.28	5.21	3.95	-1.26	Medium	..	..	..	..	..	..	..	..	..	..
BH10 1.3-1.5	*J2668/32*	Fine	23.6	0.31	5.19	3.98	-1.21	Medium	..	..	..	..	..	..	..	..	..	..

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 24/04/2020 and replaces the report published 17/04/2020. Net acidity has been added to selected samples.

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

checked: ....
Graham Lancaster
Laboratory Manager

Client: Jasbe Glenthorne Pty Ltd & Mulgrave Trust
Job No. RGS02324.1
Project: Stage 1 Site Contamination Assessment
Location: Off Manning River Drive, Glenthorne

By: APH
Date: 06.05.20

Location	*DEPTH (m)*	*MATERIAL*	*Asbestos Presence*	*TOTAL RECOVERABLE HYDROCARBONS*					*PAH*			*BTEX*	*PCB*	*OC Pesticides*	*OP Pesticides*	*HEAVY METALS*							
				C6-C10	*C10-C16*	*C16-C34*	*C34-C40*	*TOTAL 10-40*	*Total*	*B-a-p*	*B-a-p TEQ*					*As*	*Cd*	*Cr#*	*Cu*	*Pb*	*Ni*	*Zn*	*Hg*
SS1	0.0 - 0.2	Topsoil	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	<5	<1	40	10	15	8	16	<0.1
SS2 / AS1	0.0 - 0.2	Topsoil	No	<10	120	1160	770	2050	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	<5	<1	12	44	14	10	300	<0.1
SS3 / AS2	0.0 - 0.2	Topsoil	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	21	<1	28	97	203	16	320	<0.1
SS4 / AS3	0.0 - 0.2	Topsoil	No	<10	<50	260	240	500	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	<5	<1	11	7	9	3	123	<0.1
SS5 / AS5	Stockpile	Fill	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	<5	<1	15	<5	6	2	<5	<0.1
SS6 / AS6	Stockpile	Fill	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	<5	<1	42	<5	23	4	8	<0.1
SS7 / AS7	0.0 - 0.2	Topsoil	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	0.11	<0.2	<5	<1	33	5	13	3	26	<0.1
SS8	0.0 - 0.2	Topsoil	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	<5	<1	38	13	1300	4	176	<0.1
SS9 / AS8	Stockpile	Fill	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	<5	<1	52	6	11	9	<5	<0.1
SS10 / AS10	0.0 - 0.2	Topsoil	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	7	<1	57	<5	35	<2	18	<0.1
AS4	0.0 - 0.2	Topsoil	No	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
ACM1	Surface	Fibro-Cement	**Yes**	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
D1 (duplicate of SS3)	0.0 - 0.2	Fill	No	<10	<50	<100	<100	<50	<0.5	0.6	0.6	<0.2	<0.1	<0.05	<0.2	6	<1	50	9	15	6	12	<0.1
RPD %				0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18.2	0.0	17.4	**57.1**	**42.1**	**40.0**	**40.0**	0.0
Health Based Soil investigation Level:*			0.001% (w/w)	1000	800	NL	NL	NL	4000	40	40	NL	1	45	45	3000	900	3600	240000	1500	6000	400000	730
*Health Screening Level (HSL)***				310	NL	NL	NL	NL															
*Ecological Screening Level (ESL)****				215	170	1700	3300	NL		1.4	1.4	75				**Coarse grained soil in mg/kg**							
				215	170	2500	6600	NL		1.4	1.4	95				**Fine grained soil in mg/kg**							

CRITERIA:

* Health Based Investigation Levels for Commercial/Industrial D site (NEPM 2013)

** Health Screening Level (F2) for commercial/industrial land use and fine grained soil (clay), 0 - 1m depth

*** Ecological Screening Level for commerical/industrial land use

Chromium VI

Speciation testing confirmed only Chromium III present

NL	No Limit available
LOR	Limit of Reporting
RPD	Relative Percent Difference

🟦	Denotes concentration exceeds health based guideline for Commercial/Industrial D site
🟩	Denotes concentration exceeds ecological guideline for Commercial/Industrial D site
🟧	Denotes concentration exceeds health and ecological based guideline for Commercial/Industrial D site

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order : **ES2012983**
Client : **REGIONAL GEOTECHNICAL SOLUTION**
Contact : Andrew Hills
Address : 44 BENT STREET
WINGHAM NSW, AUSTRALIA 2429
Telephone : +61 02 6553 5641
Project : RGS02324.1 Proposed Rezoning
Order number : ----
C-O-C number : ----
Sampler : ----
Site : Manning River Drive, Glenthorne
Quote number : EN/222
No. of samples received : 21
No. of samples analysed : 21

Page : 1 of 17
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone : +61-2-8784 8555
Date Samples Received : 17-Apr-2020 11:00
Date Analysis Commenced : 21-Apr-2020
Issue Date : 23-Apr-2020 18:39

NATA
Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Descriptive Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Christopher Owler	Team Leader - Asbestos	Newcastle - Asbestos, Mayfield West, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EA200: Asbestos Identification Samples were analysed by Polarised Light Microscopy including dispersion staining.
- EP068: Positive result has been confirmed by re-extraction and re-analysis.
- **EA200 Legend**
- EA200 'Am' Amosite (brown asbestos)
- EA200 'Cr' Crocidolite (blue asbestos)
- EA200 'Ch' Chrysotile (white asbestos)
- EA200: 'UMF' Unknown Mineral Fibres. "-" indicates fibres detected may or may not be asbestos fibres. Confirmation by alternative techniques is recommended.
- EA200 'Trace' - Asbestos fibres ("Free Fibres") detected by trace analysis per AS4964. The result can be interpreted that the sample contains detectable 'respirable' asbestos fibres
- EA200: For samples larger than 30g, the <2mm fraction may be sub-sampled prior to trace analysis as outlined in ISO23909:2008(E) Sect 6.3.2-2
- EA200: 'Yes' - Asbestos detected by polarised light microscopy including dispersion staining.
- EA200: 'No*' - No asbestos found, at the reporting limit of 0.1g/kg, by polarised light microscopy including dispersion staining. Asbestos material was detected and positively identified at concentrations estimated to be below 0.1g/kg.
- EA200: 'No' - No asbestos found at the reporting limit 0.1g/kg, by polarised light microscopy including dispersion staining.
- EA200: N/A - Not Applicable

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-001**	**ES2012983-002**	**ES2012983-003**	**ES2012983-004**	**ES2012983-005**
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**35.0**	**29.3**	**24.0**	**22.6**	**15.2**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	**21**	<5	<5
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**40**	**12**	**28**	**11**	**15**
Copper	7440-50-8	5	mg/kg	**10**	**44**	**97**	**7**	<5
Lead	7439-92-1	5	mg/kg	**15**	**14**	**203**	**9**	**6**
Nickel	7440-02-0	2	mg/kg	**8**	**10**	**16**	**3**	**2**
Zinc	7440-66-6	5	mg/kg	**16**	**300**	**320**	**123**	<5
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Total Chlordane (sum)**	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

			Client sample ID	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-001**	**ES2012983-002**	**ES2012983-003**	**ES2012983-004**	**ES2012983-005**
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Client sample ID	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	CAS Number	LOR	Unit	**ES2012983-001**	**ES2012983-002**	**ES2012983-003**	**ES2012983-004**	**ES2012983-005**
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	**100**	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	**610**	<100	**140**	<100
C29 - C36 Fraction	----	100	mg/kg	<100	**1080**	<100	**270**	<100
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	<50	**1790**	<50	**410**	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	**120**	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	**1160**	<100	**260**	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	**770**	<100	**240**	<100
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg	<50	**2050**	<50	**500**	<50
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg	<50	**120**	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**SS1**	**SS2**	**SS3**	**SS4**	**SS5**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-001**	**ES2012983-002**	**ES2012983-003**	**ES2012983-004**	**ES2012983-005**
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Total Xylenes**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**111**	**114**	**116**	**95.9**	**107**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**112**	**132**	**114**	**91.6**	**124**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**92.1**	**62.8**	**88.5**	**92.4**	**86.9**
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**90.2**	**91.8**	**95.4**	**96.2**	**95.9**
2-Chlorophenol-D4	93951-73-6	0.5	%	**91.3**	**90.2**	**95.9**	**95.0**	**92.1**
2.4.6-Tribromophenol	118-79-6	0.5	%	**73.0**	**81.8**	**79.7**	**81.6**	**64.5**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**94.8**	**96.2**	**102**	**97.9**	**95.9**
Anthracene-d10	1719-06-8	0.5	%	**98.8**	**93.4**	**101**	**99.2**	**97.6**
4-Terphenyl-d14	1718-51-0	0.5	%	**89.9**	**85.4**	**91.3**	**89.2**	**89.0**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**86.4**	**95.4**	**100**	**97.8**	**110**
Toluene-D8	2037-26-5	0.2	%	**95.7**	**111**	**111**	**113**	**124**
4-Bromofluorobenzene	460-00-4	0.2	%	**99.0**	**106**	**110**	**109**	**121**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Client sample ID	**SS6**	**SS7**	**SS8**	**SS9**	**SS10**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	CAS Number	LOR	Unit	**ES2012983-006**	**ES2012983-007**	**ES2012983-008**	**ES2012983-009**	**ES2012983-010**
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**15.6**	**17.4**	**18.9**	**15.4**	**20.8**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	<5	<5	<5	**7**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**42**	**33**	**38**	**52**	**57**
Copper	7440-50-8	5	mg/kg	<5	**5**	**13**	**6**	<5
Lead	7439-92-1	5	mg/kg	**23**	**13**	**1300**	**11**	**35**
Nickel	7440-02-0	2	mg/kg	**4**	**3**	**4**	**9**	<2
Zinc	7440-66-6	5	mg/kg	**8**	**26**	**176**	<5	**18**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-BHC	319-85-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
delta-BHC	319-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor	76-44-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Aldrin	309-00-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Dieldrin	60-57-1	0.05	mg/kg	<0.05	**0.11**	<0.05	<0.05	<0.05
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin	72-20-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**SS6**	**SS7**	**SS8**	**SS9**	**SS10**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-006**	**ES2012983-007**	**ES2012983-008**	**ES2012983-009**	**ES2012983-010**
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	**0.11**	<0.05	<0.05	<0.05
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Dimethoate	60-51-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Diazinon	333-41-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Malathion	121-75-5	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenthion	55-38-9	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Parathion	56-38-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Ethion	563-12-2	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**SS6**	**SS7**	**SS8**	**SS9**	**SS10**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-006**	**ES2012983-007**	**ES2012983-008**	**ES2012983-009**	**ES2012983-010**
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg	**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg	**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	<10	<10	<10
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg	<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
>C34 - C40 Fraction	----	100	mg/kg	<100	<100	<100	<100	<100
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg	<50	<50	<50	<50	<50
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg	<50	<50	<50	<50	<50
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**SS6**	**SS7**	**SS8**	**SS9**	**SS10**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-006**	**ES2012983-007**	**ES2012983-008**	**ES2012983-009**	**ES2012983-010**
				Result	Result	Result	Result	Result
EP080: BTEXN - Continued								
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
^ **Total Xylenes**	----	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg	<1	<1	<1	<1	<1
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**112**	**107**	**112**	**122**	**113**
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**112**	**116**	**99.3**	**140**	**114**
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**91.9**	**108**	**74.0**	**63.3**	**82.5**
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**91.7**	**96.4**	**95.5**	**93.6**	**93.4**
2-Chlorophenol-D4	93951-73-6	0.5	%	**92.2**	**94.7**	**92.7**	**90.2**	**92.4**
2.4.6-Tribromophenol	118-79-6	0.5	%	**62.3**	**71.0**	**59.8**	**29.4**	**56.0**
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**102**	**97.6**	**94.8**	**94.8**	**95.4**
Anthracene-d10	1719-06-8	0.5	%	**97.2**	**98.4**	**96.9**	**94.9**	**96.7**
4-Terphenyl-d14	1718-51-0	0.5	%	**87.2**	**90.2**	**87.7**	**88.2**	**89.4**
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**95.0**	**104**	**106**	**95.9**	**95.5**
Toluene-D8	2037-26-5	0.2	%	**108**	**118**	**119**	**109**	**106**
4-Bromofluorobenzene	460-00-4	0.2	%	**105**	**116**	**115**	**108**	**103**

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**D1**	**AS1**	**AS2**	**AS3**	**AS4**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-011**	**ES2012983-012**	**ES2012983-013**	**ES2012983-014**	**ES2012983-015**
				Result	Result	Result	Result	Result
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**17.8**	----	----	----	----
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	----	**No**	**No**	**No**	**No**
Asbestos (Trace)	1332-21-4	5	Fibres	----	**No**	**No**	**No**	**No**
Asbestos Type	1332-21-4	-	--	----	-	-	-	-
Synthetic Mineral Fibre	----	0.1	g/kg	----	**No**	**No**	**No**	**No**
Organic Fibre	----	0.1	g/kg	----	**No**	**No**	**No**	**No**
Sample weight (dry)	----	0.01	g	----	**200**	**397**	**320**	**310**
APPROVED IDENTIFIER:	----	-	--	----	**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**6**	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**50**	----	----	----	----
Copper	7440-50-8	5	mg/kg	**9**	----	----	----	----
Lead	7439-92-1	5	mg/kg	**15**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**6**	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**12**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	----	----	----
^ **Total Chlordane (sum)**	----	0.05	mg/kg	<0.05	----	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL**)

			Client sample ID	D1	AS1	AS2	AS3	AS4
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	CAS Number	LOR	Unit	ES2012983-011	ES2012983-012	ES2012983-013	ES2012983-014	ES2012983-015
				Result	Result	Result	Result	Result
EP068A: Organochlorine Pesticides (OC) - Continued								
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	----	----
^ **Endosulfan (sum)**	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDT	50-29-3	0.2	mg/kg	<0.2	----	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg	<0.05	----	----	----	----
Methoxychlor	72-43-5	0.2	mg/kg	<0.2	----	----	----	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg	<0.05	----	----	----	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg	<0.05	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)								
Dichlorvos	62-73-7	0.05	mg/kg	<0.05	----	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg	<0.05	----	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg	<0.2	----	----	----	----
Dimethoate	60-51-5	0.05	mg/kg	<0.05	----	----	----	----
Diazinon	333-41-5	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg	<0.05	----	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg	<0.2	----	----	----	----
Malathion	121-75-5	0.05	mg/kg	<0.05	----	----	----	----
Fenthion	55-38-9	0.05	mg/kg	<0.05	----	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg	<0.05	----	----	----	----
Parathion	56-38-2	0.2	mg/kg	<0.2	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg	<0.05	----	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg	<0.05	----	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg	<0.05	----	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg	<0.05	----	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg	<0.05	----	----	----	----
Ethion	563-12-2	0.05	mg/kg	<0.05	----	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg	<0.05	----	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg	<0.05	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			*Client sample ID*	**D1**	**AS1**	**AS2**	**AS3**	**AS4**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-011**	**ES2012983-012**	**ES2012983-013**	**ES2012983-014**	**ES2012983-015**
				Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	----	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg	<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg	<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg	**0.6**	----	----	----	----
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg	**1.2**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	10	mg/kg	<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg	<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg	<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg	<100	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	10	mg/kg	<10	----	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg	<10	----	----	----	----
>C10 - C16 Fraction	----	50	mg/kg	<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg	<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg	<100	----	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg	<50	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL)**			Client sample ID	**D1**	**AS1**	**AS2**	**AS3**	**AS4**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	CAS Number	LOR	Unit	**ES2012983-011**	**ES2012983-012**	**ES2012983-013**	**ES2012983-014**	**ES2012983-015**
				Result	Result	Result	Result	Result
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions - Continued								
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg	<50	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	0.2	mg/kg	<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg	<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	----	----	----	----
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	----	----	----	----
^ **Total Xylenes**	----	0.5	mg/kg	<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg	<1	----	----	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**112**	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**98.0**	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**77.4**	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**96.3**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**93.0**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**36.8**	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**97.8**	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%	**99.9**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	**91.6**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**98.6**	----	----	----	----
Toluene-D8	2037-26-5	0.2	%	**110**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%	**110**	----	----	----	----

Analytical Results

Sub-Matrix: **SOIL**
(Matrix: **SOIL)**

			Client sample ID	**AS5**	**AS6**	**AS7**	**AS8**	**AS10**
			Client sampling date / time	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00	09-Apr-2020 00:00
Compound	*CAS Number*	*LOR*	*Unit*	**ES2012983-016**	**ES2012983-017**	**ES2012983-018**	**ES2012983-019**	**ES2012983-020**
				Result	Result	Result	Result	Result
EA200: AS 4964 - 2004 Identification of Asbestos in Soils								
Asbestos Detected	1332-21-4	0.1	g/kg	**No**	**No**	**No**	**No**	**No**
Asbestos (Trace)	1332-21-4	5	Fibres	**No**	**No**	**No**	**No**	**No**
Asbestos Type	1332-21-4	-	--	**-**	**-**	**-**	**-**	**-**
Synthetic Mineral Fibre	----	0.1	g/kg	**No**	**No**	**No**	**No**	**No**
Organic Fibre	----	0.1	g/kg	**No**	**No**	**No**	**No**	**No**
Sample weight (dry)	----	0.01	g	**629**	**436**	**598**	**275**	**461**
APPROVED IDENTIFIER:	----	-	--	**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**	**C.OWLER**

Analytical Results

Sub-Matrix: **SOLID**
(Matrix: **SOLID)**

			Client sample ID	**ACM1**	**----**	**----**	**----**	**----**
			Client sampling date / time	09-Apr-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	**ES2012983-021**	**--------**	**--------**	**--------**	**--------**
				Result	----	----	----	----
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples								
Asbestos Detected	1332-21-4	0.1	g/kg	**Yes**	**----**	**----**	**----**	**----**
Asbestos Type	1332-21-4	-	--	**Ch**	**----**	**----**	**----**	**----**
Asbestos (Trace)	1332-21-4	5	Fibres	**N/A**	**----**	**----**	**----**	**----**
Sample weight (dry)	----	0.01	g	**126**	**----**	**----**	**----**	**----**
Synthetic Mineral Fibre	----	0.1	g/kg	**No**	**----**	**----**	**----**	**----**
Organic Fibre	----	0.1	g/kg	**Yes**	**----**	**----**	**----**	**----**
APPROVED IDENTIFIER:	----	-	--	**C.OWLER**	**----**	**----**	**----**	**----**

Analytical Results

Descriptive Results

Sub-Matrix: **SOIL**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in Soils		
EA200: Description	AS1 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS2 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS3 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS4 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS5 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS6 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS7 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS8 - 09-Apr-2020 00:00	Mid brown soil.
EA200: Description	AS10 - 09-Apr-2020 00:00	Mid brown soil.

Sub-Matrix: **SOLID**

Method: Compound	Client sample ID - Client sampling date / time	Analytical Results
EA200: AS 4964 - 2004 Identification of Asbestos in bulk samples		
EA200: Description	ACM1 - 09-Apr-2020 00:00	Two pieces of asbestos cement sheeting approx. 160 x 120 x 5mm.

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	*CAS Number*	*Recovery Limits (%)*	
		Low	*High*
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

Appendix C

Site History Documentation

ADVANCE LEGAL SEARCHERS PTY LIMITED

(ACN 147 943 842)
ABN 82 147 943 842

18/36 Osborne Road,
Manly NSW 2095

Telephone: +612 9977 6713
Mobile: 0412 169 809
Email: search@alsearchers.com.au

16th March 2020

REGIONAL GEOTECHNICAL SOLUTIONS PTY LTD
44 Bent Street
WINGHAM NSW 2429

Attention: Andrew Hills

RE: **51 – 55 Glenthorne Road,**
Glenthorne
RGS02324.1

Note 1:	**Lot 2**	**DP 827097**	(page 1)
Note 2:	**Lot 50**	**DP 863972**	(page 4)
Note 3:	**Lot 2**	**DP 573214**	(page 6)

Note 1:

Current Search

Folio Identifier 2/827097 (title attached)
DP 827097 (plan attached)
Dated 12th March 2020
Registered Proprietor:
MICHAEL JOHN BARRETT
HEATHER ANNE BARRETT

Title Tree
Lot 2 DP 827097

Folio Identifier 2/827097

Folio Identifier E/37960

Certificate of Title Volume 15524 Folio 20

CA 29288

Conveyance Book 3732 No. 282

Acknowledgment Book 3538 No. 412

Deed of Partition Book 1943 No. 775

Acknowledgment Book 1943 No. 615 & 616

Conveyance Book 180 No. 376

****

Summary of proprietor(s)
Lot 2 DP 827097

Year	Proprietor(s)
	(Lot 2 DP 827097)
2017 – todate	Michael John Barrett Heather Anne Barrett
2004 – 2017	Richard Nicholas Wirth Robin Joy Wirth
1993 – 2004	Peter James Eriksson Sandra Eriksson
	(Lot E DP 37960)
1991 – 1993	Peter James Eriksson Sandra Eriksson
1989 – 1991	Norman James Eriksson, grazier Joan Eriksson, his wife
	(Lot E DP 37960 – CTVol 15524 Fol 20)
1988 – 1989	Norman James Eriksson, grazier Joan Eriksson, his wife
	(Lot E DP 37960 – Area 32 Acres 2 Roods 34 Perches – Conv Book 3732 No. 282)
1988 – 1988	Norman James Eriksson, grazier Joan Eriksson, his wife
	(Lot E DP 37960 and other land – Area 32 Acres 2 Roods 34 Perches – Acknowledgment Book 3538 No. 412)
1983 – 1988	Audrey Margaret Muldoon, married woman / devisee Patrick Allen McCaffrey, farmer / executor Robert Muldoon, farmer / executor Ronald Samuel Stewart McKay, estate
	(Lot C & E DP 37960 – Area 32 Acres 2 Roods 34 Perches – Deed of Partition Book 1943 No. 775)
1944 – 1983	Ronald Samuel Stewart McKay, farmer
	(Land at Purfleet Parish Tinonee – Acknowledgment Book 1943 No. 615 & 616)
1944 – 1944	Ronald Samuel Stewart McKay, farmer / devisee Francis James Moore, farmer / executor John Campbell Moore, farmer / executor Angus McKay, estate John McKay, estate
	(Allotment 4 of the Purfleet Estate County Gloucester – Area 119 Acres 2 Roods – Conv Book 180 No. 376)
1878 – 1944	Angus McKay, farmer John McKay, farmer

****

Note 2:

Current Search

Folio Identifier 50/863972 (title attached)
DP 863972 (plan attached)
Dated 12th March 2020
Registered Proprietor:
MICHAEL JOHN BARRETT
HEATHER ANNE BARRETT

Title Tree
Lot 50 DP 863972

Folio Identifier 50/863972

Folio Identifier 11/836884

Folio Identifier 1/573214

Certificate of Title Volume 12680 Folio 8

IVA 16026

Conveyance Book 3081 No. 865

Conveyance Book 2607 No. 997

Conveyance Book 1166 No. 658

****

Summary of proprietor(s)
Lot 50 DP 863972

Year	Proprietor(s)
	(Lot 50 DP 863972)
2016 – todate	Michael John Barrett Heather Anne Barrett
2015 – 2016	Philip Anthony Davey Ian George Davey
1997 – 2015	George Harry Davey, builder
	(Lot 11 DP 836884)
1994 – 1997	George Harry Davey, builder
	(Lot 1 DP 573214)
1989 – 1994	George Harry Davey, builder
	(Lot 1 DP 573214 – CTVol 12680 Fol 8)
1980 – 1989	George Harry Davey, builder
1978 – 1980	Vendul International Pty. Limited.
1975 – 1978	Mabel Rutherford Bird, married woman
	(Lot G of a subdivision of Lots 1 & 2 of the Purfleet Estate Parish Tinonee – Area 49 acres 0 Roods 7 Perches – Conv Book 3081 No. 865)
1972 – 1975	Vendul International Pty. Limited.
	(Lot G of a subdivision of Lots 1 & 2 of the Purfleet Estate Parish Tinonee – Area 49 acres 0 Roods 7 Perches – Conv Book 2607 No. 997)
1962 – 1972	Mabel Rutherford Bird, wife of William Allen Bird, farmer
1962 – 1962	Clarence Victor Northam / executor Eric Walwyn Ormsby, solicitor Annie Sarah Rutherford Northam, estate
	(Part Portion 155 Parish Tinonee – Area 84 Acres – Conv Book 1166 No. 658)
1919 – 1962	Annie Sarah Rutherford Northam, wife of Alfred Northam, farmer

****

Note 3:

Current Search

Folio Identifier 2/573214 (title attached)
DP 573214 (plan attached)
Dated 12th March 2020
Registered Proprietor:
EDWARD GERARD GERSBACH

Title Tree
Lot 2 DP 573214

Folio Identifier 2/573214

Certificate of Title Volume 12680 Folio 9

IVA 16026

Conveyance Book 3081 No. 865

Conveyance Book 2607 No. 997

Conveyance Book 1166 No. 658

****

Summary of proprietor(s)
Lot 2 DP 573214

Year	**Proprietor(s)**
	(Lot 2 DP 573214)
1989 – todate	Edward Gerard Gersbach, bricklayer
	(Lot 2 DP 573214 – CTVol 12680 Fol 9)
1982 – 1989	Edward Gerard Gersbach, bricklayer
1978 – 1982	Edward Gerard Gersbach, bricklayer Janice Phyliss Gersbach, his wife
1975 – 1978	Mable Rutherford Bird, married woman
	(Lot G of a subdivision of Lots 1 & 2 of the Purfleet Estate Parish Tinonee – Area 49 acres 0 Roods 7 Perches – Conv Book 3081 No. 865)
1972 – 1975	Vendul International Pty. Limited.
	(Lot G of a subdivision of Lots 1 & 2 of the Purfleet Estate Parish Tinonee – Area 49 acres 0 Roods 7 Perches – Conv Book 2607 No. 997)
1962 – 1972	Mabel Rutherford Bird, wife of William Allen Bird, farmer
1962 – 1962	Clarence Victor Northam / executor Eric Walwyn Ormsby, solicitor Annie Sarah Rutherford Northam, estate
	(Part Portion 155 Parish Tinonee – Area 84 Acres – Conv Book 1166 No. 658)
1919 – 1962	Annie Sarah Rutherford Northam, wife of Alfred Northam, farmer

****

LAND REGISTRY SERVICES

Cadastral Records Enquiry Report : Lot 50 DP 863972

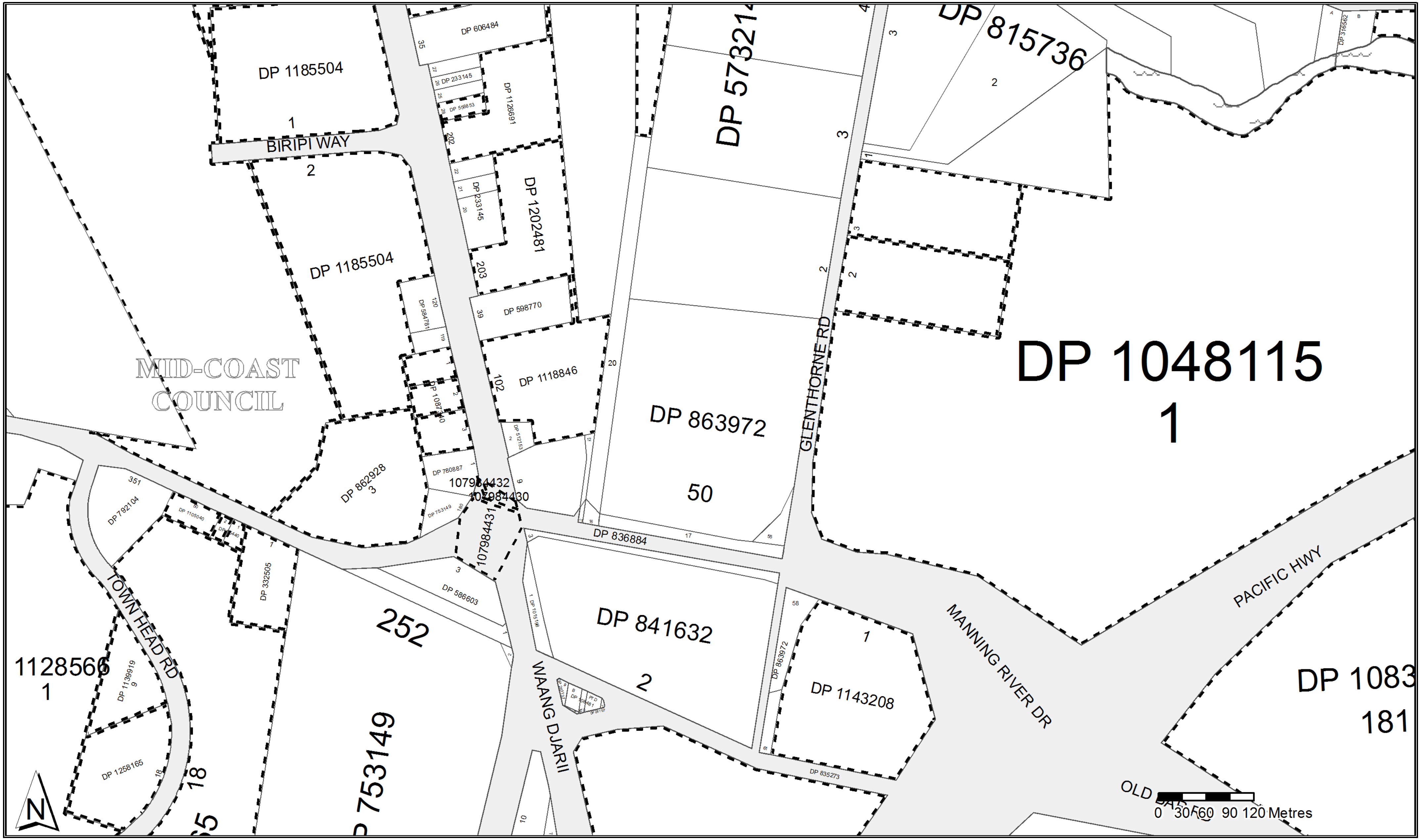
Ref : NOUSER

Locality : GLENTHORNE

Parish : TINONEE

LGA : MID-COAST

County : GLOUCESTER



Report Generated 8:36:25 AM, 12 March, 2020

This information is provided as a searching aid only.Whilst every endeavour is made to ensure that current map, plan and titling information is accurately reflected, the Registrar General cannot guarantee the information provided. For ALL ACTIVITY PRIOR TO SEPTEMBER 2002 you must refer to the RGs Charting and Reference Maps

	Status	Surv/Comp	Purpose
DP25440			
Lot(s): 1, 2			
DP1128566	REGISTERED	SURVEY	SUBDIVISION
DP332505			
Lot(s): 1			
DP1243728	REGISTERED	COMPILATION	EASEMENT
DP558853			
Lot(s): 28			
DP1228690	REGISTERED	SURVEY	EASEMENT
DP862928			
Lot(s): 3			
DP1253436	REGISTERED	SURVEY	ROADS ACT, 1993
DP1258165	REGISTERED	SURVEY	SUBDIVISION
OFFICIAL SEARCH 40252 - LOT 3 DP862928			
DP1016490			
Lot(s): 23			
DP222400	HISTORICAL	SURVEY	SUBDIVISION
DP836884	HISTORICAL	SURVEY	RESUMPTION OR ACQUISITION
DP1045690			
Lot(s): 2			
CA87100 - LOTS 1-2 DP1045690			
DP1048115			
Lot(s): 1, 2, 3			
DP863972	HISTORICAL	SURVEY	ROADS ACT, 1993
DP1059402			
Lot(s): 10			
DP815736	HISTORICAL	SURVEY	SUBDIVISION
DP1083271			
Lot(s): 181			
DP835273	HISTORICAL	SURVEY	ROAD OR MOTORWAY
DP1087340			
Lot(s): 1, 2, 3			
DP999591	HISTORICAL	COMPILATION	DEPARTMENTAL
DP1105040			
Lot(s): 50			
DP25440	HISTORICAL	SURVEY	UNRESEARCHED
NSW GAZ. ACQUIRED FOR COUNCIL PURPOSES LOT 50 DP1105040	22-06-2007		Folio : 3901
DP1118846			
Lot(s): 102			
DP836884	HISTORICAL	SURVEY	RESUMPTION OR ACQUISITION
DP1016490	HISTORICAL	SURVEY	SUBDIVISION
DP1126691			
Lot(s): 202			
DP233145	HISTORICAL	SURVEY	SUBDIVISION
DP558853	HISTORICAL	SURVEY	SUBDIVISION
DP836884	HISTORICAL	SURVEY	RESUMPTION OR ACQUISITION
DP1016490	HISTORICAL	SURVEY	SUBDIVISION
DP1118846	HISTORICAL	SURVEY	SUBDIVISION
DP1228690	REGISTERED	SURVEY	EASEMENT
DP1128566			
Lot(s): 1			
DP792104	HISTORICAL	SURVEY	SUBDIVISION
DP1139919			
Lot(s): 9			
DP792104	HISTORICAL	SURVEY	SUBDIVISION
DP1128566	HISTORICAL	SURVEY	SUBDIVISION

	Status	Surv/Comp	Purpose
DP1143208			
Lot(s): 1			
DP835273	HISTORICAL	SURVEY	ROAD OR MOTORWAY
DP862813	HISTORICAL	SURVEY	SUBDIVISION
DP863972	HISTORICAL	SURVEY	ROADS ACT, 1993
DP1254085	REGISTERED	SURVEY	LEASE
DP1185504			
Lot(s): 2			
DP1258165	REGISTERED	SURVEY	SUBDIVISION
Lot(s): 3			
DP1253436	REGISTERED	SURVEY	ROADS ACT, 1993
Lot(s): 1, 2, 3			
DP862928	HISTORICAL	SURVEY	SUBDIVISION
DP1196252	REGISTERED	SURVEY	EASEMENT
DP1202481			
Lot(s): 203			
DP233145	HISTORICAL	SURVEY	SUBDIVISION
DP836884	HISTORICAL	SURVEY	RESUMPTION OR ACQUISITION
DP1016490	HISTORICAL	SURVEY	SUBDIVISION
DP1118846	HISTORICAL	SURVEY	SUBDIVISION
DP1126691	HISTORICAL	SURVEY	SUBDIVISION
DP1227720	REGISTERED	COMPILATION	EASEMENT
DP1258165			
Lot(s): 18			
DP792104	HISTORICAL	SURVEY	SUBDIVISION
DP1128566	HISTORICAL	SURVEY	SUBDIVISION
DP1139919	HISTORICAL	SURVEY	SUBDIVISION
DP1209192	HISTORICAL	SURVEY	SUBDIVISION

Road

Polygon Id(s): 107984430, 107984431, 107984432

NSW GAZ. DEDICATED PUBLIC ROAD LOT 1 DP1032656	11-07-2003	Folio : 7143

Plan	Surv/Comp	Purpose
DP25440	SURVEY	UNRESEARCHED
DP71758	SURVEY	UNRESEARCHED
DP108481	SURVEY	UNRESEARCHED
DP233145	SURVEY	SUBDIVISION
DP261137	SURVEY	ROAD OR MOTORWAY
DP316562	SURVEY	UNRESEARCHED
DP332505	SURVEY	UNRESEARCHED
DP512153	SURVEY	SUBDIVISION
DP558853	SURVEY	SUBDIVISION
DP573214	SURVEY	SUBDIVISION
DP576383	SURVEY	SUBDIVISION
DP584781	SURVEY	SUBDIVISION
DP586603	SURVEY	SUBDIVISION
DP598770	SURVEY	SUBDIVISION
DP606484	SURVEY	SUBDIVISION
DP626077	COMPILATION	SUBDIVISION
DP753149	COMPILATION	CROWN ADMIN NO.
DP780887	COMPILATION	DEPARTMENTAL
DP792104	SURVEY	SUBDIVISION
DP815736	SURVEY	SUBDIVISION
DP827097	SURVEY	SUBDIVISION
DP836884	SURVEY	RESUMPTION OR ACQUISITION
DP841632	SURVEY	RESUMPTION OR ACQUISITION
DP862813	SURVEY	SUBDIVISION
DP862928	SURVEY	SUBDIVISION
DP863972	SURVEY	ROADS ACT, 1993
DP1015198	SURVEY	ROADS ACT, 1993
DP1016490	SURVEY	SUBDIVISION
DP1045690	COMPILATION	LIMITED FOLIO CREATION
DP1048115	SURVEY	SUBDIVISION
DP1059402	SURVEY	SUBDIVISION
DP1083271	SURVEY	SUBDIVISION
DP1087340	SURVEY	SUBDIVISION
DP1105040	COMPILATION	CONSOLIDATION
DP1118846	SURVEY	SUBDIVISION
DP1126691	SURVEY	SUBDIVISION
DP1128566	SURVEY	SUBDIVISION
DP1139919	SURVEY	SUBDIVISION
DP1143208	SURVEY	CONSOLIDATION
DP1143208	UNRESEARCHED	CONSOLIDATION
DP1185504	SURVEY	SUBDIVISION
DP1202481	COMPILATION	CONSOLIDATION
DP1258165	SURVEY	SUBDIVISION

12680008

NEW SOUTH WALES

[redacted]FICATE OF TITLE

L PROPERTY ACT, 1900

IVA NO. 16026

Vol. 12680 Fol. 8

Edition issued 14- 1 -1975

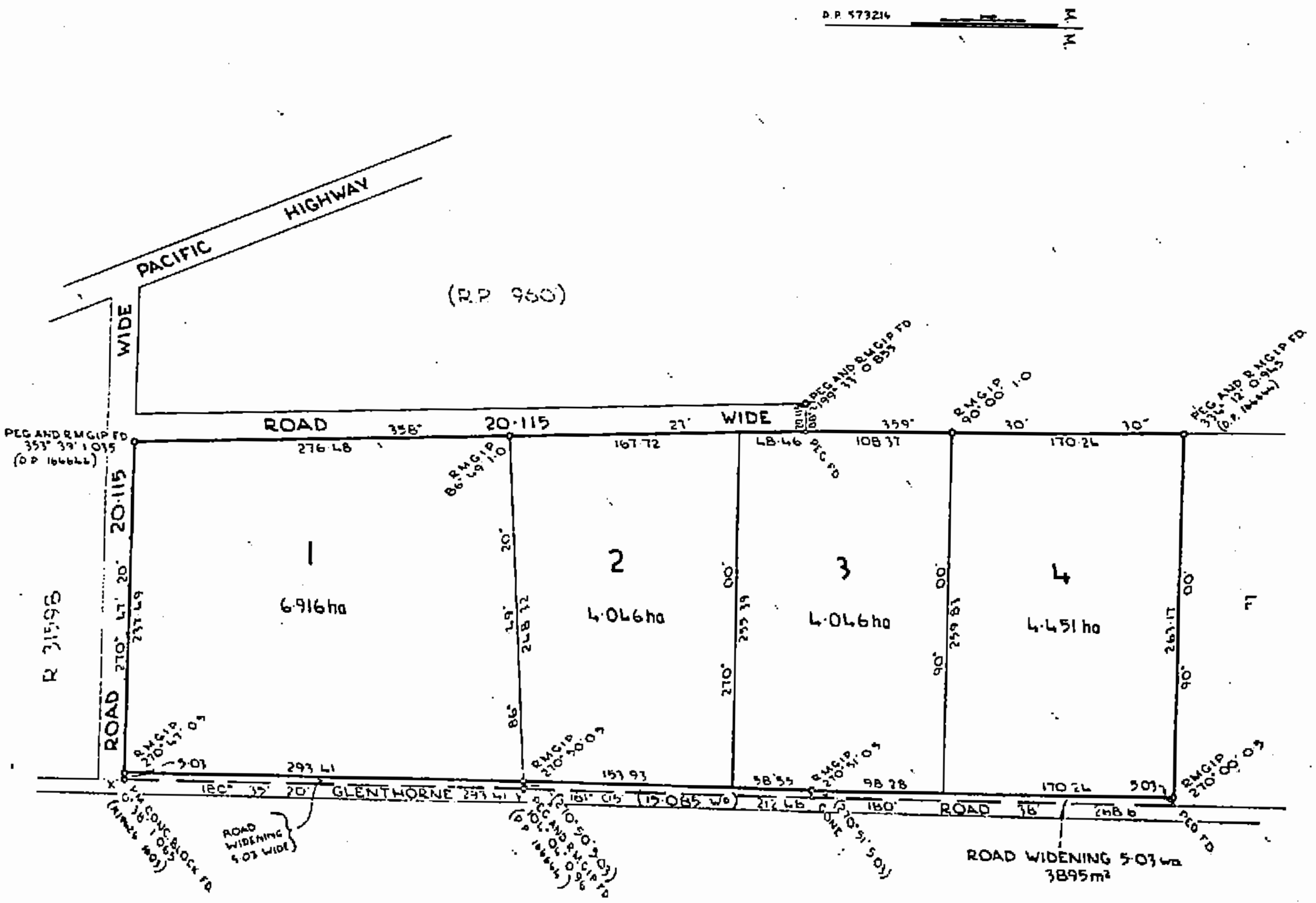
(Page 1) Vol. 12680 Fol. 8

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



S

ESTATE AND LAND REFERRED TO

Estate in Fee Simple in Lot 1 in Deposited Plan 573214 at Purfleet in the Shire of Manning, Parish of Tinonee and County of Gloucester being part of Portion 155 granted to William Caswell on 11-8-1841.

FIRST SCHEDULE

~~MABEL RUTHERFORD BIRD o[illegible]nthorne, Married Woman.~~

SECOND SCHEDULE

GRY

1. Reservations and conditions, if any, contained in the Crown Grant Grant above referred to.

QG 2. CAUTION. The land within described is held subject to any subsisting interest (as defined in Section 28A of the Real Property Act, 1900).

~~3. Caveat No. P109725 by the Registrar General.~~ Withdrawn Q537398.

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

WARNING: THIS DOCUMENT MUST NOT BE REMOVED FROM THE LAND TITLES OFFICE.

RG 2/67 NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED.

Vol. 12680 Fol. 8

CT 1-12-77
Q537398
Q583615M
S28632D/M
— 33T
W79050M

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
~~Vendul International Pty. Limited.~~	~~Transfer~~	~~Q537398~~	~~--------~~	~~6-2-1978~~	
George Harry Davey of Taree, Builder.	Transfer	S28633	---------	10-9-1980	

SECOND SCHEDULE (continued)

INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION		
~~Mortgage~~	~~Q583615~~	~~-------~~	~~to Rural Bank of New South Wales~~	~~2-3-1978~~		Discharged	S28632	
MS W79050 P Mortgage to State Bank of New South Wales. Registered 13-12-1985								

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

(Page 2 of 2 pages)

12680009

NEW SOUTH WALES

[redacted]ICATE OF TITLE

[redacted]L PROPERTY ACT, 1900

IVA NO. 16026

Vol. 12680 Fol. 9

Edition issued 14- 1 -1975

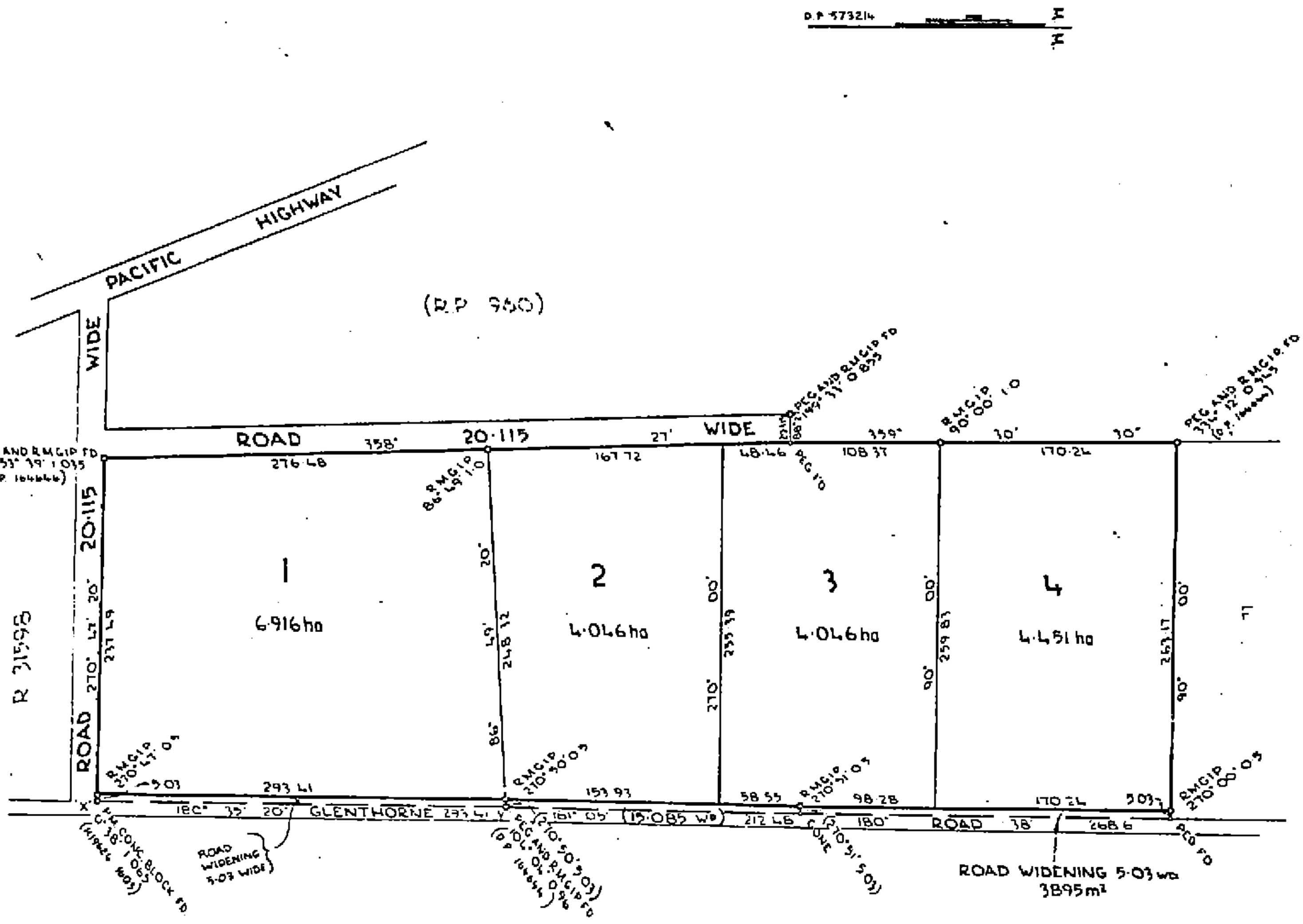
(Page 1) Vol. 12680 Fol. 9

I certify that the person described in the First Schedule is the registered proprietor of the undermentioned estate in the land within described subject nevertheless to such exceptions encumbrances and interests as are shown in the Second Schedule.

Registrar General.

PLAN SHOWING LOCATION OF LAND

LENGTHS ARE IN METRES



ESTATE AND LAND REFERRED TO

S

Estate in Fee Simple in Lot 2 in Deposited Plan 573214 at Purfleet in the Shire of Manning, Parish of Tinonee and County of Gloucester being part of Portion 155 granted to William Caswell on 11-8-1841.

FIRST SCHEDULE

~~MABEL RUTHERFORD BIRD of [illegible]thorne, Married Woman.~~

SECOND SCHEDULE

GRY

1. Reservations and conditions, if any, contained in the Crown Grant Grant above referred to.
2. ~~CAUTION. The land within described is held subject to any subsisting interest (as defined in Section 28A of the Real Property Act, 1900).~~ W338281
3. ~~Caveat No. P109725 by the Registrar General.~~ Withdrawn Q537398.

PERSONS ARE CAUTIONED AGAINST ALTERING OR ADDING TO THIS CERTIFICATE OR ANY NOTIFICATION HEREON

WARNING: THIS DOCUMENT MUST NOT BE REMOVED FROM THE LAND TITLES OFFICE.

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED.

CT 1-12-77

Q537398
99

T18382

W338281
82

X595911

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	ENTERED	Signature of Registrar General
~~Edward Gerard Gersbach of Mount Druitt, Bricklayer and Janice Phyliss Gersbach, his wife, as joint tenants.~~	~~Transfers~~	~~Q537398~~ ~~Q537399~~		~~6-2-1978~~	
Edward Gerard Gersbach by Transfer T18382. Registered 28-4-1982					

SECOND SCHEDULE (continued)

	INSTRUMENT NATURE	INSTRUMENT NUMBER	INSTRUMENT DATE	PARTICULARS	ENTERED	Signature of Registrar General	CANCELLATION
MG	W338282P MORTGAGE TO ST GEORGE BUILDING SOCIETY LTD REGISTERED 26-5-1986						
U	W338282P Mortgage X595911 Variation. Registered 6.6.1988						

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

C[redacted]ICATE OF TITLE

NEW SOUTH WALES

PROPERTY ACT, 1900

Vol. 15524 Fol. 20

First Title Old System

Prior Title CA 29288

EDITION ISSUED 13 5 1988

I certify that the person named in the First Schedule is the registered proprietor of an estate in fee simple (or such other estate or interest as is set out below) in the land described subject to the recordings appearing in the Second Schedule and to the provisions of the Real Property Act, 1900.

Registrar General.

CANCELLED

(Page 1) Vol. 15524 Fol. 20

S

LAND REFERRED TO

SEE AUTO FOLIO

Lot E in DP37960 at Purfleet in the City of Greater Taree Parish of Tinonee County of Gloucester.

Title Diagram: DP37960

FIRST SCHEDULE

NORMAN JAMES ERIKSSON and JOAN ERIKSSON as Joint Tenants.

GRY

SECOND SCHEDULE

1. Reservations and conditions in the Crown Grant. 13.5.1988
QG 2. QUALIFIED TITLE. Caution pursuant to s.28J Real Property Act, 1900. (Book 3732 No.282)

(Page 2 of 2 pages)

Vol 15524 Fol 20

L.O. 55

FIRST SCHEDULE (continued)

REGISTERED PROPRIETOR	Registrar General

SECOND SCHEDULE (continued)

PARTICULARS	Registrar General	CANCELLATION

NOTATIONS AND UNREGISTERED DEALINGS

NOTE: ENTRIES RULED THROUGH AND AUTHENTICATED BY THE SEAL OF THE REGISTRAR GENERAL ARE CANCELLED

Form: 01T

Licensee: Stacks - The Law Firm

Licence: 01-10-001

(1)

TRANSFER

New South Wales
Real Property Act, 1900

AA621909B

PRIVACY NOTE: this information is legally required and will become part of the public record

STAMP DUTY Office of State Revenue use only

OFFICE OF STATE REVENUE (N.S.W. TREASURY)
CLIENT No. 81491399
STAMP DUTY $20
TRANSACTION No 1906315
STAMP No. 102
SIGNATURE M. J. Kelly
DATE 5.4.2004
ASSESSMENT DETAILS:

(A) **TORRENS TITLE** If appropriate, specify the part transferred
2/827097

(B) **LODGED BY**

Delivery Box	Name, Address or DX and Telephone	CODES
	CORRS CHAMBERS WESTGARTH DX 133 SYDNEY 898S Reference (optional): WIRTH	T TW (Sheriff)

(C) **TRANSFEROR** Peter James Eriksson and Sandra Eriksson

(D) **CONSIDERATION** The transferor acknowledges receipt of the consideration of $ 450,000.00 and as regards

(E) **ESTATE** the land specified above transfers to the transferee an estate in fee simple

(F) **SHARE TRANSFERRED**

(G) Encumbrances (if applicable): 1. 2. 3.

(H) **TRANSFEREE** Richard Nicholas Wirth and Robin Joy Wirth

(I) **TENANCY:** JOINT

DATE 07 / 04 / 2004
dd mm yyyy

(J) I certify that the transferor, with whom I am personally acquainted or as to whose identity I am otherwise satisfied, signed this transfer in my presence

Signature of witness: Derek Richards

Name of witness: DEREK RICHARDS

Address of witness: JUSTICE OF THE PEACE FOR THE STATE OF QUEENSLAND
MEMBER, QLD. JUSTICES ASSOCIATION
Q.J.A. REGISTRATION 8837

Certified correct for the purposes of the Real Property Act 1900 by the transferor

Signature of transferor:

S. Eriksson

Certified correct for the purposes of the Real Property Act 1900 by the person whose signature appears below.

Signature: M. J. Kelly

Signatory's name: MICHAEL JOHN KELLY.

Signatory's capacity: Transferee's Solicitor/Conveyancer

Page 1 of 1
number additional pages sequentially

ALL HANDWRITING MUST BE IN BLOCK CAPITALS.

Form: 03AE
Licence: 01-05-051
Licensee: LEAP Legal Software Pty Limited
Firm name: Merrick Spicer & Associates

TRANSMISSION APPLICATION

by an Executor, Administrator or Trustee

New South Wales
Section 93 Real Property Act 1900

AJ686025B

PRIVACY NOTE: Section 31B of the Real Property Act 1900 (RP Act) authorises the Registrar General to collect the information required by this form for the establishment and maintenance of the Real Property Act Register. Section 96B RP Act requires that the Register is made available to any person for search upon payment of a fee, if any.

(A) **TORRENS TITLE** Identifier 50/863972

(B) **REGISTERED DEALING** NUMBER TORRENS TITLE

(C) **LODGED BY**

DOCUMENT COLLECTION BOX	NAME, ADDRESS OR DX, TELEPHONE, AND CUSTOMER ACCOUNT NUMBER IF ANY	CODE
268D	SYDNEY LEGAL AGENTS - INFOTRACK LLP: 132579W REFERENCE: MERRICK | 202675	AE

(D) **DECEASED REGISTERED PROPRIETOR** GEORGE HARRY DAVEY

(E) **APPLICANT** PHILIP ANTHONY DAVEY AND IAN GEORGE DAVEY

(F) The abovementioned applicant, being entitled as executor of the will of the deceased registered proprietor (who died on 01/03/2015) pursuant to Probate No. 2015/00068844 granted on 1 May 2015 to Philip Anthony Davey and Ian George Davey (a certified copy of which is lodged herewith) hereby applies to be registered as proprietor of the estate or interest of the deceased registered proprietor in the abovementioned land

DATE 5.5.2015

(G)

Certified correct for the purposes of the Real Property Act 1900 on behalf of the applicant by the person whose signature appears below.

Signature:

Signatory's name: Merrick James Spicer
Signatory's capacity: Solicitor

(H) *This section is to be completed where a notice of sale is required and the relevant data has been forwarded through eNOS.*
The applicant certifies that the eNOS data relevant to this dealing has been submitted and stored under
eNOS ID No. 877644 Full name: Merrick James Spicer Signature:

**s117 RP Act requires that you must have known the signatory for more than 12 months or have sighted identifying documentation*

ALL HANDWRITING MUST BE IN BLOCK CAPITALS.

52091 Evidence sighted and returned (office use only:

RP 13A

STAMP DUTY 0

OFFICE OF STATE REVENUE
(N.S.W. TREASURY)
1994/95 N2
NO STAMP DUTY IS PAYABLE ON THIS INSTRUMENT

B

OFFICE USE ONLY

U 346701 K

TRANSFER
(INCLUDING EASEMENT/COVENANTS)

REAL PROPERTY ACT, 1900

(See Instructions for Completion on back of form)

T of $ R

DESCRIPTION OF LAND Note (a)

LAND being transferred		
Torrens Title Reference	If part Only, Delete Whole and Give Details	Location
VOLUME 12660 FOLIO 8 (now being Folio Identifier 1/573214)	PART ~~WHOLE~~ Lot 17 DP836884	

TENEMENTS PANEL Note (b) This panel also to be completed for covenants by transferor

Servient Tenement (Land burdened by easement)		Dominant Tenement (Land benefited by easement)	
Torrens Title Reference	Torrens Title Reference	Torrens Title Reference	Torrens Title Reference
LOT 11 DP836884		LOT 17 DP836884	

TRANSFEROR Note (c)

GEORGE BARRY DAVEY

Note (d) (the abovenamed TRANSFEROR) hereby acknowledges receipt of the consideration of $ 8,500.00 and transfers an estate in fee simple in the land being transferred above described to the TRANSFEREE

TRANSFEROR Note (c)

ROADS AND TRAFFIC AUTHORITY OF NEW SOUTH WALES

OFFICE USE ONLY

over

TENANCY Note (e) ~~as joint tenants/tenants in common~~

PRIOR ENCUMBRANCES Note (f) subject to the following PRIOR ENCUMBRANCES 1. .... 2. .... 3. ....

AND the TRANSFEROR:—

Note (g) (i) ~~GRANTS/RESERVES an easement as set out in SCHEDULE ONE hereto~~
(ii) COVENANTS with the TRANSFEREE as set out in SCHEDULE TWO hereto

Note (g) ~~AND the TRANSFEREE COVENANTS with the TRANSFEROR as set out in SCHEDULE THREE hereto~~

DATE 8th June 1994

We hereby certify this dealing to be correct for the purposes of the Real Property Act, 1900.

EXECUTION Note (h)

Signed in my presence by the applicant who is personally known to me.

Signature of Witness

ALLEN BRUCE EDWARDS
Name of Witness (BLOCK LETTERS)

Address and Occupation of Witness

G B Davey
Signature of Transferor

Note (h) Signed in my presence by the Transferee who is personally known to me.

....
Signature of Witness

....
Name of Witness (BLOCK LETTERS)

....
Address and occupation of Witness

Solicitor for ~~Signature of~~ Transferee
~~B. M. Blakemore.~~

TO BE COMPLETED BY LODGING PARTY Notes (i) and (j)

LODGED BY

THOMAS KENYON & SON
LAW STATIONERS,
SUITE 503, 49 MARKET STREET
SYDNEY, N.S.W. 2000
D.X. 435 PHONE (02) 2?3 1766

Ref.: 33H

Delivery Box Number MG - DAVY

LOCATION OF DOCUMENTS

CT	OTHER	
		Herewith.
		In L.T.O. with
		Produced by

OFFICE USE ONLY

Checked	Passed	REGISTERED · -19
25 A		
Signed	Extra Fee	

Secondary Directions			
Delivery Directions			

RP 13A
1988

SCHEDULE ONE HEREINBEFORE REFERRED TO

The ~~Transferor hereby grants/reserves~~

Notes (k) and (l)

SCHEDULE TWO HEREINBEFORE REFERRED TO

The Transferor hereby covenants with

Notes (m) and (l)
Also complete tenements panel on front of form

The Transferor does hereby for the benefit of Lot 17 in Deposited Plan 836884 (hereinafter called "the dominant tenement") covenant with the Transferee (in this covenant called "the Authority") and with the Council of the City of Greater Taree and so as to bind and burden Lot 11 in Deposited Plan 836884 (hereinafter called "the servient tenement") that the Transferor will not without the written consent of the Authority (which consent may be revoked at any time by the Authority at its discretion and without compensation) construct or allow to be constructed on the servient tenement any means of access to or from the dominant tenement or use or allow to be used the servient tenement as a means of access to or from the dominant tenement AND it is hereby declared that the restriction imposed by this covenant shall cease to apply if the dominant tenement after having been declared a Controlled Access Road or Freeway under the provisions of the Roads Act 1993 thereafter ceases to be such a Controlled Access Road or Freeway.

RP 13A
1988

SCHEDULE THREE HEREINBEFORE REFERRED TO

B

Notes ~~(n) and (l) — The Transferee hereby covenants with~~

J.H. Davey

(For continuation of SCHEDULE(S) see annexure(s) hereto)

RP 13A
1988

INSTRUCTIONS FOR COMPLETION

This form is only to be used for the transfer of land together with the granting or reservation of easements and/or the creation of restrictive covenants. For other transfers use forms RP 13, RP 13B, RP 13C, as appropriate.

This dealing should be marked by the Stamp Duties Division, Department of Finance before lodgment at the Land Titles Office.

Typewriting and handwriting should be clear, legible and in permanent dense black or dark blue non-copying ink.

Alterations are not to be made by erasure; the words rejected are to be ruled through and initialled by the parties to the dealing in the left-hand margin.

If the space provided is insufficient, additional sheets of the same size and quality of paper and having the same margins as this form should be used. Each additional sheet must be identified as an annexure and signed by the parties and the attesting witnesses.

Registered mortgagees, chargees and lessees of the servient tenement should consent to any grant or reservation of easement; otherwise the mortgage, charge or lease should be noted in the memorandum of prior encumbrances.

The signatures of the parties and the attesting witnesses should appear below the last provision in the last completed schedule.

Rule up all blanks.

The following instructions relate to the side notes on the form.

(a) Description of land.

(i) TORRENS TITLE REFERENCE.—Insert the current reference to the Folio of the Register for the land being transferred, e.g., 135/SP12345 or Vol.12634 Fol. 126.
(ii) PART/WHOLE.—If part only of the land in the folio of the Register is being transferred, delete the word "WHOLE" and insert the lot and plan number, portion, &c. See also sections 327 and 327AA of the Local Government Act, 1919.
(iii) LOCATION.—Insert the locality shown on the Certificate of Title, e.g., at Chullora. If the locality is not shown, insert the Parish and County, e.g., Ph. Lismore Co. Rous.

(b) Tenement panel.—Insert the current Folio Identifier or Volume and Folio of the Certificate of Title for both the servient and dominant tenements of the easements, e.g., 135/SP12345 or Vol. 12634 Fol. 126, &c. This panel is also to be completed for covenants by the transferor.

(c) Show the full name, address and occupation or description.

(d) If the estate being transferred is a lesser estate than an estate in fee simple, delete "fee simple" and insert appropriate estate

(e) Delete if only one transferee. If more than one transferee, delete either "joint tenants" or "tenants in common", and, if the transferees hold as tenants in common, state the shares in which they hold.

(f) In the memorandum of prior encumbrances, state only the registered number of any mortgage, charge or lease (except where the consent of the mortgagee, chargee or lessee is furnished) and of any writ recorded in the Register.

(g) Delete whichever words are inappropriate.

(h) Execution.

GENERALLY (i) Should there be insufficient space for execution of this dealing, use an annexure sheet.
(ii) The certificate of correctness under the Real Property Act, 1900, must be signed by all parties to the transfer, each party to execute the dealing in the presence of an adult witness, not being a party to the dealing, to whom he/she is personally known. The solicitor for the transferee may sign the certificate on behalf of the transferee, the solicitor's name (not that of his/her firm), to be typewritten or printed adjacent to his/her signature.
Any person falsely or negligently certifying is liable to the penalties provided by section 117 of the Real Property Act, 1900.
ATTORNEY (iii) If the transfer is executed by an attorney for the transferor/transferee pursuant to a registered power of attorney, the form of attestation must set out the full name of the attorney, and the form of execution must indicate the source of his/her authority, e.g., "AB by his/her attorney (or receiver or delegate, as the case may be) XY pursuant to power of attorney registered Book No. ".
AUTHORITY (iv) If the transfer is executed pursuant to an authority (other than specified in (iii)) the form of execution must indicate the statutory, judicial or other authority pursuant to which the transfer has been executed.
CORPORATION (v) If the transfer is executed by a corporation under seal, the form of execution should include a statement that the seal has been properly affixed, e.g., in accordance with the Articles of Association of the corporation. Each person attesting the affixing of the seal must state their position (e.g., director, secretary) in the corporation.

(i) Insert the name, postal address, Document Exchange reference, telephone number and delivery box number of the lodging party.

(j) The lodging party is to complete the LOCATION OF DOCUMENTS panel. Place a tick in the appropriate box to indicate the whereabouts of the Certificate of Title. List, in an abbreviated form, other documents lodged, e.g., stat. dec. for statutory declaration, pbte for probate, L/A for letters of administration, &c.

(k) State the nature of the easement (see, e.g., section 181A of the Conveyancing Act, 1919) and accurately describe the site of the easement. The grant or reservation of easement (other than an easement in gross) must comply with section 88 of the Conveyancing Act, 1919. If not applicable, rule through this space.

(l) Annexures should be of the same size and quality of paper and have the same margins as the transfer form. Each such annexure must be identified as an annexure and signed by the parties and the attesting witnesses. Any plan annexed should comply with regulation 37 of the Real Property Act regulations, 1970.

(m) This space is provided for any restrictive covenant by the transferor (which must comply with section 88 of the Conveyancing Act, 1919). If not applicable, rule through this space.

(n) This space is provided for any restrictive covenant by the transferee (which must comply with section 88 of the Conveyancing Act, 1919). If not applicable, rule through this space.

OFFICE USE ONLY

FIRST SCHEDULE DIRECTIONS

(A) FOLIO IDENTIFIER	(B) DIRECTION	(C) NAME
1/573214	PROP	Roads and Traffic Authority of New South Wales
		of part being Lot 17 in DP836884 and George
		Harry Davey as regards the residue being Lot 11 in
		DP 836884.

SECOND SCHEDULE & OTHER DIRECTIONS

(D) FOLIO IDENTIFIER (OR REGD DEALING & FOLIO IDENTIFIER)	(E) DIRECTION	(F) NOTFN TYPE	(G) DEALING NUMBER	(H) DETAILS
" "	OFF	QG		
" "	OFF	NG	DP836884	
~~" "~~	~~ON~~	~~EV~~		~~As regards Lot 11 in DP 836884~~
" "	EN	AA		Part of the land above described
				being Lot 17 in DP836884 is required
				for road purposes.
" "	ON	ZZ		New folios created for Lots 11 and 17
				in DP 836884.
" "	Noct.			

Printed in Australia L.O. 105

PLAN FORM 2

← Plan Drawing only to appear in this space →

* OFFICE USE ONLY S

Signatures and seals only.

SIGNED BY MABEL RUTHERFORD BIRD
THE MORTGAGEE UNDER MORTGAGE
NO. 866 BOOK 3081 IN THE PRESENCE OF:

Lynette J. Jenkins J.P.

M. R. Bird.

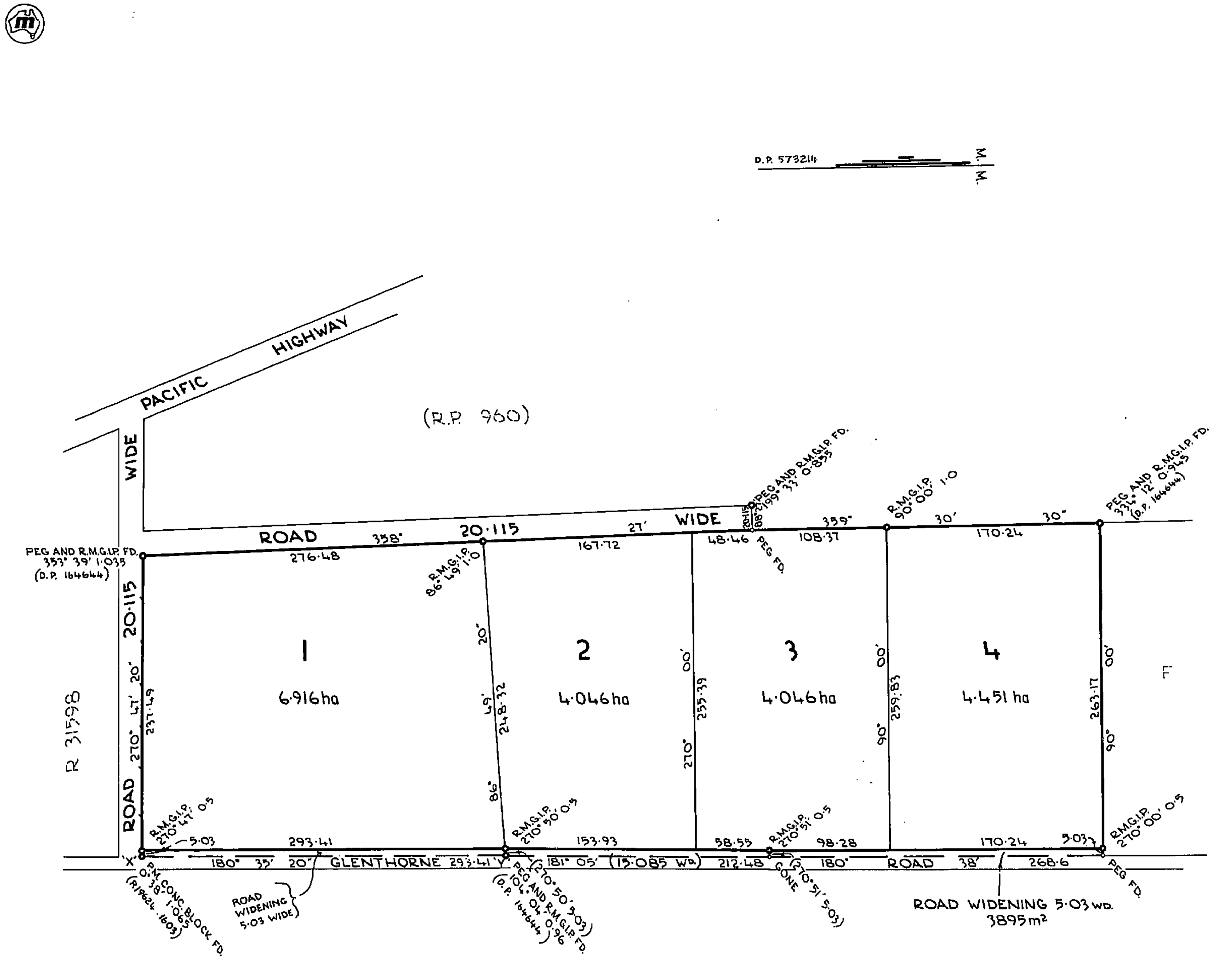
THE COMMON SEAL OF VENDUL INTERNATIONAL
PTY. LIMITED WAS HERE UNTO AFFIXED BY
AUTHORITY OF A RESOLUTION OF THE BOARD OF
DIRECTORS IN THE PRESENCE OF:-

Vendil International Pty. Limited Common Seal

SECRETARY DIRECTOR

MCKENSE

M. MOCAHON



D. P. 573214

Registered: RE. 4-12-1974.

C.A.: No. 2130 OF 26-3-1973

Title System: OLD SYSTEM

Purpose: SUBDIVISION

Ref. Map: PARISH #

Last Plan: D.P. 164644

U	I	A	4	O	O	N

PLAN

OF SUBDIVISION OF
LOT G [MPS (OS) 14644]
D. P. 164644

Reduction Ratio 1: 2500
Lengths are in metres.

~~Mun.~~/Shire ~~City~~ MANNING

Locality: PURFLEET

Parish: TINONEE

County: GLOUCESTER

~~This is sheet 1 of my plan in sheets.~~
(Delete if inapplicable).

I, PHILIP ALFRED LUKE
of DULHUNTY & TIERNEY PORT MACQUARIE
a surveyor registered under the Surveyors Act, 1929, as amended, hereby certify that the survey represented in this plan ......
is accurate and has been made *~~(1) by me~~ (2) under my immediate supervision in accordance with the Survey Practice Regulations, 1933, and was completed on † ......
21 ST SEPTEMBER 1973.

Signature P.A. Luke

Surveyor registered under Surveyors Act, 1929, as amended.
Datum Line of Azimuth. 'X' – 'Y'
*Strike out either (1) or (2). †Insert date of survey.

Panel for use only for statements of intention to dedicate public roads or to create public reserves, drainage reserves, easements or restrictions as to user.*

IT IS INTENDED TO DEDICATE THE ROAD WIDENING HEREON TO THE PUBLIC

Council Clerk's Certificate

I hereby certify that –

(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

*(b) ~~the requirements~~ of section 348 of the †Metropolitan Water, Sewerage ~~and Drainage Act, 1924~~, as amended. †Hunter District Water, Sewerage, and ~~Drainage Act,~~ 1938, as amended

have been complied with by the applicant in relation to the proposed SUBDIVISION
(Insert "new road", "subdivision" or "consolidated lot") set out herein

Subdivision No. 2130

Date 26 . 3 . 73

(Signature) ......
Council Clerk

*This part of certificate to be deleted where the application is only for a consolidated lot or the opening of a new road or where the land to be subdivided is wholly outside the areas of operations of the Metropolitan Water Sewerage and Drainage Board and the Hunter District Water Board.
†Delete if inapplicable.

M.P.D.

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 Table of mm 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

SURVEYOR'S REFERENCE: 1688

I, Jack Hayward Watson, Registrar General for New South Wales, certify that this negative is a photograph made as a permanent record of a document in my custody this 5th day of December, 1974.

J Watson

PLAN FORM 2

SIGNATURE AND SEALS ONLY.

Rhonda M Yates

COMMON SEAL
CO-OPERATIVE HOUSING SOCIETY

Gordon O. Cleaver
DIRECTOR
SECRETARY

WARREN BROOKS
ASSISTANT MANAGER
CUSTODIAL TRUSTS

FRANK MENEGOTTO
SUPERVISOR

Crown Lands Office Approval

AN APPROVED ....
Authorised Officer
Land District ....
Paper No. ....
Field Book .... pages ....

Council Clerk's Certificate

ereby certify that —

(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

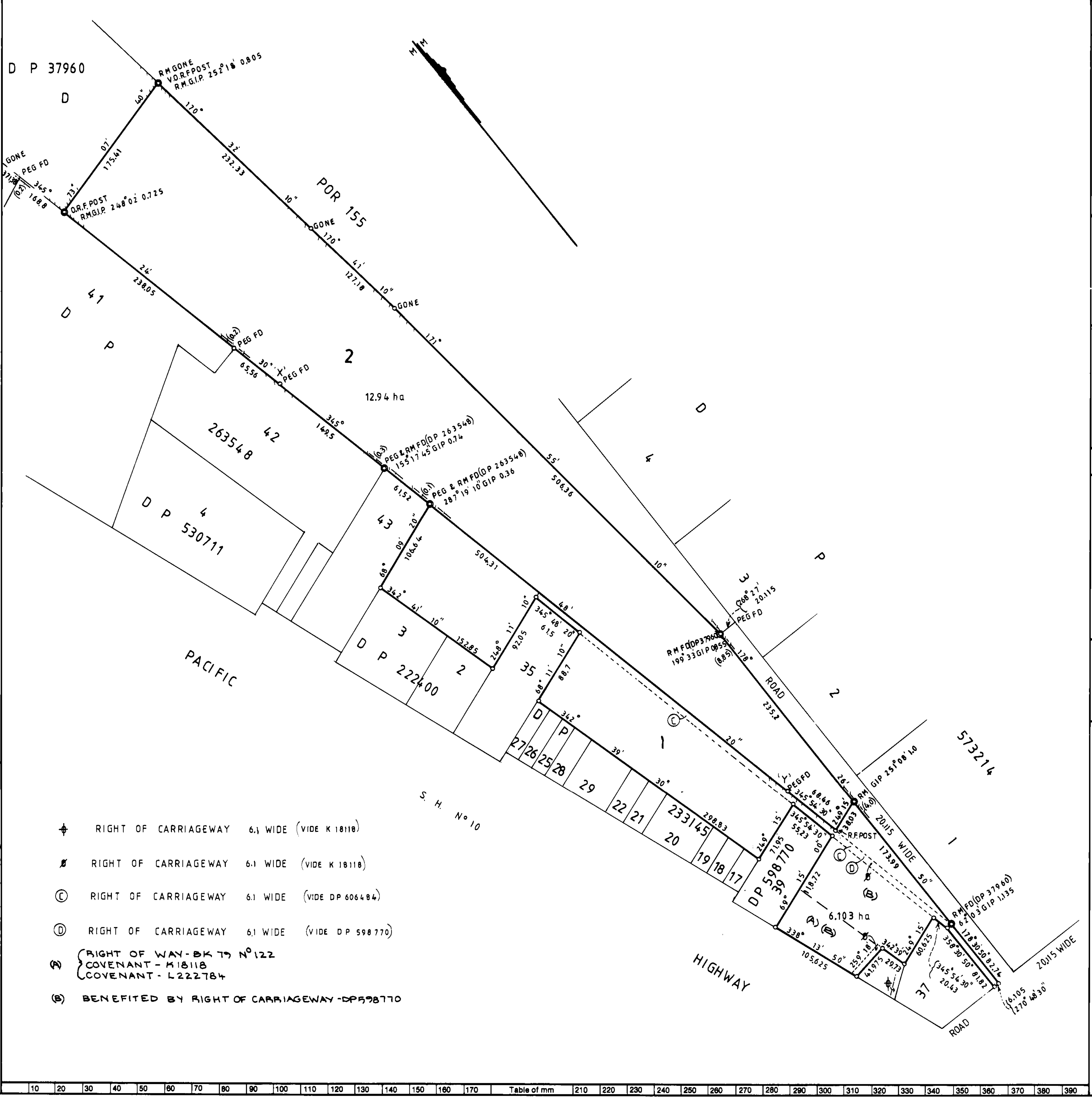
*~~(b) the requirements of section 34B of the † Metropolitan Water, Sewerage and Drainage Act, 1924, as amended † Hunter District Water, Sewerage, and Drainage Act, 1938, as amended~~

ve been complied with by the applicant in relation to the
oposed ......SUBDIVISION......
sert "new road", "subdivision" or "consolidated lot") set out herein
bdivision No. ......64/92......
te ......27.7.1992......
gnature) ......C.B. Chatwood......
Council Clerk
uncil File No. ......DA/92/84......

*This part of certificate to be deleted where the application is only for a nsolidated lot or the opening of a new road or where the land to be bdivided is wholly outside the areas of operations of the Metropolitan ter Sewerage and Drainage Board and the Hunter District Water ard.
† Delete if inapplicable.

URVEYOR'S REFERENCE: 88 | 7182

Plan Drawing only to appear in this space



- ⌖ RIGHT OF CARRIAGEWAY 6.1 WIDE (VIDE K 18118)
- ø RIGHT OF CARRIAGEWAY 6.1 WIDE (VIDE K 18118)
- Ⓒ RIGHT OF CARRIAGEWAY 6.1 WIDE (VIDE DP 606484)
- Ⓓ RIGHT OF CARRIAGEWAY 6.1 WIDE (VIDE DP 598770)
- Ⓐ { RIGHT OF WAY - BK 79 No 122
  COVENANT - K18118
  COVENANT - L222784
- Ⓑ BENEFITED BY RIGHT OF CARRIAGEWAY - DP598770

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

*OFFICE USE ONLY

DP 827097

A I A Z O O Z

Registered: E.D. 11/3/1993
C.A. No 64/92 OF 27.7.1992
Title System: TORRENS
Purpose: SUBDIVISION
Ref. Map: Z4662-5#, PARISH#
Last Plan: DP 37960, DP 598770
DP 263548

PLAN OF SUBDIVISION OF
LOT E DP 37960, LOT 38
DP 598770 AND LOT 44
DP 263548.

Lengths are in metres. Reduction Ratio 1: 3000

~~Mun./Shire~~ City: GREATER TAREE
Locality: PURFLEET
Parish: TINONEE
County: GLOUCESTER (46)

~~This is sheet 1 of my plan in sheets.
(Delete if inapplicable).~~

I, TONY FITZSIMMONS
of 7 FLORENCE ST TAREE 2430
a surveyor registered under the Surveyors Act, 1929, as amended, hereby certify that the survey represented in this plan OF LOT
is accurate and has been made in accordance with the Survey Practice Regulations, 1990 and any special requirements of the Department of Lands, and was completed on
27.1.1993
Signature T. Fitzsimmons
Surveyor registered under Surveyors Act, 1929, as amended.
Datum Line of Azimuth. 'X'-'Y'
#Insert date of survey.

Plans used in preparation of survey/~~compilation~~.
DP 37960 DP 598770, DP 263548,
DP 606484, DP 573214, DP 222400,
DP 530711, DP 263548.

PANEL FOR USE ONLY for statements of intention to dedicate public roads or to create public reserves, drainage reserves, easements or restrictions as to user.

PLAN FORM 2

Plan Drawing only to appear in this space

*OFFICE USE ONLY

SIGNATURES, SEALS AND STATEMENTS of intention to dedicate public roads or to create reserves, drainage reserves, easements, restrictions on the use of land or positive covenants.

EXECUTED FOR THE ROADS AND TRAFFIC AUTHORITY BY ITS DELEGATE ROBERT ACKERMAN PURSUANT TO BOOK 4008 No.809 AND BOOK 4117 No.182.

R. Ackerman

MANAGER, PROPERTY ASSETS.

Crown Lands Office Approval

PLAN APPROVED ....
Authorised Officer

Land District ....

Paper No. ....

Field Book .... *pages* ....

Council's Certificate

I hereby certify that -

(a) the requirements of the Local Government Act, 1919 (other than the requirements for the registration of plans), and

** (b) the requirements of † Part 3 Division 2 of the Water Board Act 1987, or † Part 5 Division 7 of the Hunter Water Board (Corporatisation) Act 1991.*

have been complied with by the applicant in relation to the

proposed ....
(insert "new road", "subdivision" or "consolidated lot") set out herein

Subdivision No. ....

Date ....

(Signature) ....
General Manager/Authorised Person

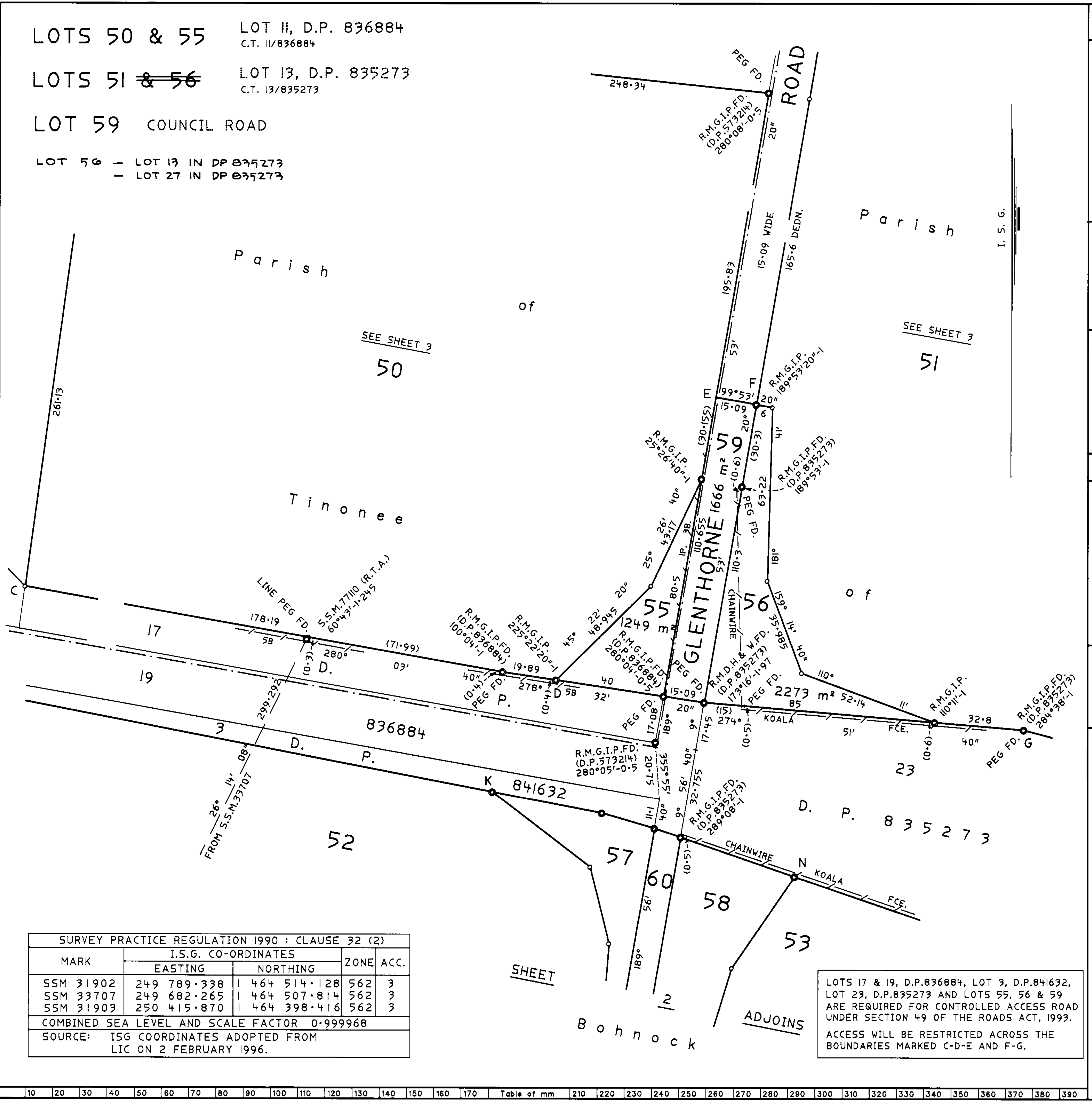
Council File No. ....

** This part of certificate to be deleted where the application is only for a consolidated lot or the opening of a new road or where the land to be subdivided is wholly outside the areas of operations of the Water Board and the Hunter Water Corporation Ltd.*

† Delete if inapplicable.

LOTS 50 & 55	LOT 11, D.P. 836884 C.T. 11/836884
LOTS 51 ~~& 56~~	LOT 13, D.P. 835273 C.T. 13/835273
LOT 59	COUNCIL ROAD

LOT 56 — LOT 13 IN DP 835273
— LOT 27 IN DP 835273



SURVEY PRACTICE REGULATION 1990 : CLAUSE 32 (2)				
MARK	I.S.G. CO-ORDINATES		ZONE	ACC.
	EASTING	NORTHING		
SSM 31902	249 789·338	1 464 514·128	562	3
SSM 33707	249 682·265	1 464 507·814	562	3
SSM 31903	250 415·870	1 464 398·416	562	3

COMBINED SEA LEVEL AND SCALE FACTOR 0·999968

SOURCE: ISG COORDINATES ADOPTED FROM LIC ON 2 FEBRUARY 1996.

LOTS 17 & 19, D.P.836884, LOT 3, D.P.841632, LOT 23, D.P.835273 AND LOTS 55, 56 & 59 ARE REQUIRED FOR CONTROLLED ACCESS ROAD UNDER SECTION 49 OF THE ROADS ACT, 1993.

ACCESS WILL BE RESTRICTED ACROSS THE BOUNDARIES MARKED C-D-E AND F-G.

Table of mm 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 210 220 230 240 250 260 270 280 290 300 310 320 330 340 350 360 370 380 390

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

LIStech

R.T.A. FILE 10/426·1402

DP 863972

Registered: IB 9.12.1996

C.A.: ....

Title System: TORRENS & CROWN LAND

Purpose: ROADS ACT, 1993

Ref.Map: Z4662-5# PARISHES

Last Plan: DP 835273, DP 836884, DP 841632 (DP 2301#)

PLAN OF LAND TO BE ACQUIRED FOR THE PURPOSES OF THE ROADS ACT, 1993.

Lengths are in metres. **Reduction Ratio 1: 1000**

L.G.A.: GREATER TAREE CITY

Locality: PURFLEET

Parishes: (9L/F) BOHNOCK & (46L/F) TINONEE

County: GLOUCESTER

This is sheet 1 of my plan in 3 sheets.
(Delete if inapplicable).

I, MICHAEL JAMES ARMSTRONG

of ROADS AND TRAFFIC AUTHORITY

a surveyor registered under the Surveyors Act 1929, hereby certify that the survey represented in this plan is accurate, has been made in accordance with the Survey Practice Regulation 1990 and was completed on

* 4 APRIL 1996.

Signature MJ Armstrong (21/10/96)
Surveyor registered under Surveyors Act, 1929.
Datum Line of Orientation. "X" - "Y" (SHT.2)
**insert date of survey.*
R.T.A. F.B.No.0010 426 FP 1742A/B MW

Plans used in preparation of survey/compilation.

NOT WITHIN P.S.A.

PANEL FOR USE ONLY for statements of intention to dedicate public roads or to create public reserves, drainage reserves, easements or restrictions as to users.

LOTS 17 & 19, D.P.836884, LOT 3, D.P.841632, LOTS 23 & 28, D.P.835273 AND LOTS 55-60 INCL, ARE REQUIRED FOR CONTROLLED ACCESS ROAD UNDER SECTION 49 OF THE ROADS ACT, 1993.

ACCESS WILL BE RESTRICTED ACROSS THE BOUNDARIES MARKED A-B, C-D-E, F-G-H, J-K-L AND M-N-P.

LOT 61 IS REQUIRED FOR ROAD AND AFTER CONSTRUCTION WILL BE DEDICATED AS PUBLIC ROAD UNDER SECTION 10 OF THE ROADS ACT, 1993.

LOT 54 IS ROAD IN USE WHICH WILL BECOME UNNECESSARY WHEN IT IS PROPOSED TO BE CLOSED.

LOT 62 IS PUBLIC ROAD.

APPROVED: G Gazzard

SURVEY & PROPERTY MANAGER
NORTHERN REGION
ROADS & TRAFFIC AUTHORITY NSW

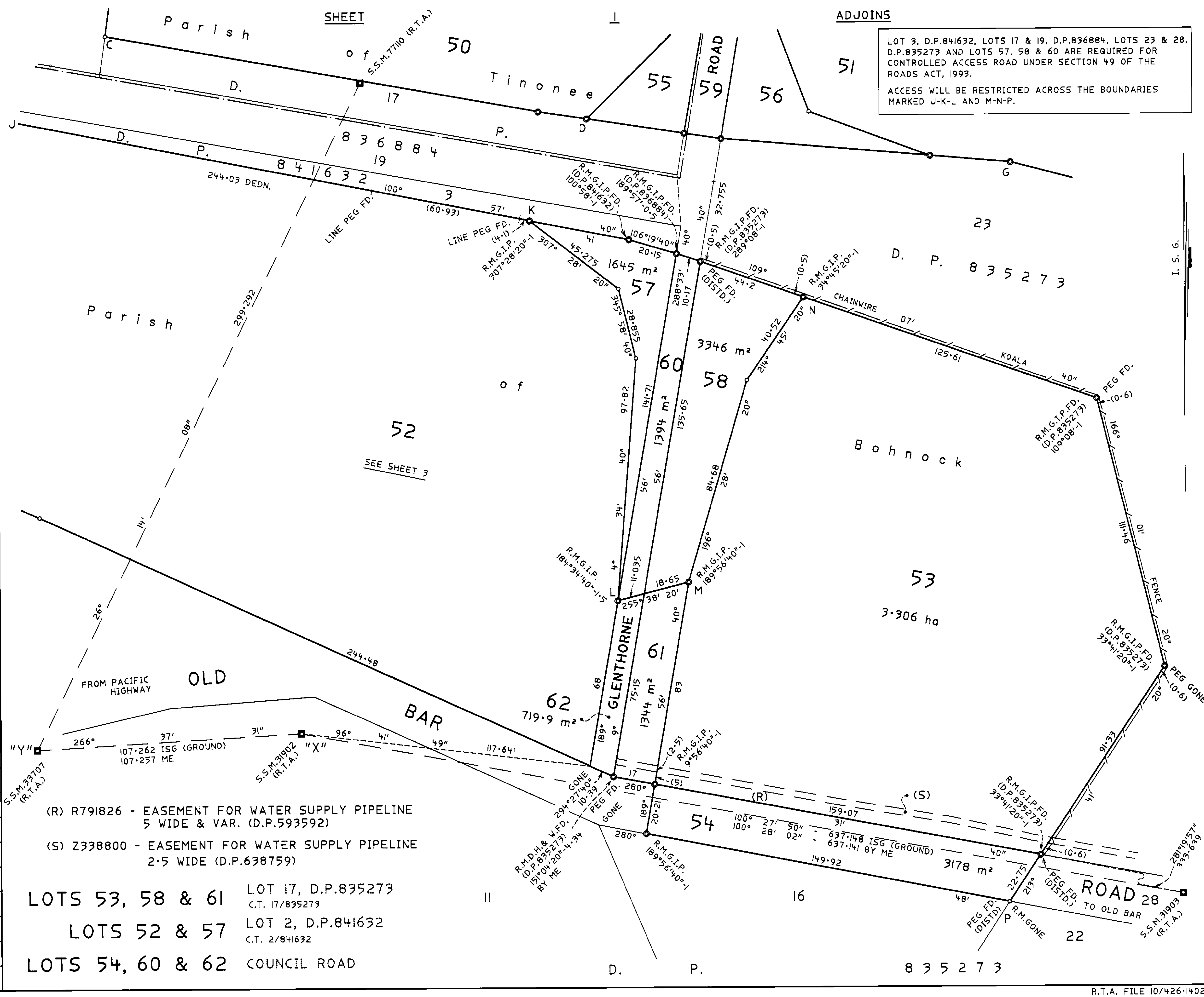
R.T.A. PLAN 0010 426 SS 2415

DP563772

PLAN FORM 3 To be used in conjunction with Plan Form 2

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

SHEET 1 ADJOINS



LOT 3, D.P.841632, LOTS 17 & 19, D.P.836884, LOTS 23 & 28, D.P.835273 AND LOTS 57, 58 & 60 ARE REQUIRED FOR CONTROLLED ACCESS ROAD UNDER SECTION 49 OF THE ROADS ACT, 1993.

ACCESS WILL BE RESTRICTED ACROSS THE BOUNDARIES MARKED J-K-L AND M-N-P.

(R) R791826 - EASEMENT FOR WATER SUPPLY PIPELINE 5 WIDE & VAR. (D.P.593592)

(S) Z338800 - EASEMENT FOR WATER SUPPLY PIPELINE 2·5 WIDE (D.P.638759)

LOTS 53, 58 & 61	LOT 17, D.P.835273 C.T. 17/835273
LOTS 52 & 57	LOT 2, D.P.841632 C.T. 2/841632
LOTS 54, 60 & 62	COUNCIL ROAD

Plan Drawing only to appear in this space

R.T.A. FILE 10/426·1402

* OFFICE USE ONLY

DP 863972

Registered: SB 9.12.1996

This is sheet 2 of my plan in 3 sheets dated 4 APRIL 1996.

MJArmstrong (21/10/96)
Surveyor registered under the Surveyors Act 1929

This is sheet of the plan of sheets covered by my Certificate No. of

General Manager/Authorised Person

L.G.A.: GREATER TAREE CITY
Locality: PURFLEET
Parishes: BOHNOCK & TINONEE
County: GLOUCESTER

For use where space is insufficient in any panel on Plan Form 2.

Reduction Ratio: 1 : 1000

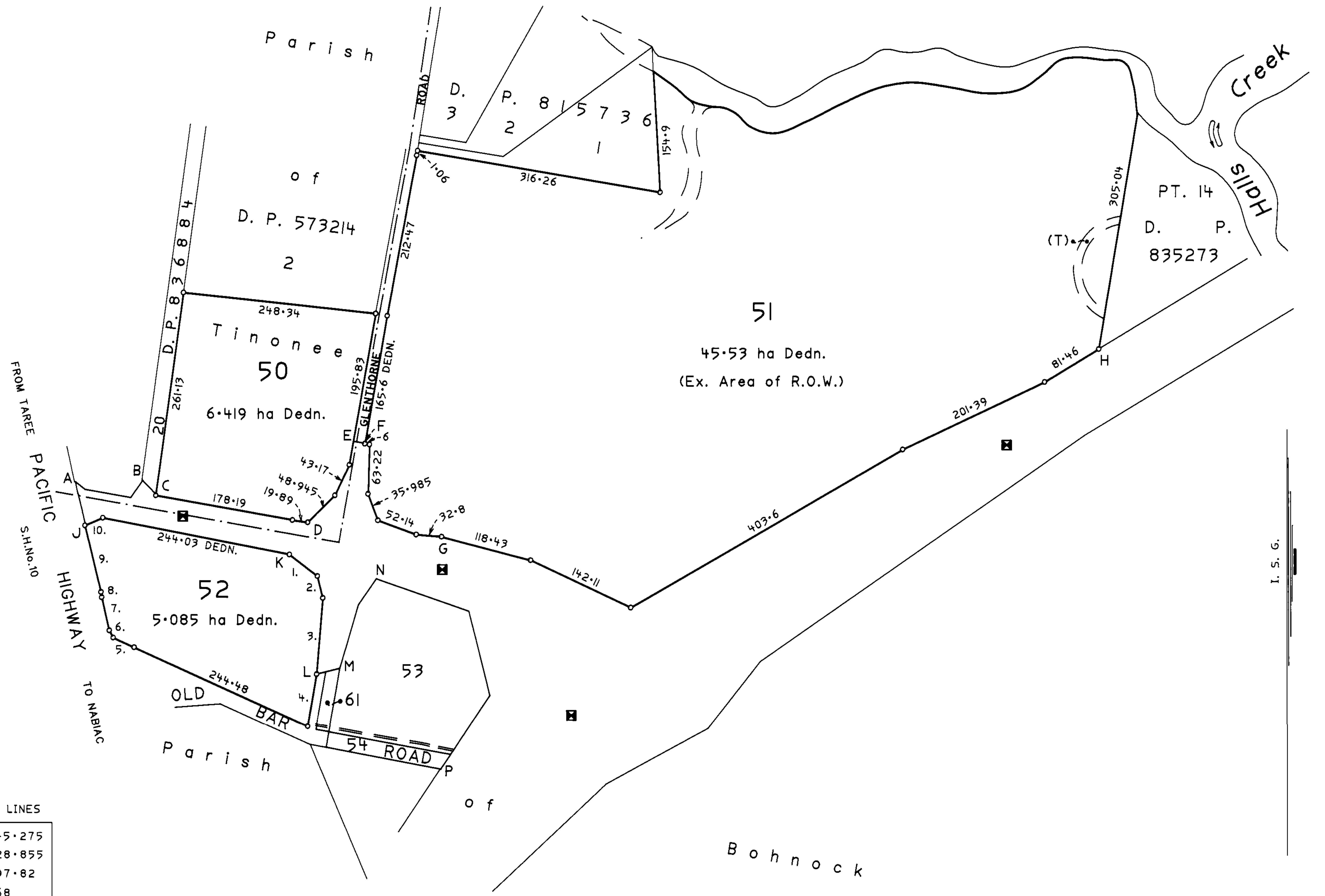
R.T.A. PLAN 0010 426 SS 2415

PLAN FORM 3 To be used in conjunction with Plan Form 2

WARNING: CREASING OR FOLDING WILL LEAD TO REJECTION

* OFFICE USE ONLY

(T) TRANSFER 152575 - RIGHT OF WAY 10·06 WIDE



SHORT LINES

1.	45·275
2.	28·855
3.	97·82
4.	68
5.	29·55
6.	10·47
7.	43·345
8.	6·8
9.	87·29
10.	24·96

☒ REQUIRED FOR CONTROLLED ACCESS ROAD UNDER SECTION 49 OF THE ROADS ACT, 1993.

ACCESS WILL BE RESTRICTED ACROSS THE BOUNDARIES MARKED A-B, C-D-E, F-G-H, J-K-L AND M-N-P.

DP 863972 *

Registered: SB 9.12.1996 *

This is sheet 3 of my plan in 3 sheets dated 4 APRIL 1996.

MJArmstrong (21/10/96)
Surveyor registered under the Surveyors Act 1929

This is sheet of the plan of sheets covered by my Certificate No. of

General Manager/Authorised Person

L.G.A.: GREATER TAREE CITY
Locality: PURFLEET
Parishes: BOHNOCK & TINONEE
County: GLOUCESTER

For use where space is insufficient in any panel on Plan Form 2.

Reduction Ratio: 1 : 4000

R.T.A. FILE 10/426·1402

Plan Drawing only to appear in this space

R.T.A. PLAN 0010 426 SS 2415

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          NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH
          ----------------------------------------------------------

                                              SEARCH DATE
                                              -----------
                                              12/3/2020 8:46AM

FOLIO: 2/827097
------

       First Title(s): OLD SYSTEM
       Prior Title(s): E/37960

Recorded     Number     Type of Instrument             C.T. Issue
---------    ------     ------------------             ----------
17/3/1993    DP827097   DEPOSITED PLAN                 FOLIO CREATED
                                                       EDITION 1

 11/4/1994   U169647    DISCHARGE OF MORTGAGE
 11/4/1994   U169648    MORTGAGE                       EDITION 2

 11/9/1997   3288107    REQUEST

24/11/1997   3606826    DEPARTMENTAL DEALING           EDITION 3

22/12/1997   3686992    DISCHARGE OF MORTGAGE
22/12/1997   3686993    MORTGAGE                       EDITION 4

  7/5/2004   AA621908   DISCHARGE OF MORTGAGE
  7/5/2004   AA621909   TRANSFER
  7/5/2004   AA621910   MORTGAGE                       EDITION 5

 13/2/2006   AC108339   DISCHARGE OF MORTGAGE
 13/2/2006   AC108340   MORTGAGE                       EDITION 6

27/11/2017   AM917220   DISCHARGE OF MORTGAGE
27/11/2017   AM917221   TRANSFER
27/11/2017   AM917222   MORTGAGE                       EDITION 7
                                                       CORD ISSUED

                  ***  END OF SEARCH  ***
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          NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH
          ----------------------------------------------------------

                                                   SEARCH DATE
                                                   -----------
                                                   12/3/2020 8:53AM

 FOLIO: 11/836884
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        Prior Title(s): 1/573214

 Recorded    Number     Type of Instrument              C.T. Issue
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 16/2/1994   DP836884   DEPOSITED PLAN                  LOT RECORDED
                                                        FOLIO NOT CREATED

 28/6/1994   U346701    TRANSFER                        FOLIO CREATED
                                                        EDITION 1

 30/5/1995   0266454    DISCHARGE OF MORTGAGE           EDITION 2

 9/12/1996   DP863972   DEPOSITED PLAN

 22/1/1997   2718910    TRANSFER                        FOLIO CANCELLED

11/10/2000   7142830    DEPARTMENTAL DEALING

                   ***  END OF SEARCH  ***


   advlegs                                        PRINTED ON 12/3/2020
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          NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH
          ----------------------------------------------------------

                                                   SEARCH DATE
                                                   -----------
                                                   12/3/2020 8:47AM

 FOLIO: 50/863972
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        First Title(s): OLD SYSTEM
        Prior Title(s): 11/836884

 Recorded     Number     Type of Instrument              C.T. Issue
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10/12/1996    DP863972   DEPOSITED PLAN                  LOT RECORDED
                                                         FOLIO NOT CREATED

 22/1/1997    2718910    TRANSFER                        FOLIO CREATED
                                                         EDITION 1

 12/6/1997    3114931    REQUEST                         EDITION 2

 25/7/2015    AJ686025   TRANSMISSION APPLICATION        EDITION 3
                         (EXECUTOR, ADMINISTRATOR,
                         TRUSTEE)

 26/9/2016    AK787178   TRANSFER
 26/9/2016    AK787179   MORTGAGE                        EDITION 4

  2/9/2018    AN678864   DEPARTMENTAL DEALING            EDITION 5
                                                         CORD ISSUED

                    ***  END OF SEARCH  ***




  advlegs                                         PRINTED ON 12/3/2020
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      NEW SOUTH WALES LAND REGISTRY SERVICES - HISTORICAL SEARCH
      ----------------------------------------------------------

                                         SEARCH DATE
                                         -----------
                                         12/3/2020 9:10AM

FOLIO: E/37960
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       First Title(s): SEE PRIOR TITLE(S)
       Prior Title(s): VOL 15524 FOL 20

Recorded    Number     Type of Instrument              C.T. Issue
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29/7/1989              TITLE AUTOMATION PROJECT        LOT RECORDED
                                                       FOLIO NOT CREATED

4/10/1989              CONVERTED TO COMPUTER FOLIO     FOLIO CREATED
                                                       CT NOT ISSUED

26/11/1991  E84504     TRANSFER
26/11/1991  E84505     MORTGAGE
26/11/1991  E84506     TRANSFER OF MORTGAGE            EDITION 1

12/3/1993   DP827097   DEPOSITED PLAN                  FOLIO CANCELLED

                  ***  END OF SEARCH  ***




  advlegs                                 PRINTED ON 12/3/2020
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NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 2/573214

SEARCH DATE	TIME	EDITION NO	DATE
12/3/2020	8:47 AM	4	10/9/2018

LAND

LOT 2 IN DEPOSITED PLAN 573214
AT PURFLEET
LOCAL GOVERNMENT AREA MID-COAST
PARISH OF TINONEE COUNTY OF GLOUCESTER
TITLE DIAGRAM DP573214

FIRST SCHEDULE

EDWARD GERARD GERSBACH (T T18382)

SECOND SCHEDULE (1 NOTIFICATION)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 2/827097

SEARCH DATE	TIME	EDITION NO	DATE
12/3/2020	8:46 AM	7	27/11/2017

NO CERTIFICATE OF TITLE HAS ISSUED FOR THE CURRENT EDITION OF THIS FOLIO.
CONTROL OF THE RIGHT TO DEAL IS HELD BY COMMONWEALTH BANK OF AUSTRALIA.

LAND

LOT 2 IN DEPOSITED PLAN 827097
AT PURFLEET
LOCAL GOVERNMENT AREA MID-COAST
PARISH OF TINONEE   COUNTY OF GLOUCESTER
TITLE DIAGRAM DP827097

FIRST SCHEDULE

MICHAEL JOHN BARRETT
HEATHER ANNE BARRETT
AS JOINT TENANTS (T AM917221)

SECOND SCHEDULE (2 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 AM917222 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

advlegs PRINTED ON 12/3/2020

NEW SOUTH WALES LAND REGISTRY SERVICES - TITLE SEARCH

FOLIO: 50/863972

SEARCH DATE	TIME	EDITION NO	DATE
12/3/2020	8:46 AM	5	2/9/2018

NO CERTIFICATE OF TITLE HAS ISSUED FOR THE CURRENT EDITION OF THIS FOLIO.
CONTROL OF THE RIGHT TO DEAL IS HELD BY COMMONWEALTH BANK OF AUSTRALIA.

LAND

LOT 50 IN DEPOSITED PLAN 863972
AT PURFLEET
LOCAL GOVERNMENT AREA MID-COAST
PARISH OF TINONEE COUNTY OF GLOUCESTER
TITLE DIAGRAM DP863972

FIRST SCHEDULE

MICHAEL JOHN BARRETT
HEATHER ANNE BARRETT
AS JOINT TENANTS (T AK787178)

SECOND SCHEDULE (4 NOTIFICATIONS)

1 RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S)
2 U346701 COVENANT
3 3114931 RESTRICTION(S) ON THE USE OF LAND
4 AK787179 MORTGAGE TO COMMONWEALTH BANK OF AUSTRALIA

NOTATIONS

UNREGISTERED DEALINGS: NIL

*** END OF SEARCH ***

Appendix D

Letter from Dr David Tully CEnvP SC

Contaminated Land Solutions

19 May 2020

Ref: 0088.L02

Regional Geotechnical Solutions Pty Ltd
44 Brent Street
Wingham
NSW 2429

For the attention of Andrew Hills

Dear Andrew,

RE: Report Review Geotechnical and Stage 1 Site Contamination Assessment – Proposed Rezoning, Off Manning Drive, Glenthorne NSW

I, Dr David Tully of Contaminated Land Solutions Pty Ltd, am a Certified Environmental Practitioner Site Contamination Specialist (General Certified Environmental Practitioner certification no. 1138 and Site Contamination Specialist certification no. SC40084).

I confirm I have reviewed the Section 3 of the Regional Geotechnical Solutions report entitled "*Geotechnical and Stage 1 Site Contamination Assessment – Proposed Rezoning, Off Manning Drive, Glenthorne NSW*" (Ref: RGS02324.1-AB), dated 19 May 2020 and a copy of which I have retained.

I can confirm that on the basis of the information contained within Section 3 of the report, I support the conclusions and recommendations provided therein.

Should the client, regulator or local authority have any queries regarding the report review, I can be contacted by e-mail via david.tully@contaminatedlandsolutions.com.au. Specific queries regarding the content of the report should be addressed to Andrew Hills at Regional Geotechnical Solutions.

For and on behalf of

Contaminated Land Solutions Pty Ltd

No. 1138 2019

No. SC40084 2019

Dr David Tully CEnvP SC
Director
Contaminated Land Solutions Pty Ltd

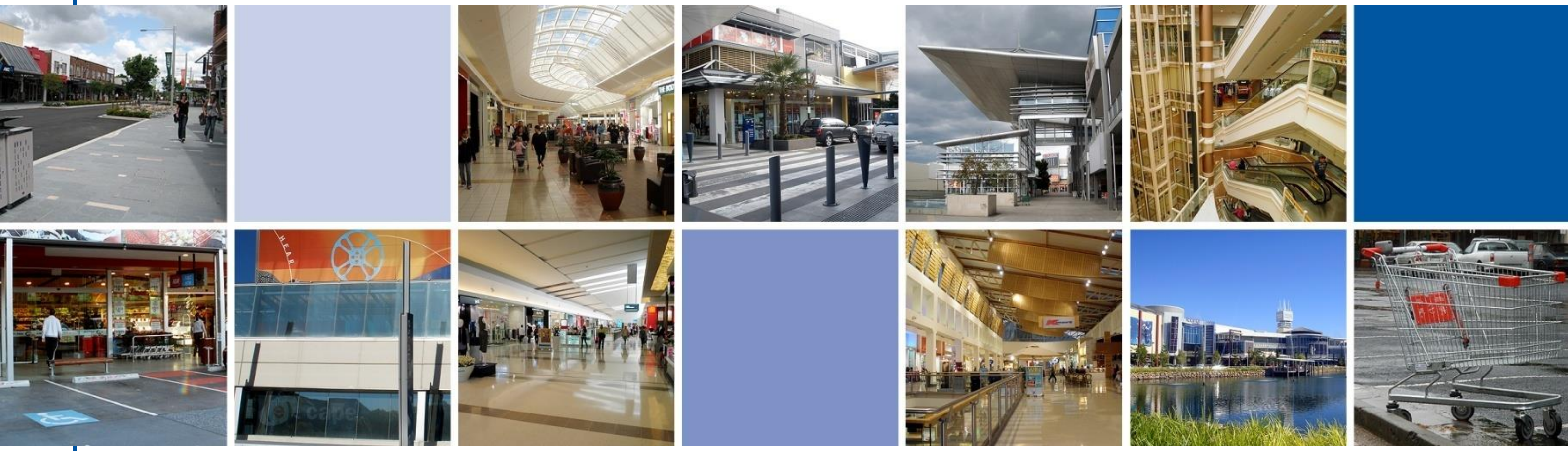
Contaminated Land Solutions Pty Ltd
10 Heath Road
Crafers West SA 5152
0410 012 292
david.tully@contaminatedlandsolutions.com.au

Appendix H – Economic Assessment

Future Land Use at Glenthorne

Economic Assessment

November 2017



MacroPlanDimasi

MacroPlan

MELBOURNE
Level 16
330 Collins Street
Melbourne VIC 3000
(03) 9600 0500

SYDNEY
Level 52
19 Martin Place
Sydney NSW 2000
(02) 9221 5211

BRISBANE
Level 15
111 Eagle Street
Brisbane QLD 4000
(07) 3221 8166

PERTH
Level 1
89 St Georges Terrace
Perth WA 6000
(08) 9225 7200

GOLD COAST
Level 2
The Wave, 89-91 Surf Parade
Broadbeach QLD 4218
(07) 3221 8166

Prepared for: Walsh Consulting

MacroPlan staff responsible for this report:

Wayne Gersbach – General Manager – New South Wales

Jason Anderson – Chief Economist

Gordon Yoon – Senior Economist

Table of Contents

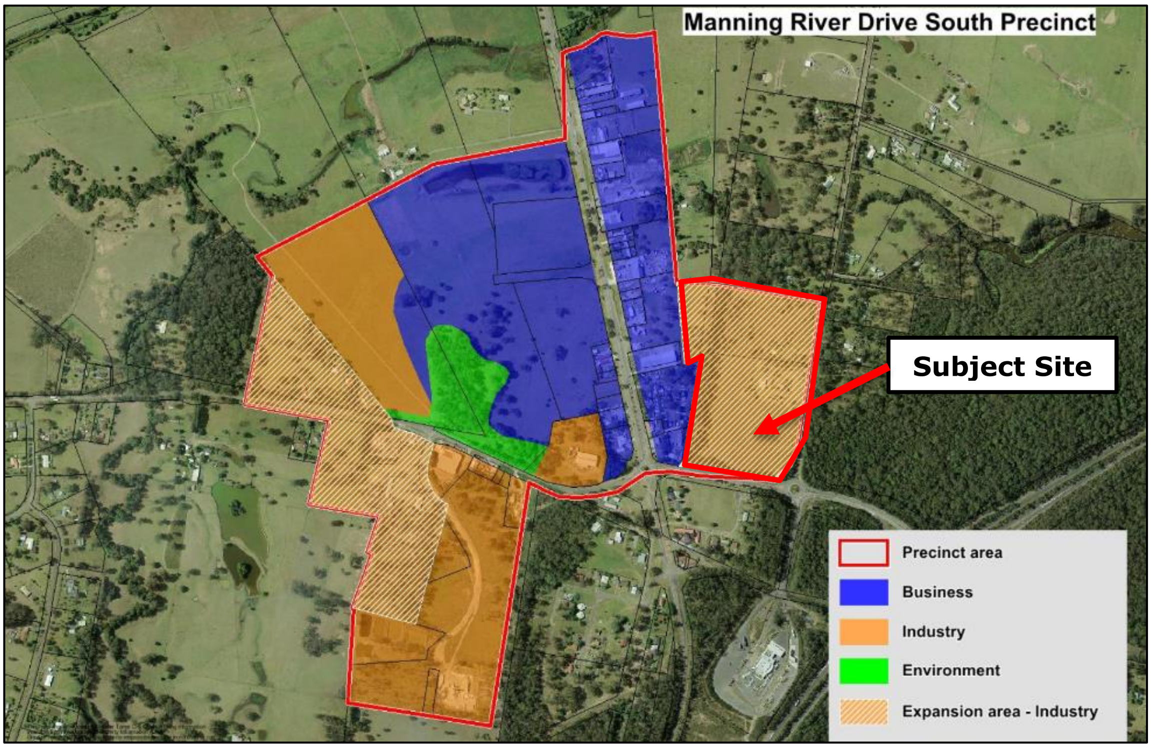
Executive Summary

Introduction

This economic assessment has been prepared by MacroPlan to inform a proposed amendment (i.e. Planning Proposal) to Greater Taree LEP 2010 which would increase the area of employment-related land in the Manning River Drive Employment Precinct, south of Taree.

The Planning Proposal seeks to rezone an area of land already identified for employment purposes in Mid-Coast Council's Draft Manning Valley Local Strategy[1]. The study area involves some 12.7ha of land in Glenthorne north of Manning River Drive, between Glenthorne Road and Erikson Lane.

Manning Valley Draft Strategy - extract



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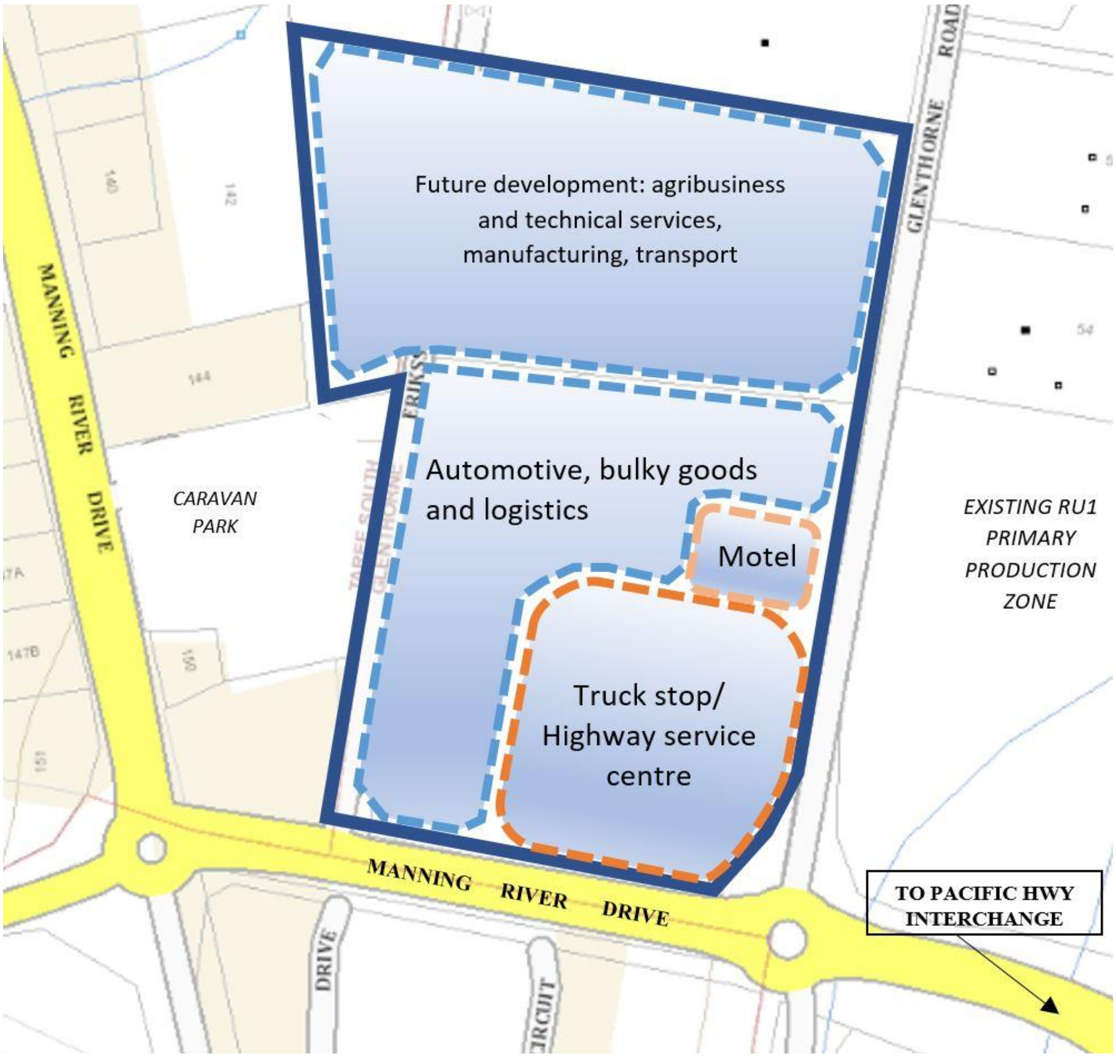
[1] Mid-Coast Council, draft Manning Valley Local Strategy, May 2016, p.12

The Proposal

The Planning Proposal's vision is to enlarge and build on the existing capacities of the Manning River Drive Employment Precinct. A specific intent is to optimise the locational strengths relating to the site's accessibility and proximity to the Pacific Highway interchange.

The proposal includes direct and committed "enabling" investment by way of a truck stop/highway service centre and directly associated transport-related servicing/manufacturing facilities and hospitality-related investments. Adequate additional land is also provided for ongoing industrial-entrepreneurial activity.

Study Area – Indicative Future Layout



The above indicative layout plan shows the development intentions for the site. **Stage 1** of development would involve a truck stop/service centre and motel. **Stage 2** would commence in parallel with the first stage and involve automotive and logistics operations. **Stage 3 (long term)** allows for other regional economic specialisations.

Context

Mid-Coast Council is undertaking current work on local and regional economic challenges and has been in the recent past participating in the NSW Government initiated Regional Economic Development program (REDS) program. This program aims to drive economic growth, focusing on actions to address challenges and opportunities in regional areas.

The economic assessment presented in this report in turn focuses on some of the challenges in the locality and analyses opportunities which may be available from the subject Planning Proposal.

Key Findings

In summary, we highlight the following key drivers:

- The local demographic situation is quite characteristic of coastal settings in regional NSW. There is continuing population growth, virtually all of which is occurring in the retiree age cohort. While demand for services is increasing from retirees, the available local workforce is tending to decline – this is a difficult environment for business investment which is reflected in jobs growth data for the region.

- The subject land enjoys distinctive locational attributes which can naturally activate the creation of new private sector investment and employment opportunities. The strength is the site's Manning River Drive frontage adjacent to the Pacific Hwy interchange and at the major southern gateway to Taree, with two-way directional access available via the Glenthorne Road roundabout.

- The subject land’s location on the highway corridor at Glenthorne brings natural locational strengths to activate the creation of these new employment opportunities, particularly in the provision of:
    - truck and passenger vehicle related retail;
    - transport related accommodation/hospitality (bringing flow-on effects to tourism);
    - transport related servicing and manufacturing; and
    - Extensive agriculture and technical services, logistics and manufacture enterprises.

- These services are able to ‘cluster’ at the subject site, ensuring mutual co-location benefits that support industry endeavour and provide for wider economic benefits to be generated. The proposal also seeks to incorporate provision for new economic and cultural development opportunities in partnership with the Purfleet/Taree Local Aboriginal Land Council.

- The construction aspect of stage 1 of the project would involve approximately $11.5 million and can be estimated to create some 100 construction stage jobs which the proponents indicate would involve principally local trades and supplies. At operational stage the truck stop/service centre would create 60-80 jobs according to the proponents. The petrol price competition benefits of a new truck stop/service centre project in this location are estimated at **$1.25 million** per annum to local households, business and highway users.

- The evolving construction and operational stages of the wider precinct in the mid and longer term will benefit the Taree and wider economy. The benefit includes:
    - A major ongoing construction program across a number of different commercial and industrial elements, supporting spending and employment multipliers throughout the region.

  - The provision of local jobs in retailing, hospitality and commercial activities for local residents, providing employment and career opportunities for Taree residents.
  - The co-location of a wide range of industrial, warehouse and related land uses that support service specialisation and a deepening of Taree's service offer and labour force.

- The Planning Proposal will contribute to the establishment of a sustainable regional economy within Greater Taree through new expenditure from residents and tourists. MacroPlan has estimated that the short-term economic benefit of stage 1 of the overall proposal will be **$1.73 million** per annum (including retail economic benefit).

- Further benefits will accrue from the progressive development of further stages. The proposed rezoning and subsequent development at Glenthorne will create a commercial and industrial hub within South Taree and can be expected to increase service retail, food catering and professional service jobs. The additional ongoing jobs from these industries will drive demand for commercial and retail floor space in the wider locality. MacroPlan has estimated **longer term potential benefits amounting to approximately 300 additional jobs per year** (i.e. in addition to those generated by the initial truck stop/service centre).

- The assessment confirms there is demand for the proposed additional service centre at the southern gateway to the Pacific Highway, based on traffic volumes and RMS servicing expectations[2].

---

[2] Roads and Maritime Services (RMS), *Highway Service Centres Along The Pacific Highway - Policy Review*, May 2014 and RMS, *Highway Service Centres Along The Pacific Highway Policy Review - Summary Feedback Report,* June 2015

- Other distinctive features of the project contribute to its potential to add local and regional value, including:
    - The project is driven by an intended end-user investor (i.e. Jasbe is a major truck stop provider in Australia) rather than being land developer/speculator-led;
    - The current land-owner is involved in transport enterprises along the state's east coast and has indicated a commitment to specific local investment
    - Jasbe's commitment to a partnership arrangement with Purfleet/Taree Local Aboriginal Land Council with potential to activate new economic and cultural development opportunities in the immediate site locality; and
    - Low-level reliance on government infrastructure investment at the project's start-up phase. The project leverages from the site's excellent accessibility and exposure, with little external funding/servicing required to enable the proposed development to progress.

Conclusion

Support for the Planning proposal is warranted on economic grounds and delivers on the Mid-Coast Council's objectives to promote a deepening of the local economy. Change to an employment zoning capitalises on the site's distinctive locational strengths (i.e. highway accessibility and exposure) and has the potential to trigger much needed local investment and job creation.

Introduction

Walsh Consulting is currently engaged by Jasbe (the proponent) and seeks to consolidate and emphasis the subject site's credentials for a zoning change, in response to demographic and market trends, for more employment land uses.

The current application to Council has been initiated by Jasbe, a major truck stop and highway service centre developer and operator in Australia. The company owns 46 facilities in Australia, located in New South Wales and Victoria, and has been operating service centres for over 25 years. Employment levels are in the order of 500 employees.

MacroPlan has been engaged by Walsh Consulting to inform the potential highest and best use of the land parcel at 51 Glenthorne Road, Glenthorne. This report assesses the specific drivers for a range of employment activities at the site.

Regional and Locational Context

Taree is located within the Mid-Coast LGA. It is around 320km north of Sydney, 620km south of Brisbane and more proximate to Newcastle (approximately 170km to the south) and Port Macquarie (approximately 80km to the north).

Taree is connected to these and other east coast population centres via both the Pacific Highway, the primary east coast arterial road, and the Sydney-Brisbane North Coast rail, which provides both passenger and freight services.

Glenthorne is located approximately 3km south of the Taree township. The Glenthorne locality is primarily rural, punctuated by Manning River Drive, the main road that connects Taree to the Pacific Highway to the south of the town.

Manning River Drive at Glenthorne accommodates a range of light industrial, warehouse, car sales and bulky goods establishments in what is known as the Manning River Drive Business Centre.

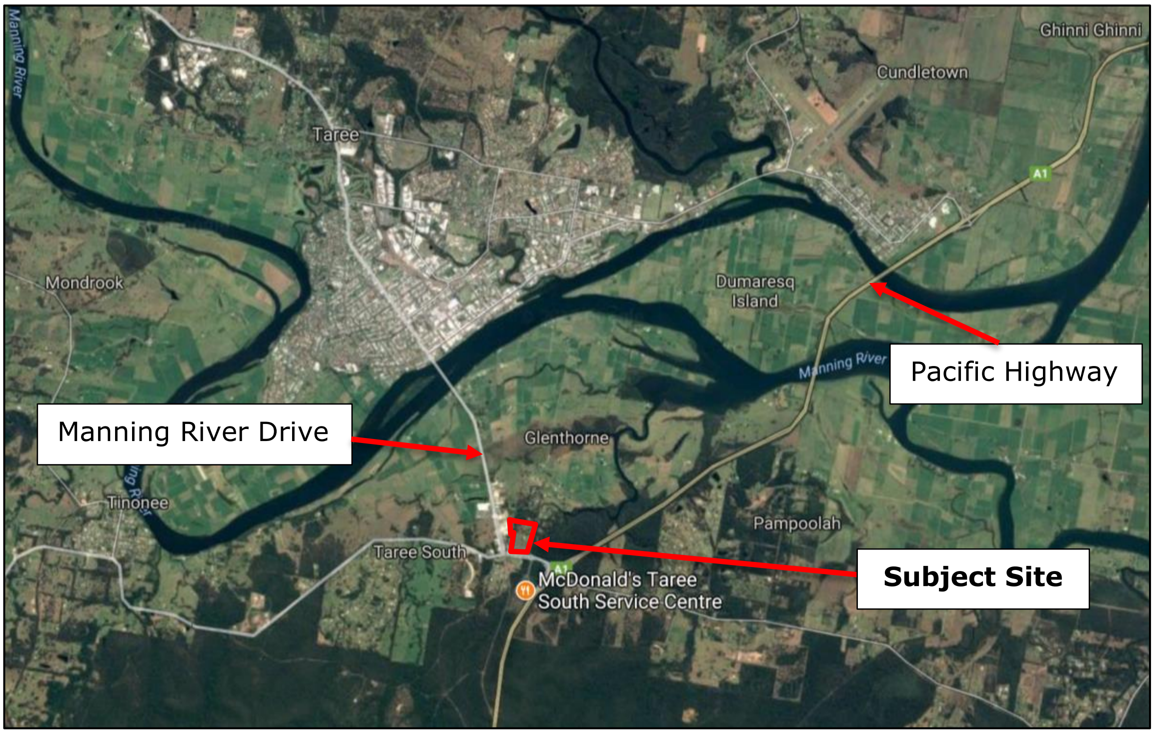
The land that is the subject of our investigations is generally situated north of Manning River Drive, at the southern end of Glenthorne Road, east of the existing Manning River Drive Business Centre.

It is located north of the existing north-bound Taree South McDonald's / Caltex Star-Mart Service Centre, located adjacent to the Pacific Highway on-and-off ramps.

The subject land frames the southern gateway entrance to Taree from the Pacific Highway.

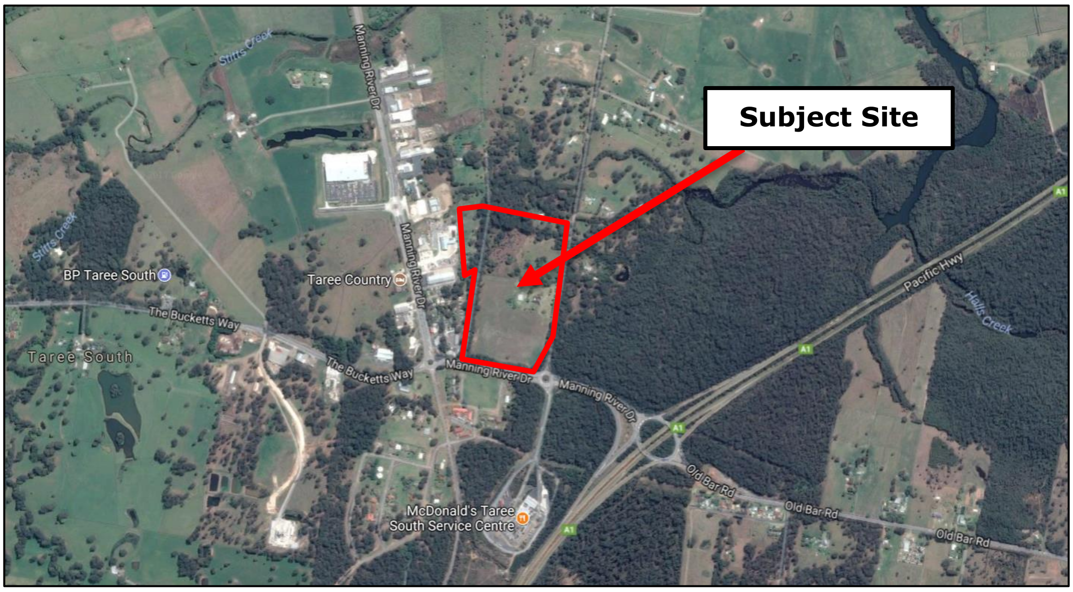
The site's location is depicted in the following locational diagrams (Figures 1 & 2).

Figure 1. Subject Land – Regional Location



Source: Google Maps, 2017

Figure 2. Subject Land – Specific Location



Source: Google Maps, 2017

Local Planning Context

The subject site is formally known as Lot 50, DP86972. It is 12.7 ha in area and currently zoned RU1 (Primary Production). The zoning context of the subject land is depicted below.

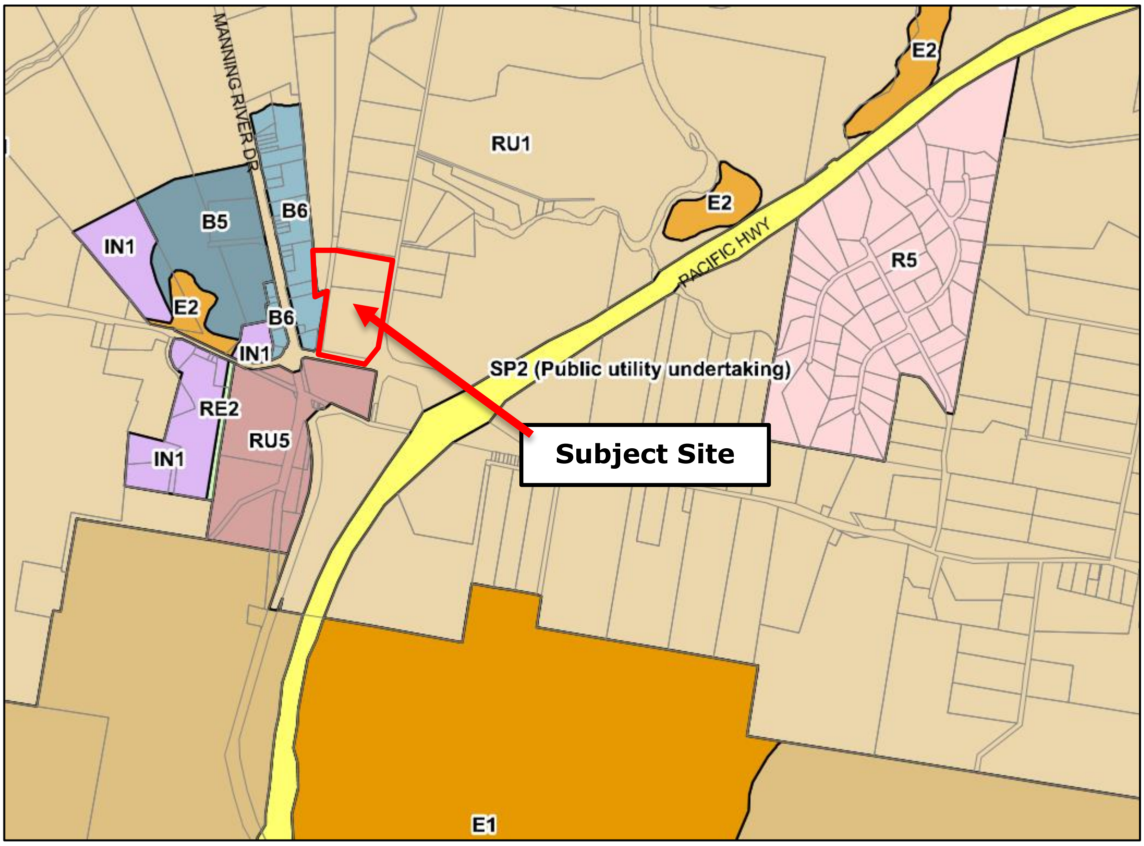
The broader area around the subject site is recognised as potential areas for expansion in the Mid-Coast Council's Manning Valley Local Strategy (May 2016) as having potential area for employment purposes.

The MVLS provides a 'blue-print' for growth across the Manning Valley and seeks to align Council's planning strategies to facilitate the coordinated delivery of key infrastructure, tourism, open space and community facilities.

A major goal of the MVLS is to 'grow the local economy', by offering accessible and affordable options for new businesses.

The strategy identifies key actions and prioritises necessary changes to Council's principal planning legislation and policies to facilitate new development.

Figure 3. Land Zoning



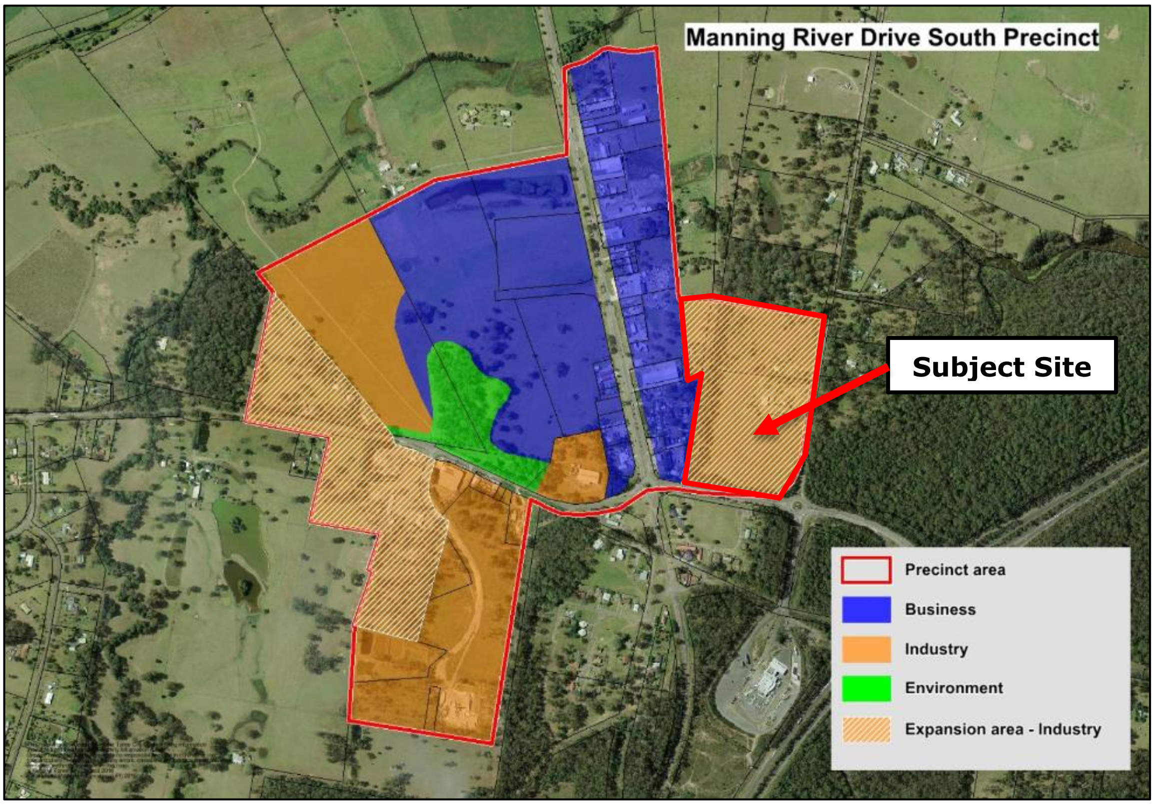
Source: Extract from Greater Taree Local Environmental Plan, 2010

High level priorities under the MVLS include:

- Planning for the **Northern Gateway Transport Precinct**, located immediately north of the Cundletown by-pass, to the north of Taree and proximate to the northern Pacific Highway access ramps.
- Accommodating an expanded **Taree Medical Precinct**, immediately north of the Taree CBD.
- Expanding the **Manning River Drive Employment Precinct**, south of Taree and proximate to the southern Pacific Highway access points, to provide a commercial and industrial hub on accessible, flood-free land with good highway exposure and access to broader markets.

An extract from the MVLS, identifying the land that has been selected for expansion of the Manning River Drive Employment Precinct is provided below. The selected area is hatched. It comprises the subject land as well as land to the south-west of the existing business centre, with a total area of about 30 ha.

Figure 4. Extract from Manning Valley Draft Strategy



Source: Mid-Coast Council

Project Concept

The proponent seeks to rezone the subject site (51 Glenthorne Road, Glenthorne) from RU1 (Primary Production) to new uses that are a mixture of primary industry employment, retail and short-term accommodation uses.

Future development on the site will likely comprise a truck shop, vehicle repair shop and food catering retail facilities and a motel. Consistent with the site’s advantageous setting, an objective of the proposed rezoning is to encourage complementary employment outcomes that supportive of the broader economy of Greater Taree.

Jasbe has indicated that the project involves three stages, leveraging from the existing two-way access off Manning River Drive (i.e. either direct ingress or via the roundabout at Glenthorne Road):

- **Stage 1 truck stop/service centre and motel:** An initial concept plan indicates a service centre building area of 1,200m^2, separate truck and car canopies, truck parking for 25 x B-Double vehicles, 5 buses/caravans and 74 cars, as well as a 30-room motel (comprising approximately 3.1ha)

- **Stage 2 transport and logistics services**: The concept plan shows a range of automotive and logistics-related uses on a site area of some 4ha (e.g. towing company, depot[3], and warehouses). This stage would link directly to the new access and services infrastructure constructed as a component of Stage 1. It brings potential for an initial crosslink to the existing Manning Valley Drive Employment Precinct.

- **Stage 3 future development:** The last stage provides for longer term and more open-ended economic development opportunities aligned to the platform created by Stages 1 and 2, accommodating other regional economic specialisations (over a site area of some 5.6ha). Both Stages 2 and 3 bring potential for crosslinks to the existing Manning Valley Drive Employment Precinct.

Jasbe has also indicated that it has entered into a verbal agreement with representatives of the Purfleet/Taree Local Aboriginal Land Council. The arrangement would provide an area of some 60-80m^2 within the service centre building for use by the local community. These arrangements are yet to be finalised, but the concept includes the provision of this space as an art and cultural ‘expo’ and sales area to support PTLALC’s ambitions to promote:

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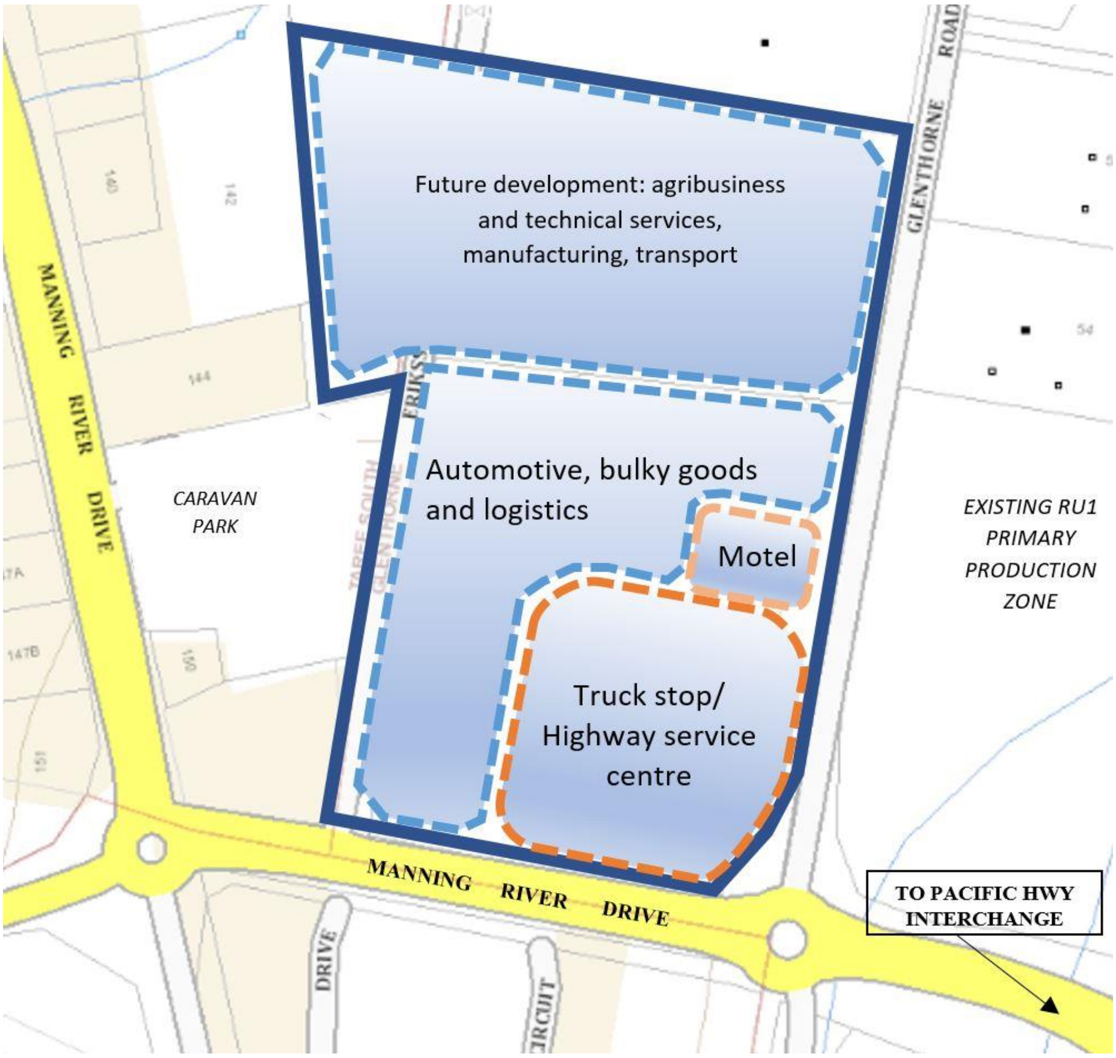
[3] For use by the existing landowner who operates a multi-centre truck and tilt tray business along the state’s east coast and has identified the need for a motorhome franchising business and service centre facility at the subject site.

- Local employment/enterprise and work experience/training opportunities; and
- Cultural heritage development.

The site's locational strengths and its potential for significant levels of patronage both from within the region and from wider traffic flows along the Pacific Highway, creates the potential for success in this venture, connecting traveller services and food, tourism, arts and cultural development ambitions.

Figure 5: Study Area - Indicative Layout



Source: Planning Proposal Report Walsh Consulting (2017)

Figure 6: Stage 1 'Truck stop'

Source: *CADWAY Projects (2017)*

Figure 7: Stage 2 'Transport and logistics services'

Source: *CADWAY Projects (2017)*

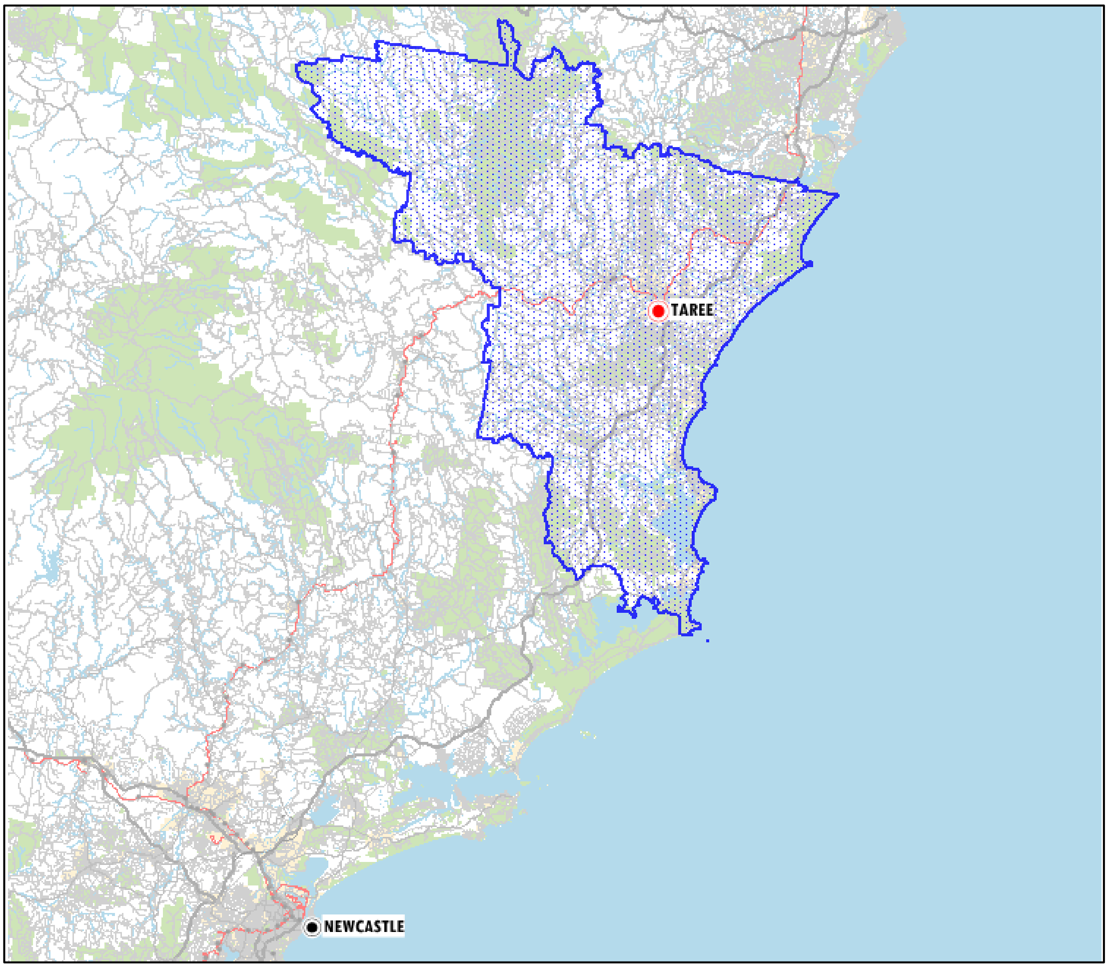
Study Area Catchment

Due to the regional location of the subject site, a large catchment is considered for our investigations, allowing for local trends to be seen in a regional context.

For our investigations, we define the catchment of the subject site as the Taree SA2 (Primary) and its surrounding SA2 areas (secondary), including:

- Taree Township – 'Taree' SA2
- Coastal suburbs – 'Forster' SA2, 'Forster – Tuncurry region' SA2, 'Tuncurry' SA2, and Old Bar – Manning Point – Red Head' SA2
- Other surrounding areas – 'Taree region' SA2 and 'Wingham' SA2

Figure 8: Glenthorne Study Catchment



Source: MacroPlan Dimasi (August 2017)

Section 1: Socio-demographic Profile

This section of this report considers relevant economic and population data, drawing a link between recent trends and the region's future employment potential.

We find that the inclusion of the subject land as part of an expanded Manning River Drive Employment Precinct will deepen Taree's potential for jobs growth by creating a platform for a number of business opportunities that are in consonance with the region's demonstrated economic strengths, viz; automotive services, tourism and retail.

Historical Population Growth

As at 2016, the population of the catchment area is 76,783 persons. Between 2011 and 2016, the population grew by 2,860 persons at an average of 0.76% per annum.

Over the 5-year period to 2016, the Taree SA2 region generated virtually no population growth (growing at 0.02% p.a.), but the population of the surrounding areas[4] grew at an average annual rate of 1.05%.

Notably, growth in the 'Old Bar – Manning Point – Red Head' SA2 area has been solid at 1.86%.

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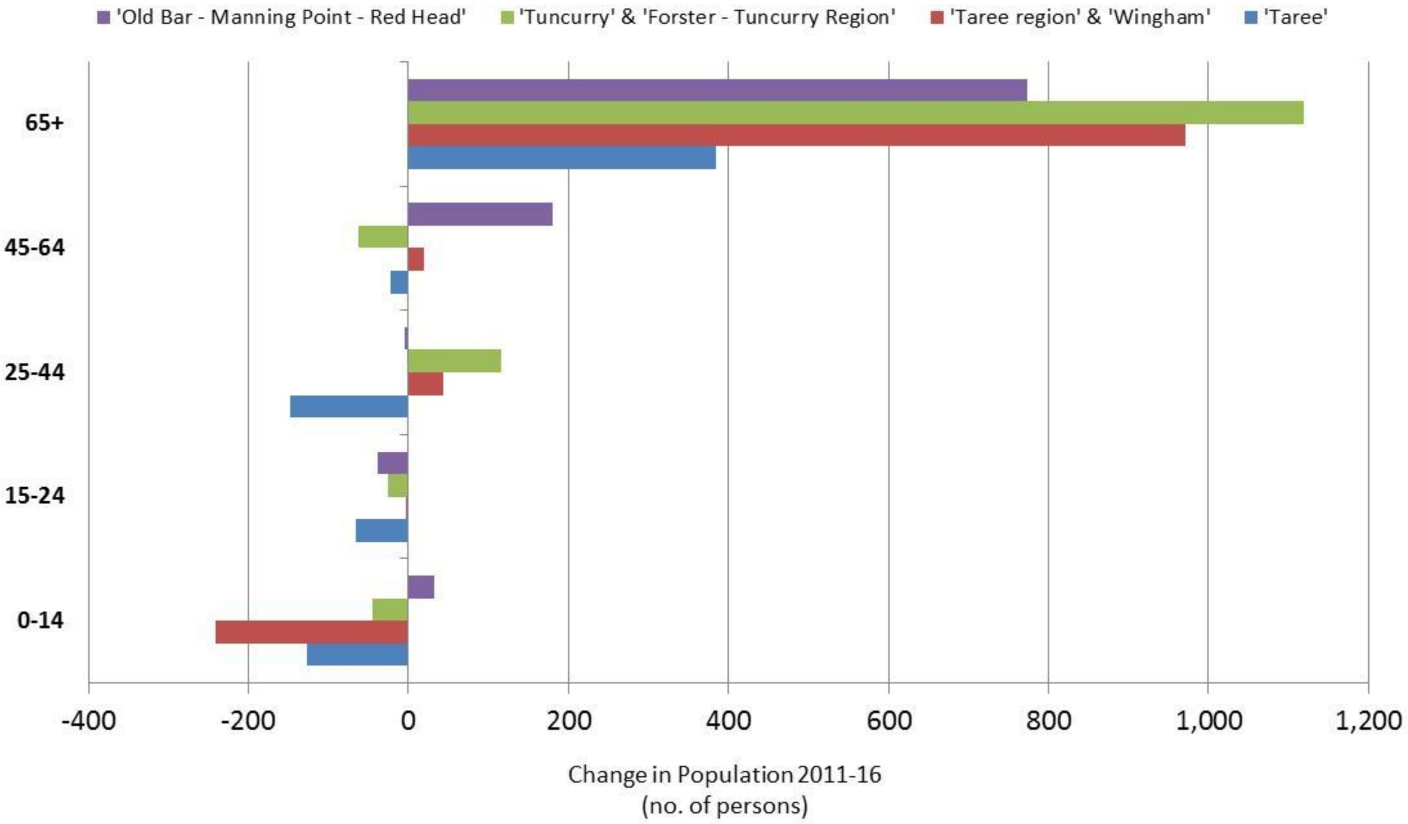
[4] 'Forster' SA2, 'Forster-Tuncurry region' SA2, Tuncurry' SA2, 'Old Bar - Manning Point - Red Head' SA2, 'Taree Region' SA2, and 'Wingham' SA2

Figure 9: Historical Population by age cohort (2011 & 2016), Selected SA2 regions[5]



Source: ABS (2017)

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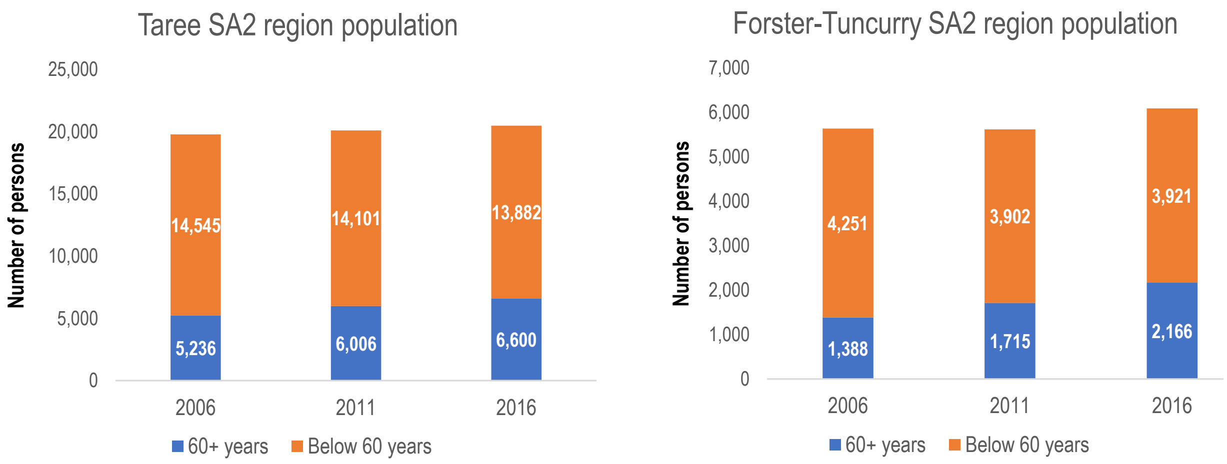
[5] A more detailed analysis of historical population growth trends in those selected SA2 areas is presented in the **Appendix A**

As depicted above, population growth across the region has been led by 65+ age cohort (i.e. empty nesters and retirees). Over the five years to 2016, this age cohort expanded by 3.28%. There has also been some intermittent growth in younger age cohorts in the different SA2 areas.

Notwithstanding intermittent growth in the younger age groups, virtually all of the region's population growth is in the retiree age cohort.

This composition of growth, depicted below for the Taree and Forster-Tuncurry SA2's, is highly unfavourable for business growth. While demand for services is increasing from retirees, the available local workforce is tending to decline – this is a difficult environment for most businesses and is reflected in jobs growth data for the region (discussed below).

Figure 10: 'Taree' SA2 vs 'Forster-Tuncurry' SA2



Source: ABS (2017)

The pressures within the local economy that result from this demographic trend will be most apparent for services that are subject to demand from local businesses and residents. Longer queues and less choice in service provisions are the more widespread outcomes. The greater risk is that some businesses face declining profitability, as revenue growth due to weak local demand loses out to stronger wages growth set by competition for workers in surrounding regions.

Our research shows that a lack of labour available to service businesses in any region will place great pressure on an increasing number of businesses to shut down, with their operators moving to other locations. This environment can create a vicious circle, where the workforce-aged population's departure places even more pressure on services for remaining residents.

This environment is likely to be already present, given current available ABS jobs data. The risk from here is that even more skilled-labour will tend to leave Taree, to pursue better job opportunities elsewhere.

Our view is that planning policy should seek to redress current demographic trends, with a view to achieving a healthier balance between household formation and labour workforce.

For Taree, if local demand is not growing, then passing trade on the Pacific Highway becomes much more important (as a basis of greater service provision for locals).

NSW DP&E Population Projections

Summary population projections for the Mid-Coast LGA, produced by the NSW Department of Planning & Environment (DP&E) are reproduced in the table below.

These projections show that the LGA is expected to continue to lose its workforce age and younger age group cohorts.

At the same time, the region's retiree age population is projected to surge.

In 2011 the ratio of workforce-aged persons to retiree-aged-persons was 2:1, but this ratio is projected to drop to just 1.1:1 by 2036.

A declining regional workforce will present increasing challenges for business, and a more difficult environment for retirees, as service choice and provisions are likely to decrease.

Table 1: NSW DP&E Population Projections by age cohort (2016 edition), Mid-Coast LGA

Age Cohort	*2011*	*2016*	*2021*	*2026*	*2031*	*2036*	Annual change p.a.
0-19	20,600	20,000	19,700	19,550	19,150	18,600	-70
20-34	10,200	10,650	10,300	9,550	8,950	8,600	-103
35-64	35,300	34,550	34,050	33,000	32,400	31,900	-133
65+	22,700	26,000	29,300	32,700	35,300	37,100	+555
Total	**88,800**	**91,200**	**93,350**	**94,800**	**95,800**	**96,200**	**+250**
Dependency ratio	34%	40%	46%	53%	58%	63%	

Source: DP&E NSW (2016)

Current DP&E projections reflect recent trends, rather than seeking to redress them.

If planning policy aimed to secure a healthy rate of expansion in the number of skilled workers and young families, an imperative would be to create new employment opportunities that retained local working-age adults.

Decrease in Workforce-Aged Population

Our analysis shows that the Mid-Coast LGA has suffered from a decline in its workforce-aged population, particularly skilled and experienced workforce. The table below shows that from 2011 to 2016, the 35-64 age cohort declined by 692 persons, although this decline was offset from an inward movement of:

- Retiree-aged persons, which contributed to the high growth in the 65 plus years cohort. This cohort grew by 2,656 persons in the same period.

- Young workers (less-experienced and low-skilled) aged 20-34 years. This cohort grew by 862 persons.

Table 2: Population Growth by Age (2011 & 2016), Mid-Coast LGA

Age Cohort	*2011*	*2016*	*Total change (2011-16)*	*Average change (p.a)*	CAGR*
0-19	20,625	19,604	-1,021	-204	-1.01%
20-34	10,227	11,089	862	172	1.63%
35-64	35,277	34,585	-692	-138	-0.40%
65+	22,689	26,680	3,991	798	3.29%
Total	**88,818**	**91,958**	**3,140**	**628**	**0.70%**

**Compound annual growth rate*

Source: ABS (2017)

The demographic trend for Mid-Coast LGA is replicated for the Taree SA2 and its surrounds, which contains the suburb of Glenthorne.

Table 3: Population Growth by Age (2011 & 2016), Taree SA2

Age Cohort	*2011*	*2016*	*Total change (2011-16)*	*Average change (p.a)*	CAGR*
0-19	5,450	5,161	-1,021	-289	-1.08%
20-34	3,058	3,238	862	180	1.15%
35-64	7,607	7,353	-692	-254	-0.68%
65+	4,744	5,129	3,991	385	1.57%
Total	**20,859**	**20,881**	**3,140**	**22**	**0.02%**

**Compound annual growth rate*

Source: ABS (2017)

Demographic Change: Impact on Business and Employment

The overall impact of fewer skilled workers in the region will gradually have direct consequences on the viability of existing businesses which trade at the local level. Retaining expenditure and expanding it through workforce growth is a vital connection for the local economy.

It is clear that the region has a rising age-dependency ratio[6], as the number of retirees is increasing, but the workforce age and household formation groups are declining. These growth trends underline market risk for local residents and businesses.

In line with national trends, the population of the Mid-Coast LGA is expected to age further, with the number of people aged 65-years and over increasing from 22,689 residents in 2011 to 26,680 residents in 2031. This highlights the need for balancing the demographic pattern with younger residents who can work and contribute services and income to the local economy.

Regional Labour Market Variations

Many young and skilled workers are leaving Taree. A greater provision of business development opportunity is necessary to meet the needs of skilled workers.

The chart below shows that employment in the Glenthorne catchment area has been flat for the past five years, with only small fluctuations from year to year. By comparison, for the Newcastle LGA, there has been trend growth, with the total number of persons employed increasing from 85,000 to more than 91,000 over the two years to 2017.

This gap has recently widened between the two regions. Between 2016 and 2017, the total labour force of the catchment only grew by 1.0%, whereas Newcastle grew by 5.0%. It appears likely that Newcastle's economic expansion has drawn local workers from the catchment area (i.e. Taree and its surrounds), to the detriment of these regional locations.

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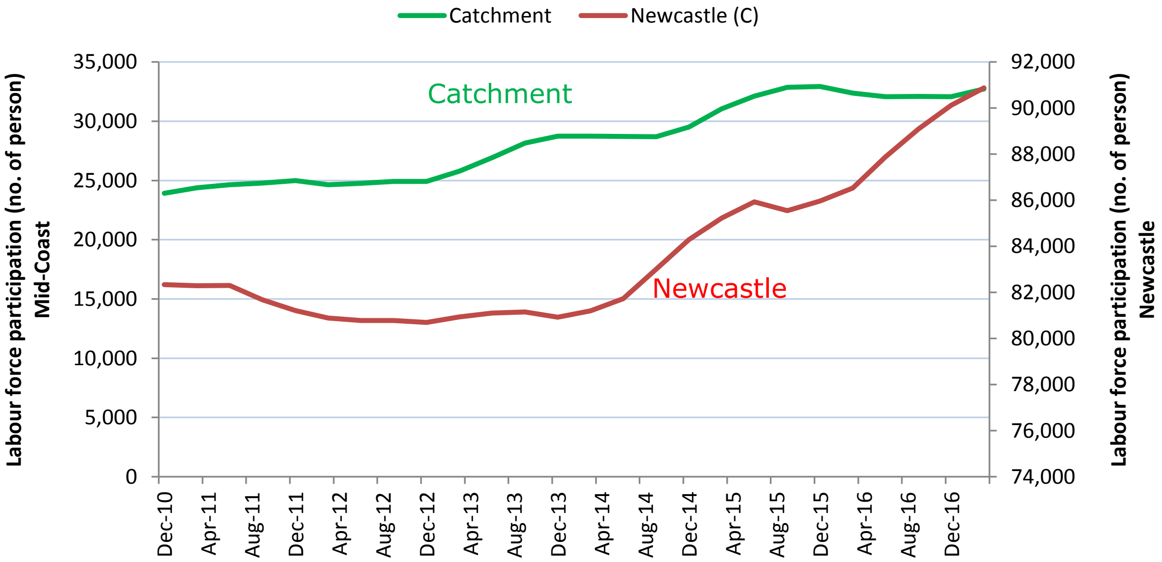
[6] The ratio of people aged 65 years and over to the working age population

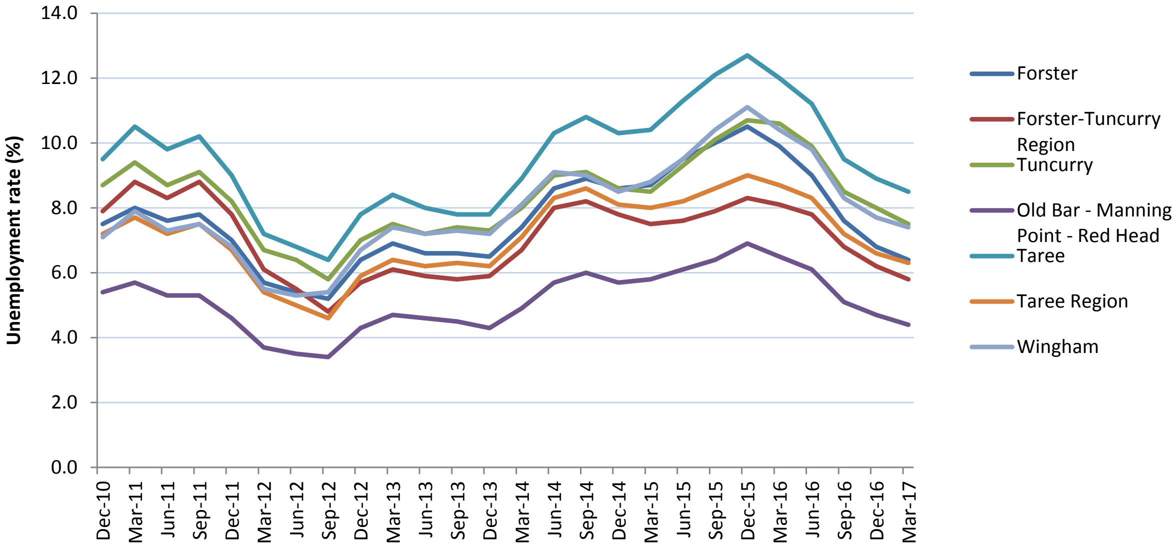
Figure 11: Labour Force Participation – Catchment and Newcastle LGAs



Source: DoE, Small Area Labour Markets (2016)

The loss of younger workers to other regions is evident in a gradual decline in the unemployment rate. This trend is shown in the chart below. Flat employment, combined with a loss of workforce, is leading to lower unemployment statistics.

Figure 12: Unemployment - Selected SA2 areas near the subject site



Source: DoE, Small Area Labour Markets (2016)

However, this trend does not reflect a healthy local economy in this case. Instead, it represents a ‘hollowing out’ of the labour force. This is a negative pattern that needs to be addressed through new employment creation.

Across the nation, substantial changes in skill needs are challenging labour market policies and institutions and contributing to skill mismatches and shortages.

Local businesses experience a worker shortage as they cannot find workers with the skills that their businesses require.

At the same time, a number of skilled workers face difficulties in finding job opportunities matching their experience and their competencies, and many lower skilled workers face difficulty in accessing ‘work-based learning’ opportunities due to an absence of skilled workers.

While genuine skill mismatches do not explain all of these imbalances, skill demand and supply policies have a role to play in ensuring a better balance between skills of workers and the needs of employers in Taree.

As shown by our demographic analysis, some coastal towns are growing and need greater service provision. Notably, growth in the adjacent region, ‘Old Bar – Manning Point – Red Head’ SA2 area, has been solid at 1.86%.

Our view is that there will be (or already is) higher inward traffic movement from the coastal regions[7] to Taree and that maintaining and enhancing this flow is important to local businesses.

Glenthorne is strategically located as a basis of greater service provision for locals and visitors to the area and is therefore able to ‘tap into’ the economic opportunity that its accessibility and exposure presents.

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[7] ‘Forster’ SA2, ‘Forster-Tuncurry region’ SA2, Tuncurry’ SA2, ‘Old Bar - Manning Point - Red Head’ SA2

Section 2: Highway Services Market Assessment

The following section of this report focuses on the potential provision of highway services at the subject site.

The NSW Government's Pacific Highway Policy Review Feedback Report (2015) addresses the role of highway service centres on the Pacific Highway between Hexham and the Queensland border in improving road safety by providing sufficient areas for motorists to rest.

The sites selected for highway service centres are all close to towns which are bypassed by upgrades to the Pacific Highway, in order to ensure that the economic benefits of new highway service provisions can remain within those localities.

Taree is identified as a 'Start/End' journey node along the highway, as it currently provides a regional service centre. However, this centre is identified by customers as being congested, affecting its provision of services and potentially deterring would-be highway users from stopping at and using its facilities. The existing centre also lacks green space and picnic amenities – its provision of 'rest stop' facilities is inadequate.

The provision of an integrated highway service centre at the subject site would deliver a set of mutually-reinforcing benefits. Specifically, a service centre at this location could:

1. Accommodate future increased patronage from increased freight task along the Pacific Highway.

2. Improve vehicle safety through the provision of accommodation co-located with motor mechanic and dining services.

3. Accommodate growth in demand from coastal visitors.

4. By meeting the overlap in demand from passing traffic, and regional visitors to Taree, help to ensure that competitive fuel pricing is delivered at this juncture.

5. Act as a catalyst for further industrial and commercial development, particularly in the automotive services industry which already exists near the site.

6. Build upon the existing automotive repairs and services offering near the subject site and effectively scale it up into an automotive services hub.

7. Provide space for information & promotion of indigenous tourism & produce.

8. Increase the amenity around the main entrance into Taree, encouraging motorists to travel into town and providing economic benefits as a result.

Increase in local traffic

The table below indicates key patronage figures along the Pacific Highway for daily traffic volumes, comprising two main categories of users - 'light' and 'heavy' vehicles.

Table 4: Daily Traffic Volume Counts, Selected Stations, Catchment, 2015-2017

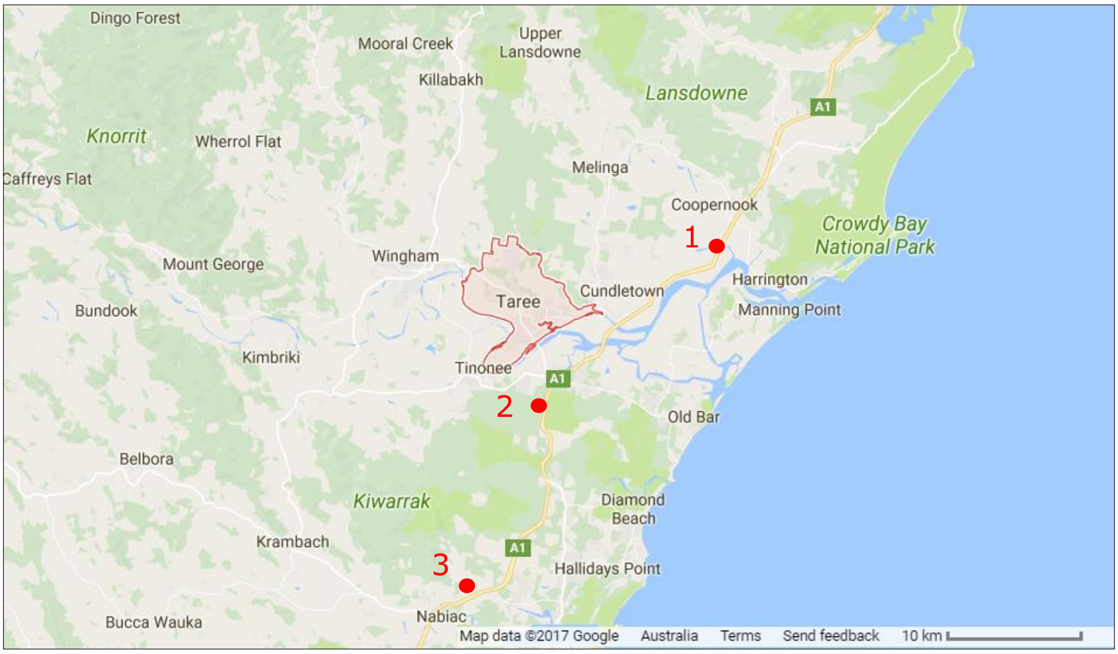
Station Location	Station ID	Traffic Direction (number of count)	Light Vehicles (2017)	% Changes (2015-2017)	Heavy Vehicles (2017)	% Changes (2015-2017)	All Vehicles (2017)	% Changes (2015-2017)
1.05km North of Barton St	PHSTC	North	6,883	*8.8%*	1,575	*6.5%*	8,458	*8.3%*
		South	7,127	*12.2%*	1,588	*6.3%*	8,715	*11.1%*
		North& South	**14,010**	***10.5%***	**3,163**	***6.4%***	**17,173**	***9.7%***
220m North of Jack Wards Rd	6120-PR	North	9,000	*5.9%*	1,695	*5.4%*	10,695	*5.8%*
		South	9,121	*9.3%*	1,837	*7.1%*	10,958	*9.0%*
		North& South	**18,121**	***7.6%***	**3,532**	***6.3%***	**21,653**	***7.4%***
390m East of Pipeclay	6119-PR	North	7,318	*8.6%*	1,633	*8.1%*	8,951	*8.5%*
		South	7,543	*14.6%*	1,627	*7.0%*	9,170	*13.2%*
		North& South	**14,861**	***11.5%***	3,260	***7.6%***	**18,121**	***10.8%***

Source: RMS (2015-2017)

The location of the selected stations with respect to Taree is depicted below.

This analysis of daily traffic counts shows that the local passing traffic has been growing quickly at each of the three locations examined.

Figure 13: Selected Stations, Catchment



Source: Google Maps (2017), RMS (2017)

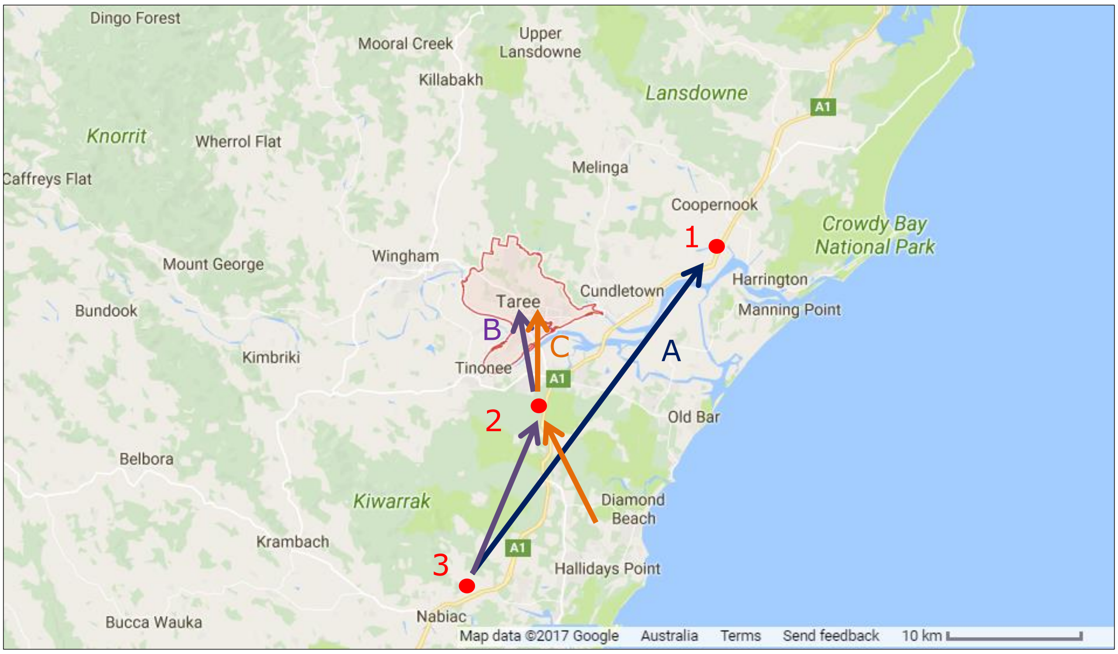
- ***Station 1 (ID: 'PHSTC')**: 1.05km north of Barton street,* ***Jones Island***
- ***Station 2 (ID: '6120-PR')**: 220m north of Jack Wards road,* ***Kiwarrak***
- ***Station 3 (ID: '6119-PR')**: 390m east of Pipeclay Creek road,* ***Nabiac***

Analysis of northbound traffic data, from Station 3 to Station 1 reveals that, the traffic inflow into Taree totalled **2,237** vehicles as at 2017 (refer to the figure 8 below):

A. Northbound net traffic flow from station 3 to station 1 (via station 2): 8,458 vehicles.
B. Northbound net traffic flow from station 3 to station 2, then into Taree: 493 vehicles.

C. Northbound net traffic flow from the nearby coastal regions to station 2, then into Taree: 1,744 vehicles.

Figure 14: Illustration of Northbound Traffic, from Station 3 to Station 1



Source: Google Maps (2017), RMS (2017)

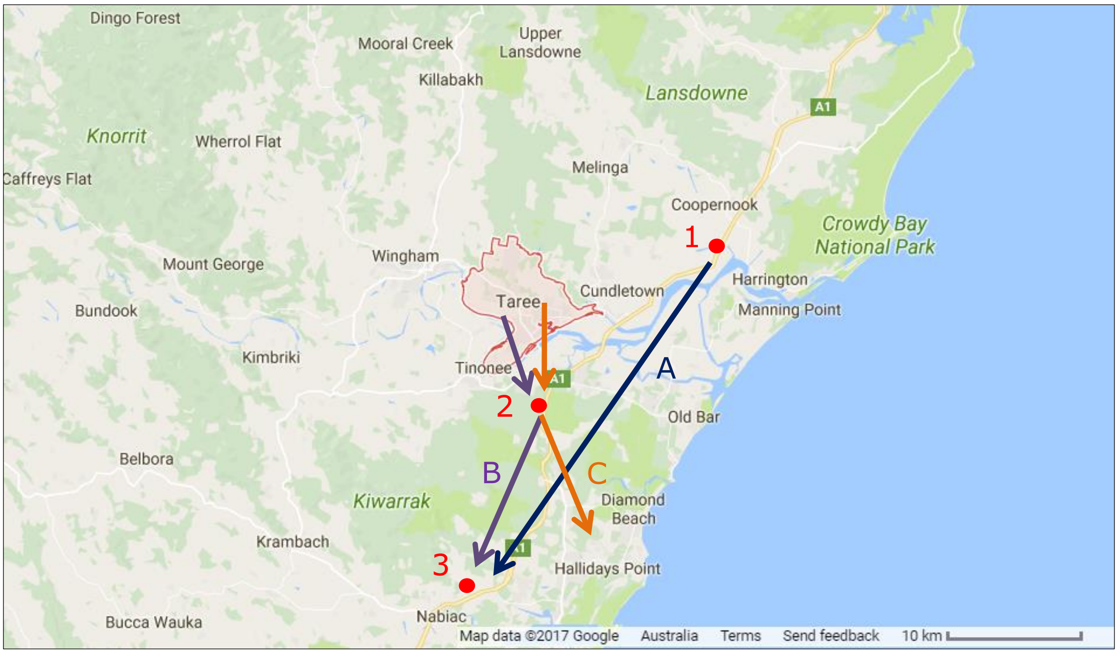
Conversely, there were **1,788** vehicles outward traffic movements from Taree (refer to the figure 9 below):

A. Southbound net traffic flow from station 1 to station 3 (via station 2): 8,715 vehicles.

B. Southbound net traffic flow from Taree to station 2, then station 3: 455 vehicles.

C. Southbound net traffic flow from Taree to station 2, then into the nearby coastal regions: 1,333 vehicles.

Figure 15: Illustration of Southbound Traffic, from Station 1 to Station 3



Source: Google Maps (2017), RMS (2017)

Key points to note from this analysis include:

- Larger light vehicle movements by number – likely to be coming from coastal traffic into Taree.
- There are also similar trends for heavy vehicles - maybe about 200 to 300 vehicles detour into Taree. This would fit with Taree being a regional service provider of building materials, construction businesses, etc.
- The increase in traffic loads from 2015 to 2017 would help explain customer feedback in the RMS report that services at the existing highway service centre at Taree are often congested. The increase in 'background' traffic levels also supports the case for additional road user services and truck stops at Taree, noting that the provision of services at the Glenthorne southern gateway will complement other services planned north of Taree at Cundletown.

Glenthorne is positioned strategically on the transport and employment corridor between Taree and the neighbouring coastal towns. It fronts the key arterial roads (i.e. Manning River Drive and Pacific Highway) and is well positioned to benefit from the completed Pacific Highway upgrades and thereby service highway user and local traffic needs.

Provision of short-term accommodation and other services

Short-term accommodation can play a significant role in creating employment, promoting tourism, providing hospitality and entertainment and supporting local community groups.

The hospitality industry can make significant contributions to the economic development of local communities on one condition: its ability to fill new positions with young workers who need on-the-job training. The industry is particularly dependent on its ability to hire youth and young workers, who make up the largest share of employees in the sector.

According to our demographic analysis, there has been some growth in the 25-29 age cohort, although intermittent across the region and usurped by a decline in older age groups.

As older employees retire, training young people to equip them with technical skills and life skills is more important than ever. The short-term accommodation sector is well suited to this transitioning of skills to younger populations.

Glenthorne is well-suited to this form of employment offer. The provision of short term accommodation at Glenthorne will complement the range of existing transport and automotive-related services in the locality (see separate listings below) and is consistent with the promotion of highway safety through the provision of overnight accommodation for road users.

The provision of existing short-term accommodation and other services proximate to the site are outlined in the below tables.

Table 5: Existing Short-term Accommodation, Glenthorne

Name	Address
Taree Country Motel	145 Manning River Dr, Taree
All Seasons Country Lodge Taree	110 Manning River Dr, Taree

Source: MacroPlan (2017)

Table 6: Service Stations, Taree

Name	Address
Woolworths Plus Petrol	70 – 76 Manning Street
United Petroleum	56 Victoria Street
United Petroleum	85 Muldoon Street
Coles Express Taree	59/63 Victoria Street
Caltex Star Mart	Glenthorne Road & Manning River Drive
BP Taree South	7087 The Bucketts Way
BP	102 Commerce Street
United Petroleum	Corner of Main Street & Else Street

Source: MacroPlan (2017)

Table 7: Existing Transport & Related Services, Manning River Drive

Name	Address
Taree Recycled Building Materials	118 Manning River Drive
Jacana Bus Sales	118 Manning River Drive
Sharpes Tractor Centre Pty Ltd	144 Manning River Drive
Stable Sheds & Garages (Fair Dinkum Sheds Distributor)	147 Manning River Drive
ShedBoss Mid North Coast	147A Manning River Drive
Taree Great Wall	136 Manning River Drive
The Shed Company Taree	118 Manning River Drive
Edstein Creative Stone	128-130 Manning River Drive
Chesterfield Australia	144 Manning River Drive
Gnomes Landscaping & Garden Supplies Pty Ltd	153 Manning River Drive

Source: MacroPlan (2017)

Table 8: Existing Automotive Businesses, Taree

Name	Address
Jacana Bus Sales	118 Manning River Drive
Twilight Caravan Park	146 Manning River Dr
Thrifty Car & Truck Rental Taree Airport	Taree Airport, 1 Lansdowne Road
Hertz Car Rental Taree Airport	Landsdowne Road
Autobarn Taree	18 Victoria Street
Autopro Taree	3 Victoria Street
Taree Truck Centre	142 Manning River Drive
Chesterfield Australia	144 Manning River Drive
Move Yourself Trailer Hire	58 Victoria Street
Manning Valley Automotive	22-26 Victoria Street
Taree Mitsubishi	136 Manning River Drive
Taree Motorama	54 Victoria Street
Men-in Trailers	118 Manning River Drive

Source: MacroPlan (2017)

Automotive Service Hub at Glenthorne

There are a series of existing local automotive services provided at Glenthorne. In our view, it is logical to build upon theses existing services to create an automotive services hub. This will act as a catalyst for further industrial and commercial development in Glenthorne and Taree, with the following likely outcomes:

- A greater degree of competition will be generated through a larger grouping of automotive repair and service providers at Glenthorne.

- The hub can deliver a large-scale, integrated vehicle repairs and servicing network to meet the needs of both freight and recreational vehicles.

- It will also improve the efficiency in matching current automotive industry workers to prospective jobs and salary growth through a deepening of the local economy's employment offer.

- Furthermore, attracting and retaining skilled automotive workers in Glenthorne and Taree could give more work-based learning opportunities for local youth and less-skilled workers. On-the-job training can be a powerful instrument for local employers to up-skill and re-train their workforce in the face of increasing needs (as shown in the daily traffic counts analysis) and to address skill shortages and reduce skill mismatch for new recruits lacking essential competences.

- At the community level, the incidence of job training is linked to higher productivity, a more skilled workforce, and more frequent work and holiday visitors from nearby suburbs or regions.

Demand from coastal neighbourhoods

Nearby coastal villages have enjoyed greater population growth compared to the Taree township. Between 2011 and 2016, the Taree SA2 saw virtually no population growth (i.e. 0.02% p.a.), but the population of the surrounding coastal towns[8] grew at an average annual rate of 1.05%. Notably, growth in the 'Old Bar – Manning Point – Red Head' SA2 area has been solid at 1.86%.

It would appear that there is a clear preference for new households to be formed at these coastal locations, which allows Taree to focus as an employment centre servicing its satellite villages.

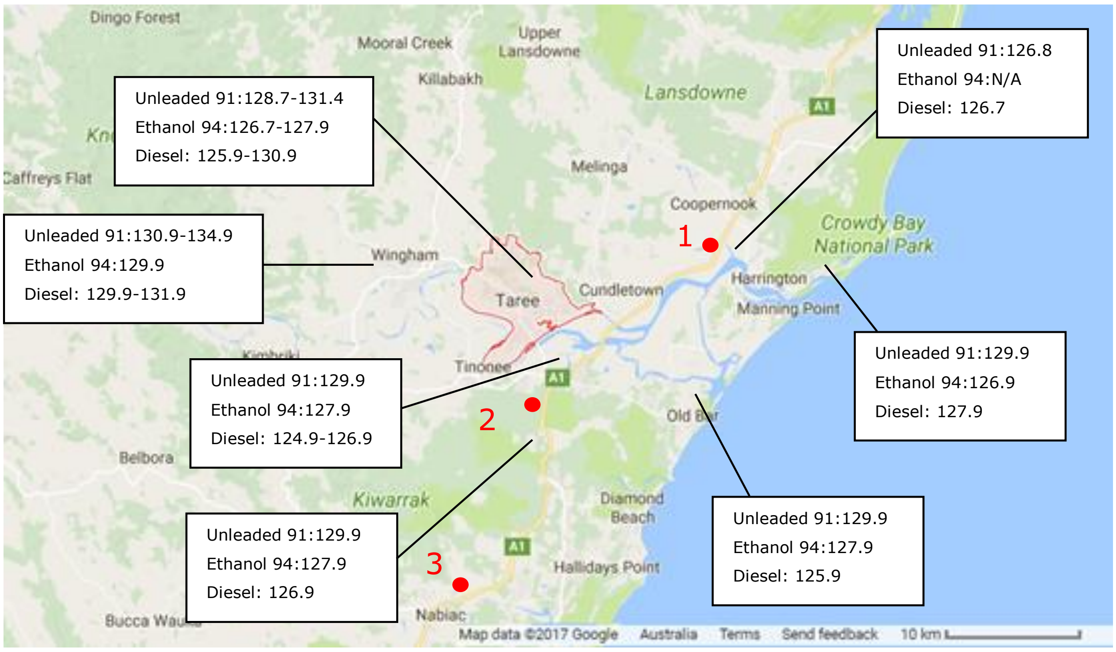
This phenomenon can translate into planning policy, where new employment opportunity is favoured at Taree.

Glenthorne is well positioned to accommodate new employment opportunities.

Competition on petrol prices

The provision of highway, automotive and related services at Glenthorne could have a direct impact on petrol pricing in the local area.

Figure 16: Current petrol prices (₵ per litre) at Glenthorne and Taree (September 2017)



Source: FuelCheck (2017)

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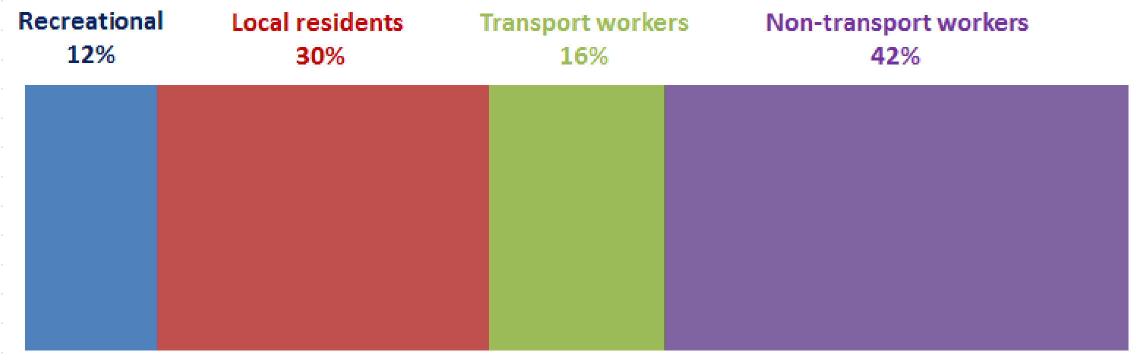
[8] 'Forster' SA2, 'Forster-Tuncurry region' SA2, Tuncurry' SA2, 'Old Bar - Manning Point - Red Head' SA2, 'Taree Region' SA2, and 'Wingham' SA2

Our assessment of impact is based on an assumed visitor profile and resident profile that may be visiting or working at the site, at the Taree Township, and its surrounding towns. Based on this approach we can calculate the expenditure and employment impact of visitors, workers and residents in the catchment area.

A detailed breakdown of our daily traffic analysis follows.

Figure 17 illustrates the assumed composition (in percentages) of daily traffic at the catchment area.

Figure 17: Composition of Daily Traffic, Catchment Area



Source: MacroPlan (2017)

Table 9 lists the assumed daily 'recreational visitor' traffic counts at each location of the selected stations.

Table 9: Recreational visitor – Indicative Daily Traffic counts

(number of vehicles)

Northbound daily traffic	***Light***
Northbound traffic flow from station 3 to station 1	1,020
Northbound traffic flow from station 3 to station 2, then into Taree	59
Northbound traffic flow from the nearby coastal towns to station 2, then into Taree	204
Southbound daily traffic	
Southbound traffic flow from station 1 to station 3	1,044
Southbound traffic flow from Taree to station 2, then station 3	54
Southbound traffic flow from Taree to station 2, then into the nearby coastal towns	156

Source: MacroPlan (2017)

Table 10 lists the assumed daily 'local resident traffic' traffic counts at each location of the selected stations.

Table 10: Local resident – Indicative Daily Traffic counts

(number of vehicles)

Northbound daily traffic	***Light***
Northbound traffic flow from station 3 to station 1	2,550
Northbound traffic flow from station 3 to station 2, then into Taree	147
Northbound traffic flow from the nearby coastal towns to station 2, then into Taree	510
Southbound daily traffic	
Southbound traffic flow from station 1 to station 3	2,610
Southbound traffic flow from Taree to station 2, then station 3	135
Southbound traffic flow from Taree to station 2, then into the nearby coastal towns	390

Source: MacroPlan (2017)

Table 11 lists the assumed daily 'transport worker' traffic counts at each location of the selected stations.

Table 11: Transport worker – Indicative Daily Traffic counts

(number of vehicles)

Northbound daily traffic	***Light***	***Heavy***
Northbound traffic flow from station 3 to station 1	1,156	204
Northbound traffic flow from station 3 to station 2, then into Taree	67	12
Northbound traffic flow from the nearby coastal towns to station 2, then into Taree	231	41
Southbound daily traffic		
Southbound traffic flow from station 1 to station 3	1,183	209
Southbound traffic flow from Taree to station 2, then station 3	61	11
Southbound traffic flow from Taree to station 2, then into the nearby coastal towns	177	31

Source: MacroPlan (2017)

Table 12 lists the assumed daily 'non-transport worker' traffic counts at each location of the selected stations.

Table 12: Non-transport worker – Indicative Daily Traffic counts

(number of vehicles)

Northbound daily traffic	***Light***
Northbound traffic flow from station 3 to station 1	3,570
Northbound traffic flow from station 3 to station 2, then into Taree	206
Northbound traffic flow from the nearby coastal towns to station 2, then into Taree	714
Southbound daily traffic	
Southbound traffic flow from station 1 to station 3	3,654
Southbound traffic flow from Taree to station 2, then station 3	189
Southbound traffic flow from Taree to station 2, then into the nearby coastal towns	546

Source: MacroPlan (2017)

By meeting the overlap in demand from passing traffic, and regional visitors to Taree, the provision of new highway services at Glenthorne will ensure that competitive fuel pricing is delivered at this juncture. It will encourage more frequent movement of light and heavy vehicles into Taree for services and will create a more competitive environment that limits the pricing power of existing operations.

All assumptions necessary for our economic benefits assessment are listed below.

Table 13: Assumptions – Economic Benefit Analysis (lower petrol prices)

Fuel Tank Capacity – light vehicle	55 litres
Fuel Tank Capacity – heavy vehicle	600 litres
Potential discount on local petrol price (max)	1 cents
Potential discount on local diesel price (max)	0.5 cents
% of light vehicle using petrol	40%
% of light vehicle using diesel	60%
% of heavy vehicle using petrol	20%
% of heavy vehicle using diesel	80%
Transport workers - % of heavy vehicle	15%
Transport workers - % of light vehicle	85%
*All other users/drivers using light vehicle	100%

Source: MacroPlan (2017)

Food-catering demand and potential

There is a relatively limited food catering supply (i.e. café or restaurant) located in close proximity to the subject site. There is also a spatial gap for food retail tenants along the Manning River Drive and the Pacific Highway, with only one café (i.e. Coolabah Tree Café) provided at the existing South McDonald's / Caltex Star-Mart Service Centre and others located within the Taree township.

The potential food catering retail uses to be incorporated within the highway service centre at the Glenthorne site will primarily be supported by demand derived from passing vehicle traffic, but will also service the local resident traffic as well.

The food catering offer at the potential retail development at the subject site could comprise two tenancies for food retail totalling a provision of around 300m^2. Table 17 provides estimated sales for the proposed food tenants.

Table 14: Potential retail opportunities, Subject Site

Food retail tenancy	GLA	Estimated sales potential	
	(m^2)	($'000)	($ per sq.m)
Tenancy 1 – café	100	500	5,000
Tenancy 2 – dining	200	1,100	5,500
Total	**300**	**1,600**	**-**

Source: MacroPlan (2017)

The average sales productivity levels of 'food catering' type retailers is typically around $5,000-6,000 per m^2. The proposed food catering offer at the subject site is estimated to achieve total sales of around $1.6 million (in constant 2017 dollars and including GST).

Taking into account the lack of food catering tenants in Glenthorne, the potential food retail uses at the subject site will benefit the local community through job creation and amenity offering in the local area. Furthermore, such uses will not undermine the existing service centre (i.e. Caltex Star-Mart Service Centre), which is heavily focused on fast-food retail (McDonalds, KFC and Subway).

Potential economic benefits

We have estimated impacts across the study catchment area resulting from the inclusion of services within the initial stages of development envisioned at Glenthorne. Our estimates are provided below:

- The provision of highway services at Glenthorne could have a direct impact on petrol pricing in the local area. We estimate that such a facility at Glenthorne will benefit about **$1.25 million per annum** to local households, business and highway users.
- In regards to the food catering impacts, the majority of trade is expected to be drawn from visitors, tourists and passers-by, and therefore the impacts would be widely spread across both the local area as well as areas further afield. Assuming that 30% of sales are generated by local residents, this reflects a general impact across the surrounding retail network of **around $0.48 million per annum**. This 'impact' is relatively minor and able to be absorbed by other existing businesses, particularly given the low level of supply at Glenthorne at present. It therefore represents a benefit to the local economy.

Table 15: Potential economic benefits

	(per annum)
Economic Benefit – Lower petrol prices	
Recreational visitor	$0.10 M
Local resident	$0.26 M
Transport worker	$0.50 M
Non-transport worker	$0.39 M
Economic Benefit – Food Retail	
Local resident	$0.48 M

Source: MacroPlan (2017)

Section 3: Other Opportunities

Bringing forward the activation of Glenthorne for industry expansion would introduce a corresponding increased level of competition for industrial land uses in the locality. This early activation would proactively provide industrial land occupiers, investors and tenants with greater choice in terms of site selection, and potentially create more investment attraction for the broader Taree catchment.

The role for Taree, as a regional service centre, should be reinforced by providing local-scale retail, commercial & industrial development and automotive services. In our view, Glenthorne is well-positioned to play an important role as automotive service hub and service centre, with surrounding coastal towns maintaining a residential focus. All three regions (i.e. Taree town, its gateway service corridors and its satellite villages) are projected to play a complementary role.

Glenthorne can support local employment by providing a motel, a truck shop, vehicle repairs and food retail facilities, which will support growing businesses and industries.

Other land uses may also provide a positive economic benefit to the catchment. In this regard, we note that:

- The Pacific Highway freight task is expected to grow rapidly over the next twenty to thirty years which will increase road traffic and the significance of freight and logistics in the area.
- Both intra and inter-state firms are able to be accommodated due to close access to the Pacific Highway.
- The Glenthorne site is flood-free, which ensures uninterrupted operation.
- Glenthorne has the flexibility to provide a range of different sized lots to accommodate a wide range of firms and industries.

The following candidate industries are suited to the attributes that Glenthorne offers.

Transport, Postal and Warehousing (TPW)

The TPW industry represents a game changer for the industrial land uses. The changing trends within this sector therefore are leading to ever increasing demand as existing supply continues to be taken up. This demand, from both within the Taree catchment and from beyond is being driven by the local population's needs as well global forces including:

- Reduced tariffs
- Free trade agreements
- Increased competition
- Improved infrastructure
- E-commerce (internet retail) and changing consumer behaviours and tastes
- Regional population growth.

TPW in the form of warehouse and distribution facilities are likely industries that could be accommodated on the subject site. Given the locational attributes and future projected freight task along the Pacific Highway, this industry is considered as a 'natural fit'.

Construction

Population growth and changing demographic patterns will ensure that there will be an ongoing need for businesses within the construction sector in the catchment. Given the location within the catchment, there exists the opportunity to support growth of firms in the construction and building materials sector. Examples of firms that provide building materials include those that:

- Supply and install roofing, fascia, gutter, patios, downpipes, solar systems, steel and timber house frames and commercial safety systems;
- Design, manufacture and installation of residential, commercial fixtures and fittings;
- Other building materials supplies – landscape, sand soil, cement, timber, steel etc.

Construction firms are considered likely candidates to take up key sites in the immediate near term. This is considered an important opportunity to pursue given that the ongoing demand for residential and commercial buildings, particularly in nearby coastal locations.

Manufacturing

With automotive servicing firms in place, there may be an opportunity for manufacturing mechanical components and parts. Firms could also be involved in metal fabrication and respond to demand for steel fabrication, sheet-metal, laser cutting and precision machining and engineering. Firms that supply, fabricate and install metalwork and light to medium structural steel may also be attracted to the subject location.

Environmental Technologies

Pressures from population growth on the environment presents a series of business opportunities relating to agriculture, water and wastewater systems, construction and other industries. Examples of firms which may operate within this niche in the catchment include those that:

- Provide environmental consulting and monitoring in areas such as air quality, acoustics and groundwater;
- Design, produce and supply of water hygiene technologies;
- Produce wastewater treatment and domestic grey water systems; and
- Deliver energy and water efficiency using wireless technology.

Food Processing and Distribution

There is an opportunity for the early activation of the subject lands to accommodate the needs of the surrounding food and agribusiness sector. Taree presents a diverse range of production capabilities, from fresh seafood, meat, fruit and vegetables to value-added products. This may be in the form of storage, warehousing and distribution facilities that provide efficient access to the busy north-south Pacific Highway freight corridor.

Employment Generation

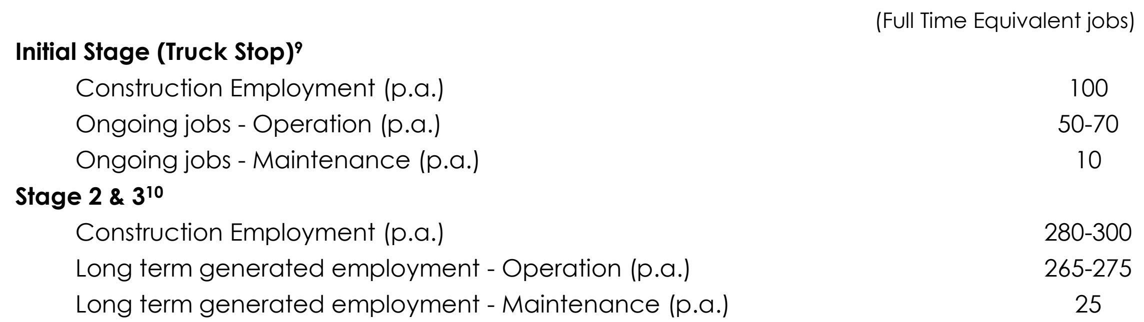
The proposed development has the potential to generate locally-significant employment opportunities. These opportunities include:

- Direct employment generation: the initial amount of ongoing jobs directly created by the proposed construction/ development phase and other visitor expenditure flows; and
- Indirect employment generation: additional ongoing jobs indirectly created by the proposed development in other industries not directly linked to the initial development.

A summary of the total employment impact is provided below. Total direct employment generated from the construction of the development would be 50-70 jobs per annum during the construction phase. There will also be 10 ongoing jobs related to the maintenance expenditure.

Moreover, there will also be 300 ongoing jobs from resident and visitor expenditure in other industries including extensive industrial uses, retail, recreation and tourism. The construction jobs during stage 2 and 3 is estimated at around 300 jobs.

Table 16: Employment Impact



	(Full Time Equivalent jobs)
Initial Stage (Truck Stop)[9]	
Construction Employment (p.a.)	100
Ongoing jobs - Operation (p.a.)	50-70
Ongoing jobs - Maintenance (p.a.)	10
Stage 2 & 3[10]	
Construction Employment (p.a.)	280-300
Long term generated employment - Operation (p.a.)	265-275
Long term generated employment - Maintenance (p.a.)	25

Source: MacroPlan (2017)

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[9] Jasbe (2017)

[10] MacroPlan (2017)

Conclusion

Our examination of demographic and employment trends relevant to Taree and its surrounding regions suggests that:

- Growing local jobs is key to curtailing population decline and maintaining service levels for Taree's ageing demographic.
- Retaining expenditure and expanding it through workforce growth is a vital connection for the local economy.
- For Taree, if local demand is not growing, then passing trade on the Pacific Highway becomes much more important (as a basis of greater service provision for locals).
- There is a vital need to balance Taree's ageing demographic with younger residents who can work and contribute services and income to the local economy.

Glenthorne is strategically located as a basis of greater service provision for locals and visitors to the area and is therefore able to 'tap into' the economic opportunity that the site's accessibility and exposure presents.

A service-oriented employment offer at Glenthorne will facilitate a direct and committed "enabling" investment by way of a truck stop/highway service centre and directly associated transport-related servicing/manufacturing facilities and hospitality-related investments. This offer can be further complemented through the provision of additional land that is sufficiently sized to provide for ongoing industrial-entrepreneurial activity.

These services can 'cluster' at Glenthorne, ensuring mutual co-location benefits that support the wider region over a staged development provision. The proposal also seeks to incorporate provision for new economic and cultural development opportunities in partnership with the Purfleet/Taree Local Aboriginal Land Council.

The proposed initial stage of development at Glenthorne will inject some $11.5 million into the local economy, and is estimated to create some 100 construction jobs. The proponents have indicated a preference to source local trades and supplies. At its operational stage, the truck stop/service centre would create 60-80 FTE jobs.

Our estimates also indicate that the additional competition generated by the proposal would present a net price saving of $1.25 million per annum to local households, business and highway users.

Further, we estimate that $0.48 million of additional food catering expenditure will be generated by the project. The 'impact' of this expenditure capture is minor and can be absorbed by other existing businesses. It therefore represents a benefit to the local economy, bringing the total estimated benefit from stage one of the project to $1.73 million annually.

The increase in 'background' traffic levels into and out of, and that which bypasses Taree supports the case for additional road user services and truck stops at Taree. In this light the provision of additional services at the Glenthorne southern gateway will complement the nearby existing highway service centre and other automotive services planned for the north of Taree at Cundletown.

The Glenthorne rezoning will consolidate the significance of Manning River Drive Employment Precinct as an important southern entry to Taree. The proposal complements the Northern Gateway precinct, ensuring that Taree captures every opportunity to trade from highway traffic and local resident movements in order to maximise the available local economic benefits.

The provision of an integrated highway service centre at the subject site would deliver a set of mutually-reinforcing benefits. Specifically, a service centre at this location could meet the anticipated increase in demand from Pacific Highway users and act as a catalyst for further industrial and commercial development, strengthening and deepening the employment relevance of the adjacent Manning River Drive Employment Precinct.

Other benefits will be derived as further stages of development occur.

We find that the proposed rezoning is consistent with the aims of the Manning Valley Local Strategy which seeks to 'grow the local economy' by offering accessible and affordable options for new businesses. This objective is key to current Council and state government initiatives to strengthen the regional economy and to build local resilience in the face of challenging demographic and economic trends.

Overall, there are strong economic grounds to support the proposed rezoning of land at Glenthorne. An employment zone capitalises on the site's distinctive locational strengths (i.e. highway accessibility and exposure) and has the potential to trigger much needed local investment and job creation.

Our view is that planning policy should seek to redress Taree's current demographic trends, with a view to achieving a healthier balance between household formation and labour workforce. Building capacity for employment growth and retaining a youthful workforce is key to achieving this outcome. The proposal for Glenthorne is consistent with this primary economic aim.

Appendix A: Historical Population Growth Trends

Table 17: Historical Population by age cohort (2011 & 2016), Selected SA2 regions[11]

Taree SA2					Taree region' & 'Wingham'				
Age Cohort	**2011**	**2016**	**Total Change (2011 - 2016)**	**CAGR (%)**	**Age Cohort**	**2011**	**2016**	**Total Change (2011 - 2016)**	**CAGR (%)**
0-4	1,265	1,272	7	0.1%	0-4	909	765	-144	-3.4%
5–9	1,339	1,303	-36	-0.5%	5–9	973	1,052	79	1.6%
10–14	1,408	1,310	-98	-1.4%	10–14	1,210	1,034	-176	-3.1%
15–19	1,438	1,276	-162	-2.4%	15–19	1,089	1,034	-55	-1.0%
20–24	1,088	1,184	96	1.7%	20–24	660	712	52	1.5%
25–29	1,046	1,045	-1	0.0%	25–29	561	693	132	4.3%
30–34	924	1,009	85	1.8%	30–34	637	678	41	1.3%
35–39	1,110	940	-170	-3.3%	35–39	802	699	-103	-2.7%
40–44	1,190	1,129	-61	-1.0%	40–44	959	932	-27	-0.6%
45–49	1,281	1,220	-61	-1.0%	45–49	1,291	1,128	-163	-2.7%
50–54	1,374	1,282	-92	-1.4%	50–54	1,435	1,424	-11	-0.2%
55–59	1,289	1,454	165	2.4%	55–59	1,529	1,594	65	0.8%
60–64	1,363	1,328	-35	-0.5%	60–64	1,555	1,684	129	1.6%
65–69	1,231	1,433	202	3.1%	65–69	1,339	1,630	291	4.0%
70–74	1,094	1,178	84	1.5%	70–74	937	1,294	357	6.7%
75–79	906	1,001	95	2.0%	75–79	635	792	157	4.5%
80–84	725	688	-37	-1.0%	80–84	452	494	42	1.8%
85 and over	788	829	41	1.0%	85 and over	305	429	124	7.1%
Total	20,859	20,881	22	0.02%	**Total**	17,278	18,068	790	0.90%

Tuncurry' & 'Forster' & 'Forster - Tuncurry Region'					Old Bar - Manning Point - Red Head'				
Age Cohort	**2011**	**2016**	**Total Change (2011 - 2016)**	**CAGR (%)**	**Age Cohort**	**2011**	**2016**	**Total Change (2011 - 2016)**	**CAGR (%)**
0-4	1,223	1,198	-25	-0.4%	0-4	595	562	-33	-1.1%
5–9	1,328	1,353	25	0.4%	5–9	539	692	153	5.1%
10–14	1,383	1,338	-45	-0.7%	10–14	687	600	-87	-2.7%
15–19	1,366	1,346	-20	-0.3%	15–19	632	578	-54	-1.8%
20–24	947	942	-5	-0.1%	20–24	335	351	16	0.9%
25–29	839	977	138	3.1%	25–29	352	402	50	2.7%
30–34	957	1,025	68	1.4%	30–34	378	432	54	2.7%
35–39	1,237	1,099	-138	-2.3%	35–39	547	462	-85	-3.3%
40–44	1,302	1,350	48	0.7%	40–44	634	611	-23	-0.7%
45–49	1,587	1,443	-144	-1.9%	45–49	609	637	28	0.9%
50–54	1,764	1,681	-83	-1.0%	50–54	745	670	-75	-2.1%
55–59	1,838	2,008	170	1.8%	55–59	788	824	36	0.9%
60–64	2,227	2,222	-5	0.0%	60–64	793	985	192	4.4%
65–69	2,215	2,590	375	3.2%	65–69	747	1,047	300	7.0%
70–74	1,861	2,283	422	4.2%	70–74	552	800	248	7.7%
75–79	1,523	1,706	183	2.3%	75–79	398	497	99	4.5%
80–84	1,285	1,231	-54	-0.9%	80–84	284	298	14	1.0%
85 and over	1,120	1,313	193	3.2%	85 and over	169	281	112	10.7%
Total	26,002	27,105	1,103	0.83%	**Total**	9,784	10,729	945	1.86%

Source: ABS (2017)

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[11] A more detailed analysis of historical population growth trends in those selected SA2 areas is presented in our appendix

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Appendix I – Traffic Impact Assessment

TAREE SOUTH, GLENTHORNE INDUSTRIAL ESTATE

Rezoning Application
Traffic Impact Assessment

Prepared for:

Jasbe Glenthorne Pty Ltd and Mulgrave Trust

SLR Ref: 620.12373-R01
Version No: -v0.6
August 2020

PREPARED BY

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Jasbe Glenthorne Pty Ltd and Mulgrave Trust (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
620.12373-R01-v0.6	13 August 2020	Charlie Seventekin	Brett McClurg	
620.12373-R01-v0.5	11 August 2020	Charlie Seventekin	Brett McClurg	Brett McClurg
620.12373-R01-v0.4	27 July 2020	Charlie Seventekin	Brett McClurg	Brett McClurg
620.12373-R01-v0.3	21 July 2020	Charlie Seventekin	Brett McClurg	Brett McClurg

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APPENDICES

1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Jasbe Glenthorne and Mulgrave Trust, in the care of Blue Sky Planning & Environment, to prepare a traffic and transport impact assessment to support a Rezoning Application for the consideration of Midcoast Council (Council).

The application seeks development consent for a proposed industrial and enterprise rezoning. The proposed rezoning is over Lot 2 DP 573214, Lot 50 DP 863972, Lot 2 DP 827097. A potential future subdivision is likely to result in the creation of twelve lots.

The traffic assessment and report herein represent an update of that documented in the SLR Consulting report "*Taree, Glenthorne Industrial Rezoning – Traffic Impact Assessment*" dated December 2018. The latter report was prepared to assess the earlier rezoning application.

The first stage rezoning Gateway determination was received on 21st of August 2019.

This report does not include detailed review of any on site layout or parking elements of the proposal, as this will form part of the subsequent applications to Council. The focus of this report has therefore been to evaluate the impacts of the rezoning proposal on traffic and transport operations and safety and to present suitable mitigation strategies.

2 Planning Proposal

2.1 Subject Site

The subject land is within MidCoast Council (Council) local government area (LGA), adjoining Manning River Drive Employment Precinct and located approximately 3 kilometres south of Taree town centre.

The subject site represents 51 Glenthorne Road, and 50 Eriksson Lane with formal property descriptions of Lot 50 DP 863972 and Lot 2 DP 8207097. An adjacent site at 55 Glenthorne Road (with formal property description of Lot 2 DP 573214) is being considered for environmental purposes, and has not been considered to be a development lot.

The extents of the study area and the key local road network are indicated in Figure 1 where sites are labelled as follows:

- **<u>Site A:</u>** 50 Eriksson Lane – Lot 2 DP 827097.
- **<u>Site B:</u>** 55 Glenthorne Road – Lot 2 DP 573214 – This is part of the rezoning application. It is excluded from analysis as it is not a development lot.
- **<u>Site C and D:</u>** 51 Glenthorne Road – Lot 50 DP 863972.

Figure 1 Extents of the Study Area

Map Source: maps.au.nearmap.com

2.2 Proposed Rezoning

The proposal is formally identified as “Glenthorne Employment Area” in the Gateway Determination Report and seeks to amend Greater Taree Local Environmental Plan (LEP) 2010 to facilitate the development of the site for industrial, employment and environmental purposes.

The subject site is currently zoned RU1 - Primary Production. As part of this planning proposal however, it is proposed that the subject site would be rezoned in parts as “IN1 – General Industrial”, “B6 - Enterprise Corridor” and “E2 – Environmental Conservation”.

Please note that the proposed development referenced within this report will be subject to a separate Development Application. Reference to development and diagrams are provided for the purposes of informed modelling in the circumstances of the Rezoning proposal.

The proposed rezoning represents a total land area of approximately 23 hectares. A potential future subdivision is likely to result in the creation of twelve lots, as shown in the plan included at Appendix A.

Details of the land uses on the site have not been confirmed, however the overall rezoned land will be developed over time and the land use types will be subject to the market demands at the time of development of each component of the land. Therefore, the proposed development uses will not be known for many years.

Notwithstanding the latter, for the purpose of consideration of the traffic impacts of the proposal, the potential development of the rezoning land is assumed as below (with reference to Figure 1). It should be recognised that the traffic analysis in Section 5 is based on slightly different GFA numbers, but the differences are insignificant (i.e. they represent less than 1-2vph on any one movement).

Site A: Developable land area is 59,685m^2 (having excluded the land for roads and waterway / environmental corridors). This net developable land area is assumed to have a 50% site cover.

Therefore, 59,685 x 50% = **29,843m^2 Gross Floor Area (GFA) Industrial**.

Site C: Developable land area is 33,756m^2 (having excluded the land for roads and environmental corridors). This net developable land area is assumed to have a 50% site cover. Land use is assumed 35% Industrial and 65% Specialised Retail Premises.

- Therefore, it is assumed that this is to be developed as follows:
  - 33,756m^2 x 50% x 35% = **5,908m^2 GFA Industrial.**
  - 33,756m^2 x 50% x 65% = **10,971m^2 GFA Specialised Retail Premises.**

Site D (Service Station): Developable land area is 24,003m^2. Based on indicative planning, the development is assumed to include car bowsers, truck bowsers and the following building areas:

  - **390m^2 GFA service station building.**
  - **620m^2 GFA fast food buildings.**
  - **Approximately 1,550m^2 GFA future development, assumed industrial and specialised retail premises.**

Based on the items above, total building area in Site D is 2,560m^2 GFA.

Table 1 provides a summary of the assessed land uses, recognising that this is a ‘potential’ development scenario.

Table 1 Potential / Assumed Land Uses

Site	Land Use	Yield
A	Industrial	29,843m^2 GFA
C	Industrial	5,908m^2 GFA
	Specialised Retail Premises	10,971m^2 GFA
D	Service Station	390m^2 GFA
	Fast-Food	620m^2 GFA
	Future Developments (assumed 50% industrial and 50% specialised retail premises)	1,550m^2 GFA

2.3 Potential Development

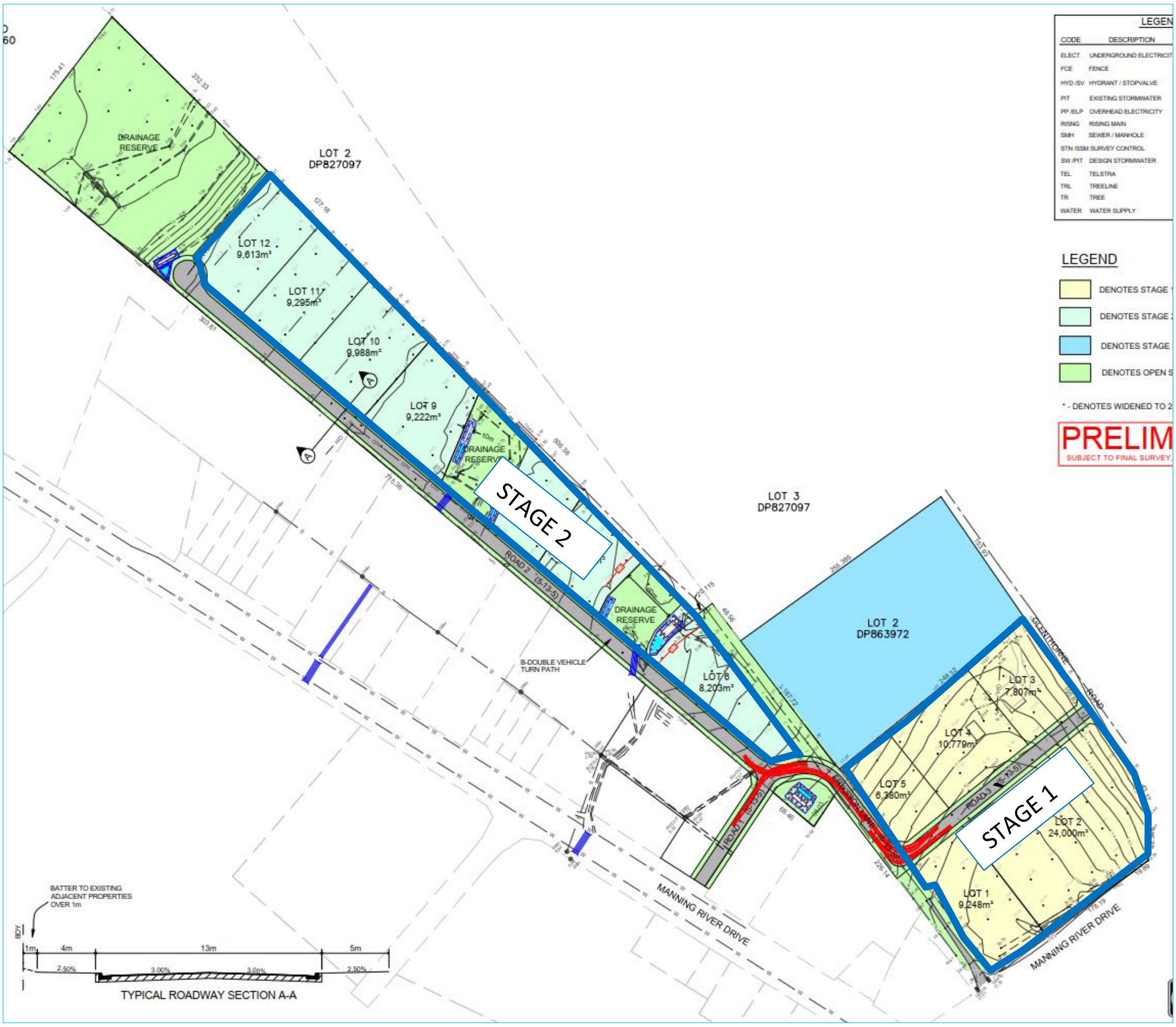
2.3.1 Potential Stages of the Proposed Development

As SLR understands, the potential development would be delivered in two main stages. Staging of the potential development is shown in Figure 2.

Figure 2 also indicates that the potential development comprises the following properties:

- **Stage 1:** DP863972 – Lots 1 to 5 with a developable area of 57,759m^2.
- **Stage 2:** DP827097 – Lots 6 to 12 with a developable area of 59,685m^2.

Figure 2 Potential Stages of the Proposed Development



2.3.2 New Road Construction

For the initial part of Stage 1, it is assumed that the development of Site D (Service Station site – 24,003m^2) would require Road 3 to be completed and open to traffic by the end of 2021. Road 3 is planned to be the principal road for the service station and release of Site C (the balance of Stage 1).

Road 1 is planned to be completed and open to traffic by the end of 2025. The connecting section of Eriksson Lane (between Road 3 and Road 1) is assumed be constructed and open to traffic by the end of 2025. Note that Road 1 is proposed to provide a connection to Manning River Drive (via a service road connection at Biripi Way).

Road 2 is planned to be completed and open to traffic by the end of 2030.

The above roads are shown on Figure 2 and the plan included at Appendix A.

2.3.3 Development Timing

The timing of the proposed development is yet to be determined, however development is expected to commence with a service station situated in Lot 2 of Stage 1 (being part of Site D).

For the purposes of consistency with the previous SLR reports, and ease of understanding the development timing, we have identified the service station as Site D and the remaining lots in Stage 1 as Site C. Site A refers to Stage 2.

Table 2 provides a summary of the development timing assumed for the purposes of our traffic impact assessment.

Table 2 Development Timing Assumptions

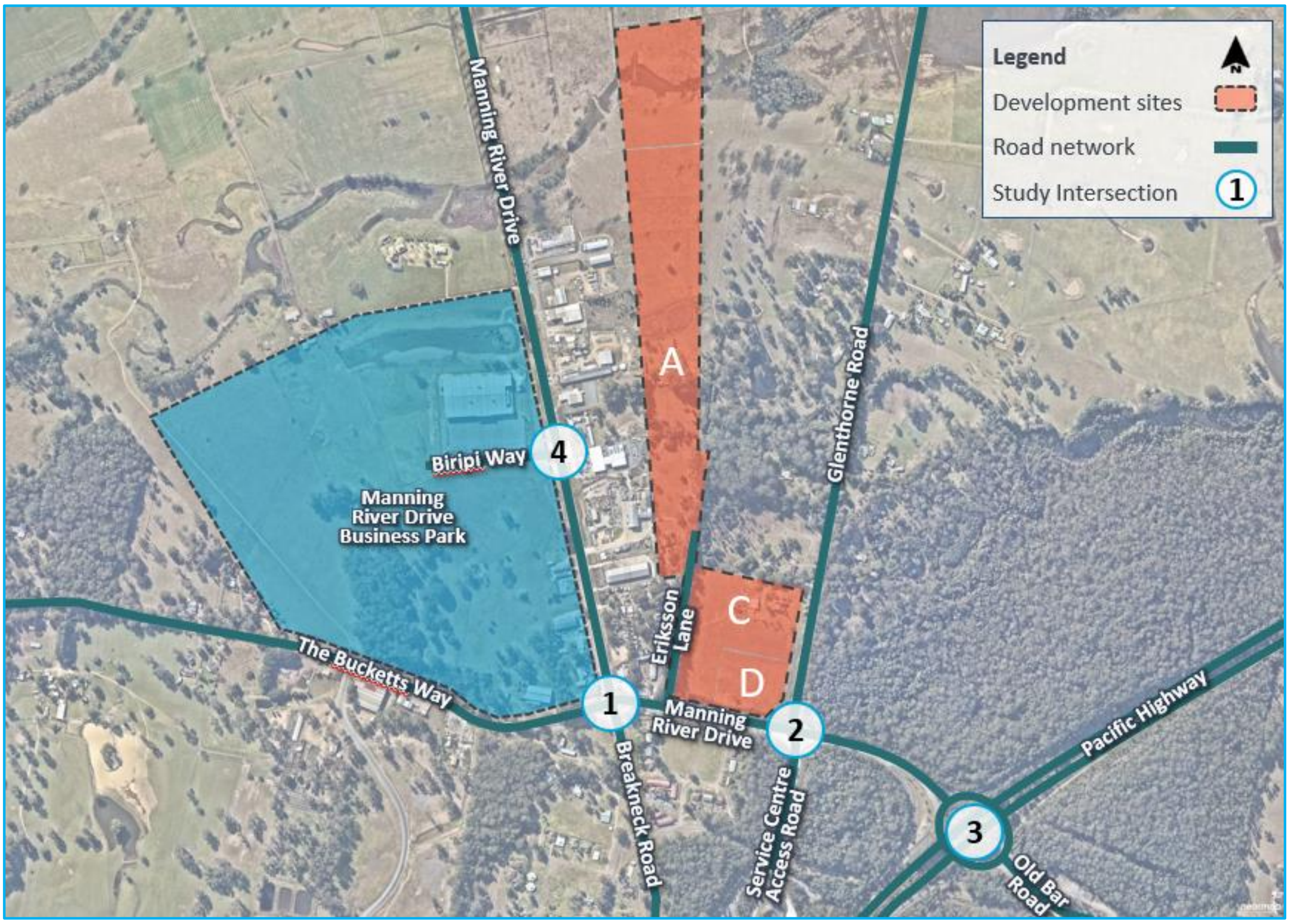
Site	Stage	Year			
		2021	2025	2030	2040
A	2	0%	0%	50%	100%
C	1	0%	50%	100%	100%
D	1	100%	100%	100%	100%

3 Scope of Traffic Assessment

3.1 Study Intersections

The assessment considers the intersections indicated in Figure 3 and listed in Table 3.

Figure 3 Study Intersections



Map Source: maps.au.nearmap.com

Table 3 provides information on the operational layout of each study intersection.

Table 3 Study Intersections

No	Intersection	Operational Layout
1	The Bucketts Way / Manning River Drive	Roundabout
2	Manning River Drive / Glenthorne Road / Service Centre Access	Roundabout
3	Pacific Highway / Manning River Drive / Old Bar Road	Roundabout at Highway Ramp (Interchange)
4	Biripi Way / Manning River Drive	Roundabout

3.2 Background Traffic

In the current COVID-19 circumstances, commissioning new traffic surveys is not deemed appropriate. As part of our initial assessment to obtain a Gateway determination, SLR undertook traffic surveys during the AM and PM peak periods on Thursday 26th of July 2018 at each of the four study intersections. The survey periods from 2018 are outlined in Table 4.

Pre-COVID-19 traffic volumes are not expected to have changed significantly from the 2018 traffic volumes, however SLR has applied 2% pa background growth to ensure a conservative assessment. This calculation is detailed in Section 3.3.

Table 4 Survey Timing – Thursday 26/07/2018

Location	Period	Survey Times
Study Intersections	Weekday AM Peak	7:00 – 10:00am
	Weekday PM Peak	3:00 – 6:00pm
Pacific Motorway	Weekday	24-hour

3.3 Traffic Growth

The background traffic growth rates used for future years' assessment were adopted from the Taree CBD Transport Study, Stage 2 – Action Plan prepared by Bitzios Consulting. This "Action Plan" used the growth rates outlined in Table 5.

Table 5 Annual Growth Rates

Region	2012 to 2017	2012 to 2022	2012 to 2032	Source
Great Taree	0.88%	1.38%	1.63%	Bitzios CBD Transport Study
Old Bar / Wallabi Point	1.61%	1.89%	1.89%	
Taree	0.22%	0.48%	0.66%	

Based on Table 5, SLR has adopted the growth rate presented in Table 6.

Growth will be applied to:

- all movements at intersections 1 and 3.
- only the through movements on Manning River Drive at intersections 2 and 4.

Table 6 Adopted Growth Rate

Growth Rate	Source
2.0% linear per annum	SLR Calculation

The background traffic volumes / counts and traffic growth rate assumptions adopted herein have been considered by Council to be appropriate for the subject assessment.

3.4 Background Development

For the purposes of our traffic and transport assessment, the background development in the subject area is represented by the proposed Manning River Drive Business Park. The background traffic generation included in this assessment is derived using the following land development assumptions:

- “Masters” Site: assumed 70% of the approximate 10,000m^2 GFA building area = **7,000m^2 GFA of Office Block**, assumes the Council staff would move in by 2021.
- Balance of Specialised Retail Premises in catchment: assumed **16,000m^2 GFA of Specialised Retail Premises.**
- Balance of Industrial in catchment: assumed **24,000m^2 GFA of Industrial.**

The latter two use areas (16,000m^2 + 24,000m^2) are consistent with the assumption in the “*Taree CBD Transport Study, Stage 2 – Action Plan*” prepared by Bitzios Consulting of 80,000m^2 land area x 50% site cover, with 40% specialised retail premises (80,000 x 50% x 40% = 16,000m^2) and 60% industrial (80,000 x 50% x 60% = 24,000m^2).

The timing of development within the Manning River Drive Business Park is also not clear, however for the purpose of assuming background traffic impacts, assumed development timing is outlined in Table 7.

Table 7 Background Development Timing Assumptions

Site	Year			
	2021	**2025**	**2030**	**2040**
Masters Site	100%	100%	100%	100%
Balance of Specialised Retail Premises / Industrial	0%	25%	50%	100%

The background development assumptions adopted herein have been considered by Council to be appropriate for the subject assessment.

4 Development Traffic

4.1 Planning Proposal

The traffic generation assumptions for the potential development as part of this planning proposal are tabulated in Table 8.

Table 8 Adopted Trip Rates & Sources

Use	Peak Trip Rates		Source
	AM Peak	PM Peak	
Service Station	66 trips per 100sqm GFA of shop		RTA Guide to Traffic Generating Developments
Food Outlets in Service Station	100 trips irrespective of GFA		RTA Guide to Traffic Generating Developments, assumed Kentucky Fried Chicken rates.
Specialised Retail Premises	2.7 per 100sqm GFA	2.7 per 100sqm GFA	RTA Guide to Traffic Generating Developments – TDT2013/04a Updated Traffic Surveys
Industrial	0.7 per 100sqm GFA	0.78 per 100sqm GFA	

It should be noted that the traffic counts of the adjacent highway service centre indicate that the RTA traffic generation rate for the Service Station is appropriate.

The development traffic distribution assumptions for the planning proposal are outlined in Table 9.

Table 9 Planning Proposal – Distribution

Direction	Proportion		
	Service Station	Specialised Retail Premises	Industrial
North (Taree, Manning River Drive)	70%	40%	40%
West (The Bucketts Way)	9%	9%	9%
South (Purfleet)	1%	1%	1%
East (Old Bar Road)	10%	20%	20%
North East (Pacific Highway)	5%	15%	15%
South East (Pacific Highway)	5%	15%	15%

The service station development traffic on the rezoning land is assumed to be drop-in traffic from the passing traffic on Manning River Drive (i.e. it is not added as new trips).

This drop-in traffic is assigned to the external network as outlined in Table 10.

Table 10 Planning Proposal – Service Station – Drop-In Traffic Assignment

Movement		Route	Proportion
Entry Traffic	From West	Left turn into Glenthorne Road	50%
		Direct left turn in from Manning River Drive	50%
	From East	Right turn into Glenthorne Road	100%
		Direct left turn in from Manning River Drive	0%
Exit Traffic	To West	Right turn from Glenthorne Road	100%
		Direct left turn out to Manning River Drive	0%
	To East	Left turn from Glenthorne Road	100%
		Direct left turn out to Manning River Drive	0%

The specialised retail premises and industrial development traffic on the planning proposal land is assumed to be assigned to the external road network via Glenthorne Road in the 2021 and 2025 assessment years.

By 2030, it is assumed that a new connection to Manning River Drive (via Road 1 and a service road connection at Biripi Way) is expected to be available and some traffic would use this route. The adopted assignment in the 2030 and 2040 assessment horizons is outlined in Table 11.

Table 11 Planning Proposal – Specialised Retail Premises and Industrial – 2030 and 2040 Assignment

Direction	Route	Proportion
North (Taree, Manning River Drive)	Glenthorne Road	50%
	New Connection to Manning River Drive at Biripi Way	50%
West (The Bucketts Way)	Glenthorne Road	50%
	New Connection to Manning River Drive at Biripi Way	50%
South (Purfleet)	Glenthorne Road	50%
	New Connection to Manning River Drive at Biripi Way	50%
East (Old Bar Road)	Glenthorne Road	100%
North East (Pacific Highway)	Glenthorne Road	100%
South East (Pacific Highway)	Glenthorne Road	100%

The development traffic generation rates, distribution and assignment assumptions as adopted herein are generally consistent with that adopted in the December 2018 traffic assessment (by SLR) which was used as part of the currently approved Gateway determination.

4.2 Background Development

The traffic generation assumptions for the background development within the Manning River Drive Business Park are outlined in Table 12.

Table 12 Background Development – Trip Rates

Use	Peak Trip Rates		Source
	AM Peak	PM Peak	
Specialised Retail Premises	2.7 per 100sqm GFA	2.7 per 100sqm GFA	RTA Guide to Traffic Generating Developments – TDT2013/04a Updated Traffic Surveys
Industrial	0.7 per 100sqm GFA	0.78 per 100sqm GFA	
Office Block	1.6 per 100sqm GFA	1.2 per 100sqm GFA	

The traffic distribution assumptions for the background development are outlined in Table 13.

Table 13 Background Development – 2021 and 2025 Assignment

Direction	Proportion
North (Taree, Manning River Drive)	40%
West (The Bucketts Way)	9%
South (Purfleet)	1%
East (Old Bar Road)	20%
North East (Pacific Highway)	15%
South East (Pacific Highway)	15%

In 2021 and 2025, 100% of the background development traffic from the Manning River Drive Business Park is assumed to be assigned to the external road network via the existing Biripi Way connection to Manning River Drive.

In 2030, a new connection to The Bucketts Way is assumed to be available and some traffic would use this route. The adopted assignment in 2030 and 2040 is outlined in Table 14.

Table 14 Background Development – 2030 and 2040 Assignment

Direction	Route	Proportion
All Directions	Existing Biripi Way connection to Manning River Drive	65%
	New connection to The Bucketts Way	35%

The traffic generation rates, distribution and assignment assumptions for the background development, as adopted herein, are generally consistent with that adopted in the December 2018 traffic assessment (by SLR) which was used as part of the currently approved Gateway determination.

5 Traffic Analysis

5.1 Operational Assessment

The traffic analysis has been undertaken using the volumes developed in a spreadsheet model making the assumptions outlined in Section 2, Section 3 and Section 4.

Detailed volumes are provided in Appendix C.

The performance of the nominated study intersections was assessed using SIDRA Intersection 8.0 (SIDRA), a computer-based modelling software that determines intersection operation based on input parameters, including carriageway geometry and traffic volumes. Amongst other parameters, SIDRA provides an estimate of the intersection's Degree of Saturation (DOS), queues and delays. The desirable maximum DOS threshold considered to be appropriate is 0.80 for an unsignalised priority intersection, 0.85 for a roundabout and 0.90 for a signalised intersection.

TfNSW (formerly RMS) defines intersection performance based on vehicle delay. SIDRA calculates the average delay encountered by all vehicles that travel through the modelled intersection and determines a level of service per intersection, approach and lane.

Based on Guide to Traffic Generating Developments[1] by TfNSW (2002), Table 15 indicates the criteria that is adopted by SIDRA in assessing the level of service.

Table 15 TFNSW SIDRA Level of Service Criteria

Level of Service (LOS)	Average Delay per Vehicle (seconds / vehicle)	Signalised Intersections and Roundabouts	Give Way & Stop Sign
A	0 to 14.5	Good operation	Good operation
B	14.5 to 28.5	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	28.5 to 42.5	Satisfactory	Satisfactory, but accident study required
D	42.5 to 56.5	Operating near capacity	Near capacity, accident study required
E	56.5 to 70.5	At capacity; at signals, incidents will cause excessive delays	At capacity, requires other control mode
F	Greater than 70.5	Extra capacity required	Extreme delay, major treatment required

Level of Service (LOS) values exceeding LOS E indicate that an intersection is nearing its practical capacity and upgrades works or other interventions may be required. At LOS F, road users are likely to experience significant delays and excessive queueing.

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[1] TfNSW (formerly RMS) Guide to Traffic Generating Developments, Version 2.2 Dated October 2002
https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/guide-to-generating-traffic-developments.pdf

It should also be noted that for roundabouts and priority control intersections, the critical movement for level of service assessment should be that with the worst movement delay, however for signalised intersections, level of service should be reported based on the average delay.

5.2 Assessment Scenarios

SLR has undertaken SIDRA analysis for the following scenarios:

- 2018 surveys (existing conditions assessment);
- 2021 background growth and background development without the proposed rezoning traffic;
- 2021 background growth and background development with the proposed rezoning traffic;
- 2025 background growth and background development with the proposed rezoning traffic;
- 2030 background growth and background development without the proposed rezoning traffic;
- 2030 background growth and background development with the proposed rezoning traffic;
- 2040 background growth and background development with the proposed rezoning traffic;

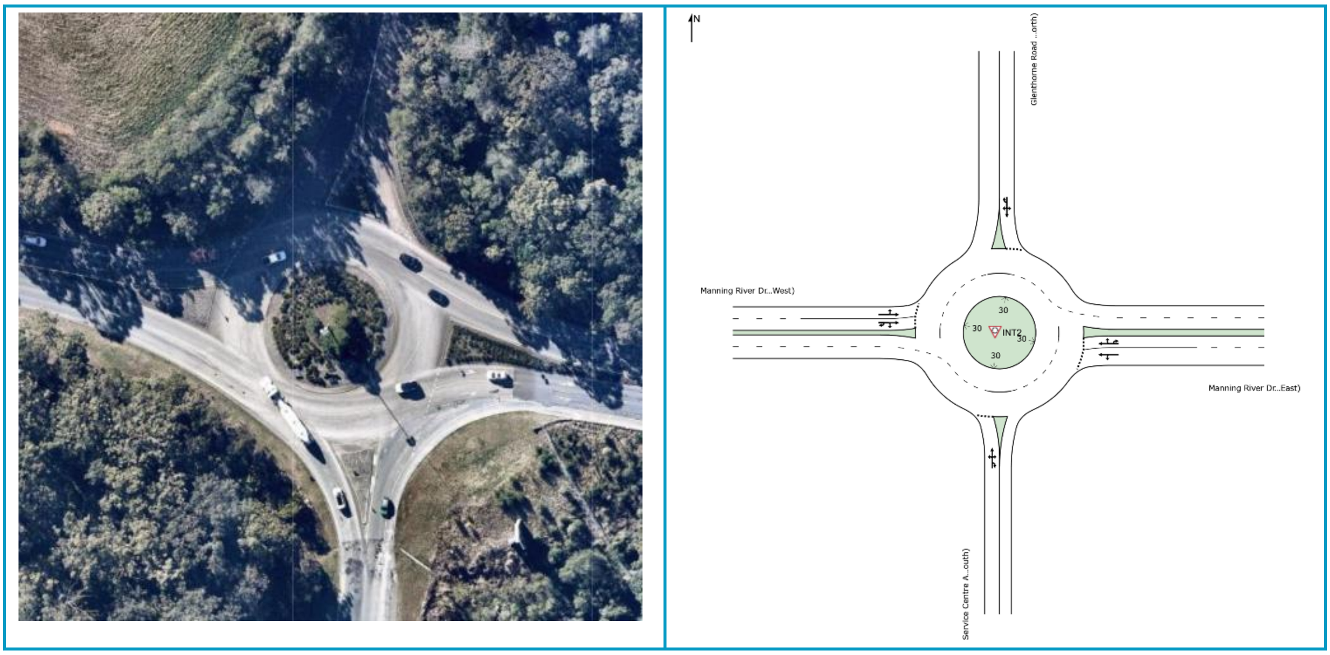
For each intersection, the assessment results are summarised in the following sections, with SIDRA results summarised at Appendix D.

5.3 Glenthorne Road / Manning River Drive / Caltex Service Centre

The Glenthorne Road / Manning River Drive / Caltex Service Centre intersection was assessed in its current layout as a dual lane roundabout.

Existing SIDRA intersection layout is indicated alongside an aerial image in Figure 4.

Figure 4 Glenthorne Road / Manning River Drive / Caltex Service Centre – Assessed Intersection Layout



SIDRA analysis results are presented in Table 16.

Table 16 Glenthorne Road / Manning River Drive / Caltex Service Centre – SIDRA Outputs

Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2018 Existing Conditions	0.474	4.9	18.4	0.470	5.5	23.6
2021 BG Growth & DEV	0.515	4.9	21.3	0.509	5.5	26.9
2021 BG Growth & DEV with Rezoning	0.587	6.0	26.8	0.516	6.5	27.3
2025 BG Growth & DEV with Rezoning	0.693	6.8	42.1	0.625	7.5	36.4
2030 BG Growth & DEV	0.641	5.0	33.6	0.647	5.6	42.2
2030 BG Growth & DEV with Rezoning	0.770	6.9	54.8	0.661	7.7	46.8
2040 BG Growth & DEV with Rezoning	0.939	12.3	136.0	0.987	14.0	108.3

SIDRA analysis results indicate that this intersection with its existing layout would operate satisfactorily until 2035 with background growth, background development and the proposed rezoning, however by 2035 its operation would exceed the desired threshold (DOS of 0.85).

To offset the impacts of the future (beyond 2035) background growth, background developments and the proposed rezoning and bring the intersection performance to an acceptable level (DOS of 0.85), the intersection would require minor upgrades, these being two dedicated short-lanes (40m only) for the left-turn movements on the east and west approaches on Manning River Drive.

The upgraded intersection layout is presented in Figure 5.

Figure 5 Glenthorne Road / Manning River Drive / Caltex Service Centre – Upgraded Intersection Layout

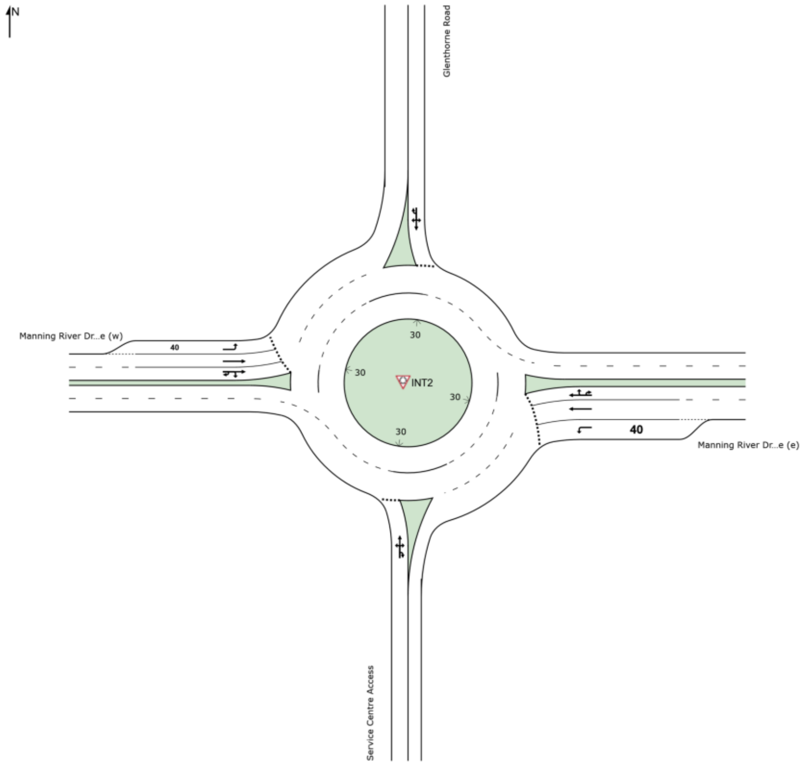


Table 17 Glenthorne Road / Manning River Drive / Caltex Service Centre – Upgraded SIDRA Outputs

Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2040 BG Growth & DEV with Rezoning	0.762	7.1	48.5	0.819	8.4	56.1

The SIDRA analysis results indicate that upgrading this intersection beyond 2035 would improve the intersection performance from DOS of 0.987 to DOS of 0.819 in the PM peak period and reduces the queue lengths from 108.3m to 56.1m in the PM peak period.

It is important to recognise that the analysis at this intersection makes no allowance for the potential for the existing Caltex Service Centre (on the southern leg of the intersection) to be accessed via a direct connection from the Pacific Highway. It is understood that such a connection was previously approved. This connection would result in a significant reduction in traffic volumes at this intersection, potentially reducing the intersection upgrading required at this location.

5.4 Old Bar Road / Manning River Drive / Pacific Highway Ramps

The Old Bar Road / Manning River Drive / Pacific Highway Ramps intersection was assessed in its current layout as an interchange roundabout.

Existing SIDRA intersection layout is indicated alongside an aerial image in Figure 6.

Figure 6 Old Bar Road / Manning River Drive / Pacific Highway Ramps – Assessed Intersection Layout

SIDRA analysis results are presented in Table 18.

Table 18 Old Bar Road / Manning River Drive / Pacific Highway Ramps – SIDRA Outputs

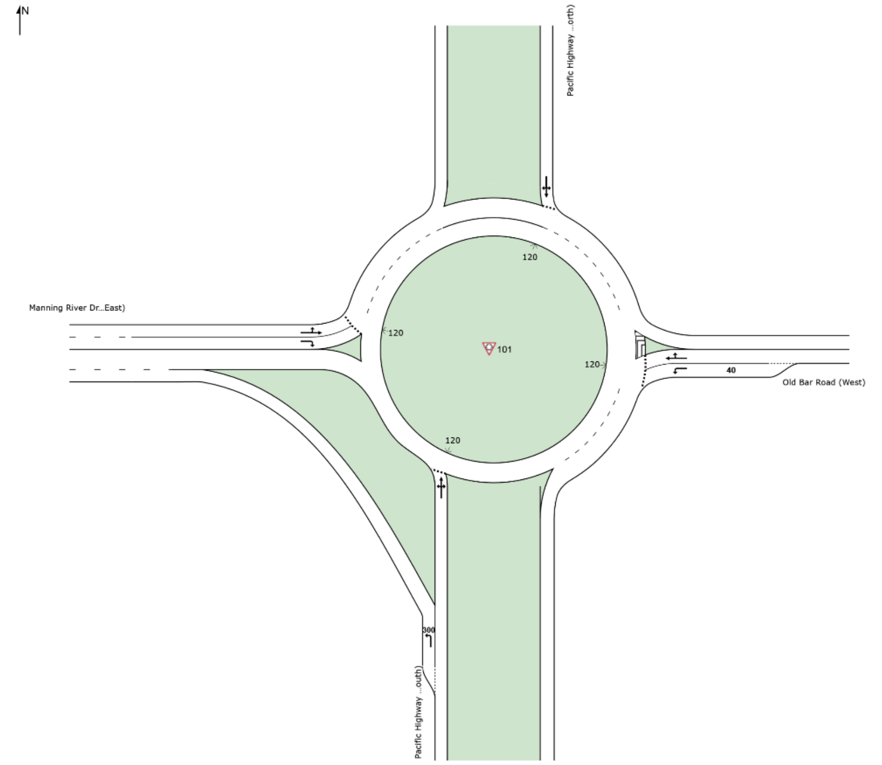
Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2018 Existing Conditions	0.579	5.4	37.0	0.392	5.5	21.1
2021 BG Growth & DEV	0.646	5.9	49.8	0.425	5.6	23.9
2021 BG Growth & DEV with Rezoning	0.641	5.8	48.0	0.408	5.6	22.5
2025 BG Growth & DEV with Rezoning	0.782	7.5	89.6	0.481	5.8	29.2
2030 BG Growth & DEV	0.852	8.5	123.9	0.540	6.3	35.8
2030 BG Growth & DEV with Rezoning	0.982	18.1	316.1	0.568	6.8	47.4
2040 BG Growth & DEV with Rezoning	1.323	110.6	229.7	0.971	18.0	260.5

The SIDRA analysis results indicate that the intersection would operate above the desired threshold for a roundabout (DOS of 0.85) in 2030 with and without the rezoning traffic. The impact of the planning proposal traffic is to cause intersection capacity to fail by approximately three (3) years sooner (by 2027) than failure occurring with background traffic only by 2030.

To offset the impacts of the rezoning traffic, the roundabout requires a dedicated short-lane for the left-turn movement in the east approach as well as an additional circulating lane between the east and south approaches.

The upgraded intersection layout is presented in Figure 7.

Figure 7 Old Bar Road / Manning River Drive / Pacific Highway Ramps – Upgraded Intersection Layout



SIDRA analysis results for the upgraded layout are presented in Table 19.

Table 19 Old Bar Road / Manning River Drive / Pacific Highway Ramps – Upgraded SIDRA Outputs

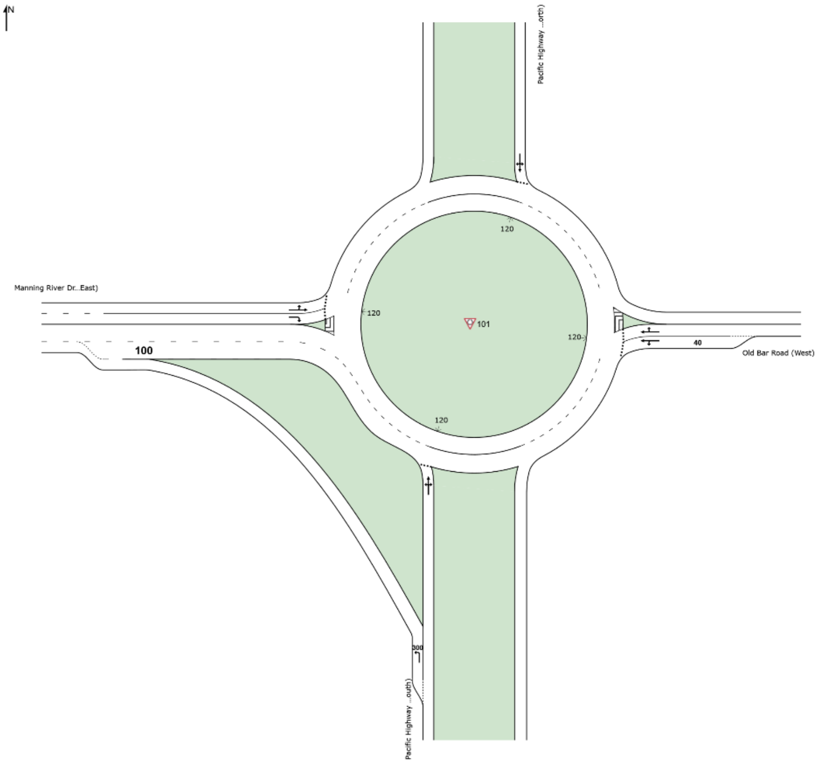
Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2030 BG Growth & DEV with Rezoning	0.666	6.9	64.0	0.570	6.2	39.8
2040 BG Growth & DEV with Rezoning	0.894	12.6	209.3	0.676	5.0	57.8

The SIDRA analysis results indicate that the upgraded roundabout layout (see Figure 7) would be able to accommodate the proposed rezoning traffic in 2030. By 2036 however, the intersection is expected to operate above the satisfactory threshold (DOS of 0.85).

Since the 2036 / 2040 horizon is so distant (16 / 20 years away) and the traffic volumes are based on very conservative assumptions (i.e. 2% pa growth), it would be unreasonable to implement intersection upgrading works for the 2036 / 2040 horizon. Notwithstanding the latter, as a guide for future planning by others, a performance assessment for the 2040 horizon at this intersection has been undertaken by SLR.

To improve the operation in 2040, the roundabout could be upgraded (by others) to provide two full circulating lanes as shown in Figure 8.

Figure 8 Old Bar Road / Manning River Drive / Pacific Highway Ramps – 2040 Ultimate Intersection Layout



SIDRA analysis results for the ultimate layout are provided in Table 20.

Table 20 Old Bar Road / Manning River Drive / Pacific Highway Ramps – 2040 Ultimate SIDRA Outputs

Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2040 BG Growth & DEV with Rezoning	0.627	7.1	62.0	0.703	7.2	57.5

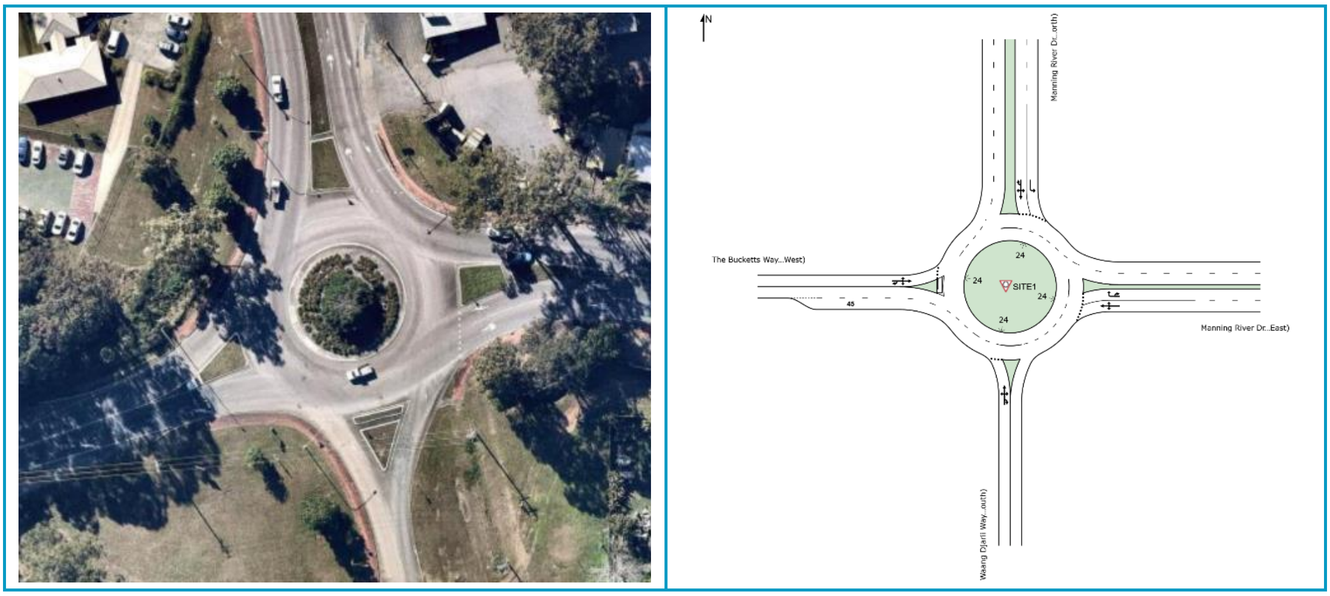
SIDRA analysis results indicate that the 2040 ultimate intersection layout (full dual lane roundabout) would significantly reduce the intersection degree of saturation to below the desired threshold (DOS of 0.85).

5.5 The Bucketts Way / Manning River Drive

The Bucketts Way / Manning River Drive intersection was assessed in its current layout as a dual lane roundabout.

Existing SIDRA intersection layout is indicated alongside an aerial image in Figure 9.

Figure 9 The Bucketts Way / Manning River Drive – Assessed Intersection Layout



SIDRA analysis results are presented in Table 21.

Table 21 The Bucketts Way / Manning River Drive – SIDRA Outputs

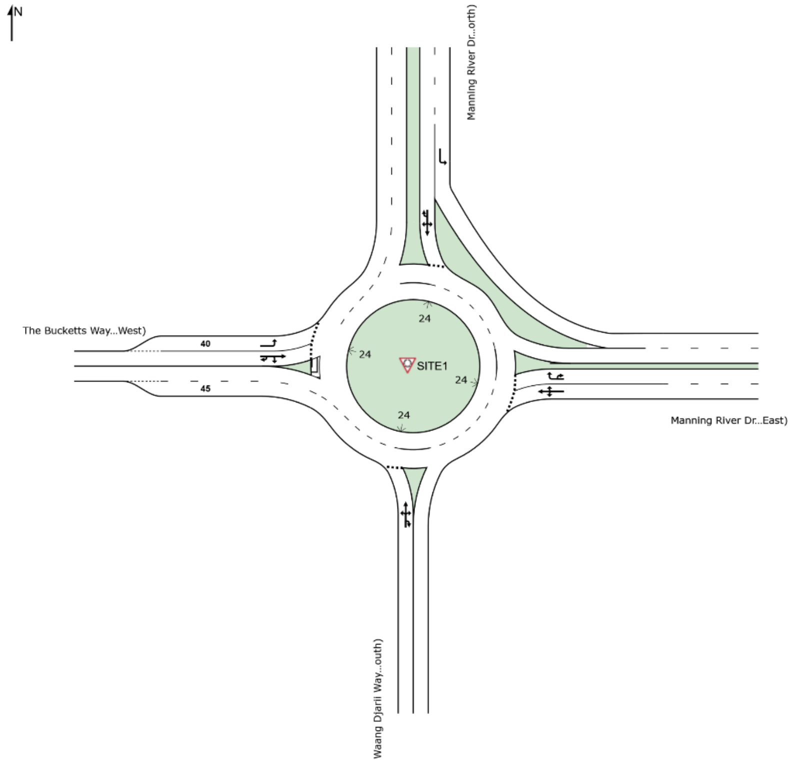
Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2018 Existing Conditions	0.767	14.7	86.3	0.483	6.8	24.9
2021 BG Growth & DEV	1.099	38.3	324.4	0.530	6.9	29.3
2021 BG Growth & DEV with Rezoning	1.652	96.2	745.7	0.553	7.1	31.9
2025 BG Growth & DEV	2.489	204.2	1163.2	0.608	7.0	38.1
2025 BG Growth & DEV with Rezoning	2.660	211.4	1206.8	0.642	7.5	43.0
2030 BG Growth & DEV	2.961	266.3	1423.8	0.736	8.3	55.1
2030 BG Growth & DEV with Rezoning	3.228	308.9	1606.8	0.749	9.7	58.8
2040 BG Growth & DEV with Rezoning	3.951	434.9	2123.0	1.402	59.8	781.0

SIDRA analysis results indicate that the intersection would not operate satisfactorily (DOS of 0.85) as of 2021, with or without the inclusion of the rezoning traffic.

To offset the impacts of the rezoning traffic, the roundabout requires a continuous left slip lane from the north approach as well as a short and dedicated left-turn lane on the west approach. It must be recognised that these works seek to offset the impact of the rezoning traffic, but the background traffic and growth would still result in a poor operation by 2025 and beyond.

The upgraded intersection layout is presented in Figure 10.

Figure 10 The Bucketts Way / Manning River Drive – Upgraded Intersection Layout



SIDRA analysis results for the upgraded layout are presented in Table 22.

Table 22 The Bucketts Way / Manning River Drive – Upgraded SIDRA Outputs

Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2021 BG Growth & DEV	0.568	11.8	39.3	0.433	6.4	20.9
2021 BG Growth & DEV with Rezoning	0.746	17.6	60.8	0.449	6.6	22.4
2025 BG Growth & DEV	1.017	32.6	152.0	0.496	6.5	26.1
2025 BG Growth & DEV with Rezoning	1.572	60.6	435.7	0.518	6.9	28.6
2030 BG Growth & DEV	1.796	87.0	597.4	0.569	7.0	32.5
2030 BG Growth & DEV with Rezoning	1.972	107.3	708.3	0.578	7.5	33.9
2040 BG Growth & DEV with Rezoning	2.407	187.9	1016.3	0.732	11.5	58.7

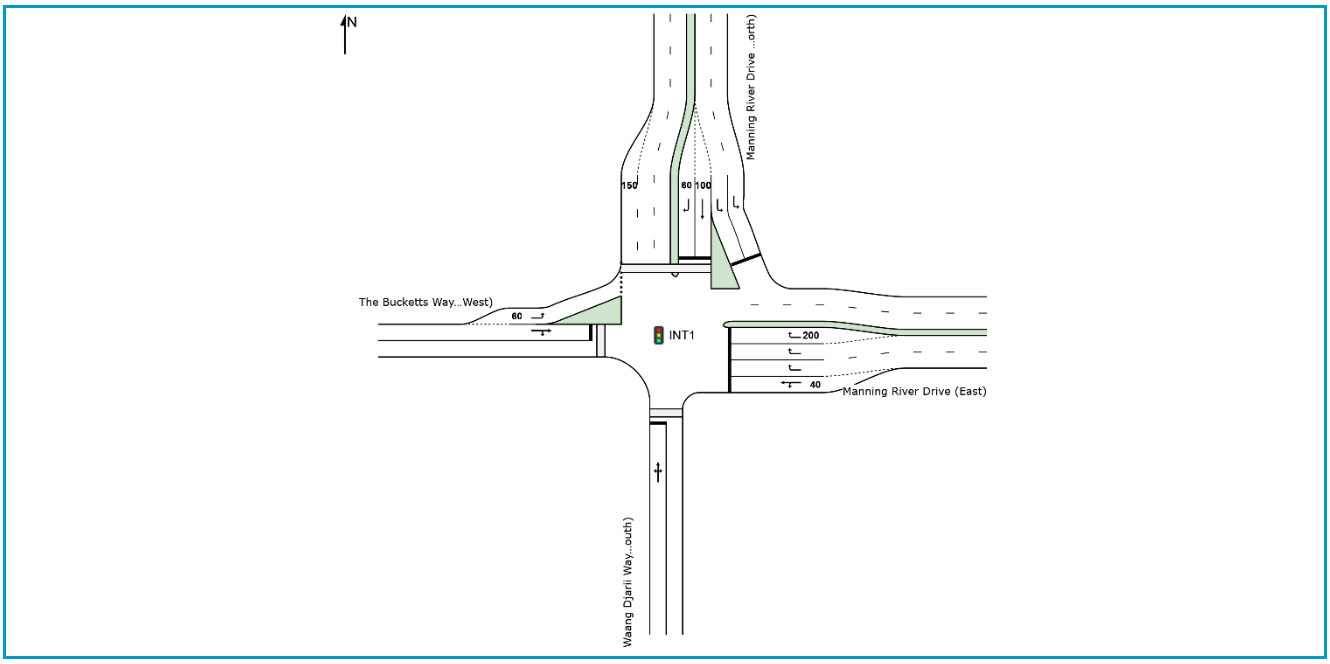
SIDRA analysis results indicate that the upgraded roundabout (see Figure 10) would operate satisfactorily at 2021 with the rezoning traffic, however by 2025 its operation would exceed the desired threshold (irrespective of the rezoning).

Whilst the following is not considered to be a reasonable requirement of the rezoning, an assessment has been undertaken to determine a possible intersection arrangement to accommodate the background traffic and growth at the 2040 horizon.

To provide capacity at the 2040 horizon, the roundabout could be upgraded to signals as shown in Figure 11.

To provide adequate capacity, the signalised layout requires three right turn lanes from east to north and two left slip lanes (signalised) on the northern approach. This configuration is not a realistic outcome but has been identified for theoretic capacity reasons only. For the SIDRA analysis, phasing has been set to optimise for minimum delay.

Figure 11 The Bucketts Way / Manning River Drive – Ultimate Intersection Layout



SIDRA analysis results for the ultimate layout are presented in Table 23.

Table 23 The Bucketts Way / Manning River Drive – Ultimate SIDRA Outputs

Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2025 BG Growth & DEV with Rezoning	0.650	19.9 (LOS B)	111.3	0.796	27.9 (LOS C)	166.1
2030 BG Growth & DEV with Rezoning	0.756	22.9 (LOS C)	136.9	0.826	30.4 (LOS C)	184.6
2040 BG Growth & DEV with Rezoning	0.826	31.1 (LOS C)	266.2	0.892	37.2 (LOS D)	320.6

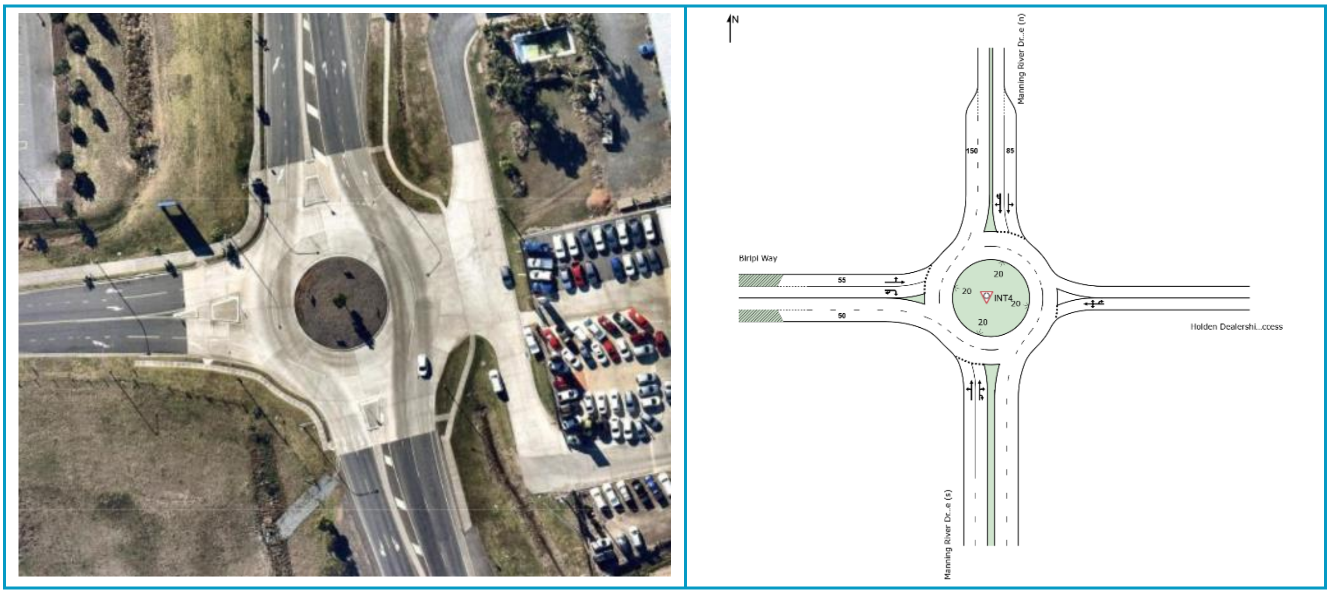
The SIDRA analysis results indicate that the intersection would operate satisfactorily in each of the 2025 / 2030 / 2040 scenarios. Notwithstanding this result, upgrading to the signalised configuration shown in Figure 11 is not proposed or recommended.

5.6 Biripi Way / Manning River Drive

The Biripi Way / Manning River Drive intersection was assessed in its current layout as a dual lane roundabout.

Existing SIDRA intersection layout is indicated alongside an aerial image in Figure 12.

Figure 12 Biripi Way / Manning River Drive – Assessed Intersection Layout



SIDRA analysis results are presented in Table 24.

Table 24 Biripi Way / Manning River Drive – SIDRA Outputs

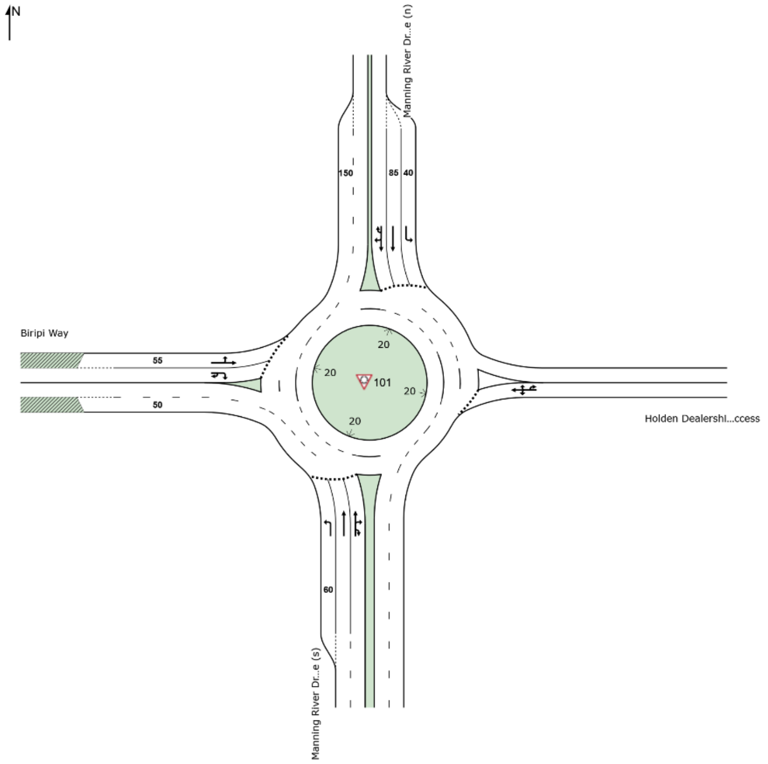
Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2018 Existing Conditions	0.502	4.5	23.0	0.443	4.5	18.2
2021 BG Growth & DEV	0.585	4.8	29.5	0.509	4.8	25.0
2021 BG Growth & DEV with Rezoning	0.629	4.8	34.1	0.526	4.8	26.7
2025 BG Growth & DEV with Rezoning	0.766	5.6	52.9	0.643	5.5	37.5
2030 BG Growth & DEV	0.783	5.7	56.0	0.696	5.9	44.4
2030 BG Growth & DEV with Rezoning	0.893	8.6	117.5	0.744	7.3	55.4
2040 BG Growth & DEV with Rezoning	1.116	58.1	822.5	1.017	25.9	264.0

SIDRA analysis results indicate that the existing intersection would operate satisfactorily for a roundabout (DOS of 0.85) in 2029 with the rezoning traffic.

To offset the impacts of the rezoning traffic and achieve a good operation at 2040, the roundabout requires short and dedicated left-turn lanes in the north and south approaches (including a third circulating lane from north to east and south to west).

The upgraded intersection layout is presented in Figure 13.

Figure 13 Biripi Way / Manning River Drive – Upgraded Intersection Layout



SIDRA analysis results for the upgraded layout are presented in Table 25.

Table 25 Biripi Way / Manning River Drive – Upgraded SIDRA Outputs

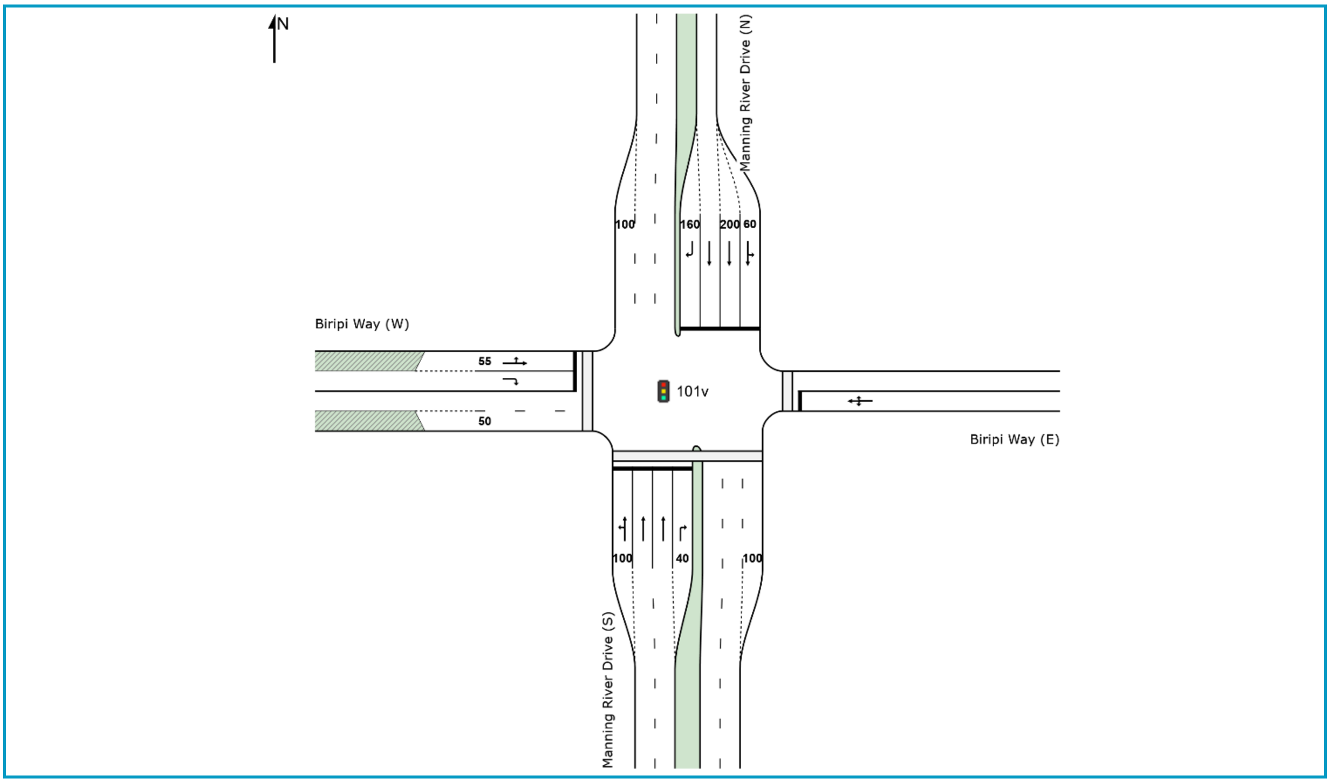
Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2030 BG Growth & DEV with Rezoning	0.725	6.1	47.9	0.623	6.3	34.7
2040 BG Growth & DEV with Rezoning	0.877	8.5	110.0	0.820	9.5	80.8

The SIDRA analysis results indicate that the upgraded roundabout layout (see Figure 13) would be able to accommodate the proposed rezoning traffic in 2030. By 2038 however, the intersection is expected to operate above the satisfactory threshold (DOS of 0.85).

Since the 2038 / 2040 horizon is so distant (18 / 20 years away) and the traffic volumes are based on very conservative assumptions (i.e. 2% pa growth), it would be unreasonable to implement intersection upgrading works for the 2038 / 2040 horizon. Therefore, the upgrading identified in Figure 14 could be delayed, and reconsidered, closer to the 2030 horizon.

Whilst the following is not considered to be a reasonable requirement of the rezoning, an assessment has been undertaken to determine a possible intersection arrangement to accommodate the background traffic and growth at the 2040 horizon. This signalised layout requires two through lanes on Manning River Drive in the southbound direction and three through lanes in the northbound direction with one short exit lane in the kerbside lane. This configuration is not a realistic outcome but has been identified for theoretic capacity reasons only. Phasing in the SIDRA analysis has been set to optimise for minimum delay.

Figure 14: Biripi Way / Manning River Drive – Ultimate Intersection Layout



SIDRA analysis results for the ultimate layout are presented in Table 26.

Table 26: Biripi Way / Manning River Drive – Ultimate SIDRA Outputs

Scenario	AM Peak			PM Peak		
	DOS	Average Delay (s)	95th %ile Queue (m)	DOS	Average Delay (s)	95th %ile Queue (m)
2040 BG Growth & DEV with Rezoning	0.890	30.1 (LOS C)	452.4 (South approach)	0.879	29.7 (LOS C)	316.9 (North approach)

The SIDRA analysis results indicate that the potential signalised intersection layout (see Figure 14) would accommodate the 2040 traffic forecasts satisfactorily and within the desired threshold. Notwithstanding this result, upgrading to the signalised configuration shown in Figure 14 is not proposed or recommended.

6 Road and Access Geometry

In the review of the traffic impacts of the planning proposal, consideration has been given to a number of road geometry related matters, in respect of proposed access arrangements for the subject land. These matters are discussed in the following sections.

6.1 Service Station Access

Whilst the access arrangements for the service station development will be assessed as part of a separate application, the preferred means of access for the potential service station would occur in two locations:

- Direct access / egress can be achieved on Manning River Drive via a left-in / left-out only driveway. The direct left-in access will need to provide enough queuing spaces to ensure that vehicles do not queue back onto Manning River Drive. The direct left-in / left-out driveways on Manning River Drive would provide the most efficient means of entry and exit for the majority of service station patrons. Such access (being left in and left out) is appropriate for the service station use on an arterial roadway. A visual assessment of the sight distances along the Manning River indicates that adequate visibility to / from the relevant driveways can be achieved to satisfy Austroads guidelines[2].
- Secondary access / egress for the service station site can be provided via the Road 3 connection to / from Glenthorne Road. This secondary access provides the opportunity for the service station site have entry from the east (from the Pacific Highway or Old Bar Road) and exit to the west (Taree) without the need for remote U-turns via the roundabouts on Manning River Drive.

6.2 Traffic Weave from Pacific Highway Ramps

Traffic exiting the Pacific Highway northbound and wanting to turn right into Glenthorne Road (to access the rezoning land) currently has an 80m length over which lane merging / weaving is permitted (i.e. to cross a dashed / broken lane line). The physical road form is such that this could be extended to a length of 130m (with revised line marking).

The Austroads guidelines suggest that weaving (or merge) across one traffic lane requires the following:

- a posted speed of 70km/h (design speed of 80km/h) requires a distance of 130m.
- a posted speed of 60km/h (design speed of 70km/h) across one traffic lane requires a distance of 113m.

Therefore, appropriate weaving distance can be achieved by minor revisions to the line marking and/or a reduction of the posted speed limit on Manning River Drive to 60km/h in this location. Given the adjacent land uses, intersection configurations and traffic volumes in this location, a reduced speed limit of 60km/h would be appropriate.

6.3 Future Connection West to / from Manning River Drive

This potential new road is identified on the potential future subdivision plan as Road 1 and would also provide a link between Manning River Drive and Glenthorne Road via part of Eriksson Lane. This would provide secondary connections to / from the north (Taree) for all of the rezoning land.

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[2] Subject to detailed design of the service station.

An alternative alignment for this connection has previously been considered, but this is beyond the land ownership controls of the planning proposal. This alternative new road could potentially connect between Eriksson Lane and Manning River Drive through Site A. This would also provide a link through to Glenthorne Road via Site C. An indicative concept for this is indicated in Figure 15.

Figure 15 Future Road Connections

This potential future connection would provide improved accessibility of the rezoning land to the other industrial / specialised retail premises precinct within the overall DCP area. It would also provide better connections to / from the north (Taree) without the need to use the intersections at The Buckets Way / Manning River Drive and Glenthorne Road / Manning River Drive. The road connection could be incorporated within Council's future plans for a service road that connects the existing industrial properties along the eastern side of Manning River Drive to the Manning River Drive / Biripi Way roundabout (eastern leg). It is recognised that further planning and concept design for such a road connection would be needed in the future.

6.4 Pedestrian and Cyclist Connections

The new roadways within the potential development of the rezoning land can include an appropriate network of pathways within the road verge (or within open space corridors). These pathways would facilitate pedestrians and cyclists. It would be desirable for such pathways to connect with other (existing and planned) pathways along Manning River Drive. In particular, connection as part of the potential future road connecting to the Manning River Drive / Biripi Way roundabout (eastern leg) will provide a valuable pedestrian and cyclist link.

In addition, it is understood that Midcoast Council is proposing to develop an off-road cycleway from Taree to Old Bar through parts of Khappinghat National Park's existing road and trail system and other public land. While the route has not yet been confirmed, a dedicated off-road facility in the vicinity of the site will enable cycle trips to be made from further afield.

7 Conclusion

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Jasbe Glenthorne & Mulgrave Trust (in the care of Blue Sky Planning and Environment) to prepare a traffic assessment and report to accompany a Rezoning Application for land on Manning River Drive, at Taree South.

This document has been prepared to inform the Midcoast Council and Transport for NSW (previously RMS) assessment of the application by identifying and addressing the traffic and transport matters relevant to the Rezoning Application, including the presentation of suitable mitigation strategies to offset any impact of the rezoning traffic.

A subsequent and separate application is expected to be made for a potential service station on the south east corner of the rezoned land (Stage 1 within Site D). This report does not include detailed review of any on site layout or parking elements of the planning proposal, as this will from part of the subsequent applications to Council.

The assessment outlined herein considered the traffic impacts of the rezoning, which will potentially comprise a mix of industrial and specialised retail premises land uses as well as a service station. The adopted traffic forecasts are considered to be very conservative, given that land development (including land use type and yield) will be driven by market demands over the next 20 or so years. In addition, the traffic forecasts include 2% per annum growth in existing traffic, added to the rezoning land traffic and the background development traffic estimated for the Manning River Drive Business Park (DCP area).

The forecasts represent the 2020, 2025, 2030 and 2040 future horizon years (including 2% annual background growth and the adjacent Manning River Drive Business Park).

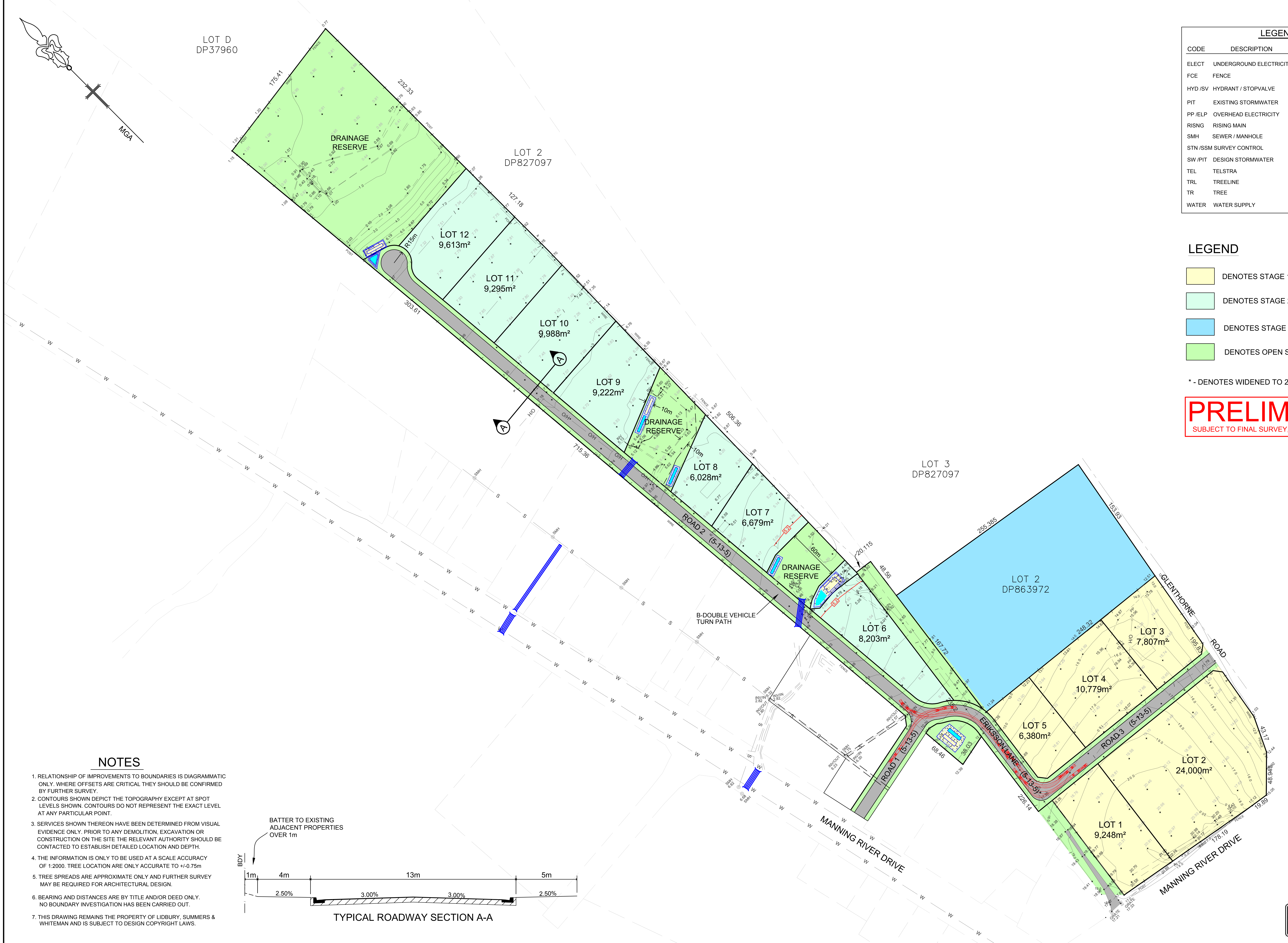
SIDRA intersection assessment has concluded the following, recognising that the background traffic growth assumptions are conservative:

- Glenthorne Road / Manning River Drive / Caltex Service Station:
    - The existing roundabout form can accommodate the rezoning traffic up until at least 2035 (a 20-year horizon).
    - Beyond 2035, some minor expansion works (two short and dedicated left-turn lanes) would be required to accommodate the 2040 horizon traffic.
- Old Bar Road / Manning River Drive / Pacific Highway Ramps:
    - The existing roundabout form can accommodate the rezoning traffic up until about 2027.
    - With background development and growth only (i.e. ignoring the rezoning traffic), the existing roundabout form would be adequate until about 2030.
    - Beyond 2027, a minor upgrade of the existing roundabout (short additional lane on the eastern approach, plus additional circulating lane between the eastern and southern legs) would be needed to accommodate the impact of the rezoning traffic to about 2037. The latter is considered to be a reasonable requirement of the proposed rezoning.
    - To accommodate the 2040 traffic, and beyond, upgrading to a full two-lane circulating roundabout would be needed. The latter is not considered to be a reasonable requirement of the proposed rezoning.
- The Bucketts Way / Manning River Drive:

  - The existing roundabout form can not accommodate traffic at the 2021 horizon, irrespective of the rezoning traffic.
  - Beyond 2021, an upgrade of the existing roundabout (short additional left turn lane on the western approach, plus a continuous left turn slip lane from the northern approach) would be needed to offset the impact of the rezoning traffic. The latter is considered to be a reasonable requirement of the proposed rezoning.
  - To accommodate the significant background traffic up to a 2030 and 2040 horizon, substantial upgrading of the roundabout (or complete replacement with an alternative intersection form) would be needed. The latter is not considered to be a reasonable requirement of the proposed rezoning.
- Biripi Way / Manning River Drive:
  - The existing roundabout form can accommodate the rezoning traffic up until about 2029.
  - Beyond 2029, an upgrade of the existing roundabout (additional short left-turn lane on the south approach, plus additional circulating lane between the south and west approaches, plus additional short left turn lane on the north approach, plus additional circulating lane between north and east approaches) would be needed to offset the impact of the rezoning traffic. The latter is considered to be a reasonable requirement of the proposed rezoning.
  - Since the above upgrading is only needed to accommodate traffic beyond 2029, it would be appropriate to delay such upgrading until a reconsideration closer to the 2029 horizon.
  - To accommodate the significant background traffic up to 2040 horizon, substantial upgrading of the roundabout (or complete replacement with an alternative intersection form) would be needed by 2038. The latter is not considered to be a reasonable requirement of the proposed rezoning.

APPENDIX A

Road and Drainage Strategy



B-DOUBLE VEHICLE TURN PATH

LEGEND

CODE	DESCRIPTION	LINETYPE
ELECT	UNDERGROUND ELECTRICITY	——— UG —
FCE	FENCE	—/—/—/—/—
HYD /SV	HYDRANT / STOPVALVE	Ⓗ ⓧ
PIT	EXISTING STORMWATER	▤ ═══ ═══ ═══ =
PP /ELP	OVERHEAD ELECTRICITY	⊙ ——— O/H ———
RISNG	RISING MAIN	——— RM ———
SMH	SEWER / MANHOLE	◎ ——S——S——
STN /SSM	SURVEY CONTROL	△ ◷ ———
SW /PIT	DESIGN STORMWATER	▥ ▬▭▬▭▬
TEL	TELSTRA	⊡ ——T——
TRL	TREELINE	︵︵︵︵︵
TR	TREE	✲
WATER	WATER SUPPLY	——— W ———

LEGEND

🟨	DENOTES STAGE 1 (LOTS 1 - 5)
🟦	DENOTES STAGE 2 (LOTS 6 - 12)
🟦	DENOTES STAGE 3 (FUTURE)
🟩	DENOTES OPEN SPACE / DRAINAGE RESERVE

* - DENOTES WIDENED TO 23m ROAD RESERVE

PRELIMINARY

SUBJECT TO FINAL SURVEY, DESIGN & APPROVAL

NOTES

1. RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE OFFSETS ARE CRITICAL THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.
2. CONTOURS SHOWN DEPICT THE TOPOGRAPHY EXCEPT AT SPOT LEVELS SHOWN. CONTOURS DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT.
3. SERVICES SHOWN THEREON HAVE BEEN DETERMINED FROM VISUAL EVIDENCE ONLY. PRIOR TO ANY DEMOLITION, EXCAVATION OR CONSTRUCTION ON THE SITE THE RELEVANT AUTHORITY SHOULD BE CONTACTED TO ESTABLISH DETAILED LOCATION AND DEPTH.
4. THE INFORMATION IS ONLY TO BE USED AT A SCALE ACCURACY OF 1:2000. TREE LOCATION ARE ONLY ACCURATE TO +/-0.75m
5. TREE SPREADS ARE APPROXIMATE ONLY AND FURTHER SURVEY MAY BE REQUIRED FOR ARCHITECTURAL DESIGN.
6. BEARING AND DISTANCES ARE BY TITLE AND/OR DEED ONLY. NO BOUNDARY INVESTIGATION HAS BEEN CARRIED OUT.
7. THIS DRAWING REMAINS THE PROPERTY OF LIDBURY, SUMMERS & WHITEMAN AND IS SUBJECT TO DESIGN COPYRIGHT LAWS.

BATTER TO EXISTING
ADJACENT PROPERTIES
OVER 1m

TYPICAL ROADWAY SECTION A-A

NOTE: The contractor shall check and verify all works on site (including works by others) before commencing any works. All discrepancies are to be reported to the Project Manager or Lidbury, Summers & Whiteman prior to commencing work. Do not scale dimensions from the plan. All dimensions to be confirmed by dimensions from the plan. All dimensions to be confirmed by Lidbury, Summers & Whiteman.

HORIZONTAL
CO-ORDINATE SYSTEM: MGA
MARKS ADOPTED: SSM 33707
EAST: 449803.703 NORTH: 6465898.949

PLOT FILE/DWG No.:
F:\DATA5DWG\12013PROPOSAL.DWG

VERTICAL
DATUM: AHD
BENCHMARK: SSM33707
R.L.: 20.399

DRAWN/CHECKED:
MG

PRELIMINARY ROAD AND DRAINAGE STRATEGY
LOT 50 DP 863972, LOT 2 DP 827097 & LOT 20 DP836884 ERIKSSON LANE, GLENTHORNE
SUBDIVISION PROPOSAL PLAN

LS&W LIDBURY, SUMMERS & WHITEMAN
CONSULTING SURVEYORS, PLANNERS & ENGINEERS
INCORPORATING DEGOTARDI, SMITH & PARTNERS (FORSTER)
1st FLOOR, 3 WHARF ST. FORSTER 2428 (02) 65547988 FAX (02) 65549378
PO BOX 510 FORSTER NSW 2428 EMAIL consult@lswsurveyors.com.au WEBSITE www.lswsurveyors.com.au

SCALES
HORIZONTAL: 1:2000
VERTICAL: N/A
SHEET SIZE: A1

FIELD SHEETS
Date of survey: 25/11/19

COUNCIL:
MID - COAST
DA NUMBER:

DATE:
26/11/19

SHEET 1 OF 1

FILE No.:
12013

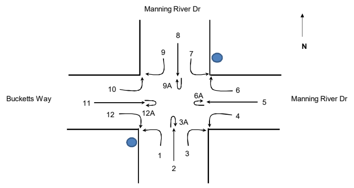
ISSUE	DATE	COMMENTS
A	15/01/20	FIRST ISSUE
B	24/01/20	SECOND ISSUE
C	31/01/20	THIRD ISSUE
D	31/03/20	FOURTH ISSUE

APPENDIX B

Base Traffic Counts

austraffic

Client : SLR Consulting
Job : SLR Taree Traffic Counts Counts Survey
Day/Date : Thursday, 26 July 2018
Survey Location : The Bucketts Way & Manning River Dr
Weather : Fine



AM

Time	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Total of all Movements	Peak Hour Volume Determination	
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total			
6:00 - 6:15	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	6	0	6	44	4	48	0	0	0	50	6	56	0	0	0	3	1	4	1	0	1	3	1	4	14	4	18	0	0	0	0	0	0	139	6:00 - 7:00	848
6:15 - 6:30	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	6	0	6	78	6	84	1	0	1	53	12	65	2	0	2	1	4	5	1	0	1	18	2	20	13	3	16	0	0	0	0	0	0	201	6:15 - 7:15	931
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Total	2	0	2	17	2	19	10	1	11	1	0	1	16	0	16	147	29	176	2149	87	2236	2	0	2	926	138	1064	42	4	46	110	27	137	24	3	27	315	22	337	217	26	243	6	0	6	0	0	0	4323		
AM Peak	0	0	0	6	2	8	6	0	6	1	0	1	13	0	13	72	12	84	1112	35	1147	1	0	1	368	44	412	29	1	30	53	9	62	12	2	14	166	11	177	108	7	115	4	0	4	0	0	0	2074		

PM

Time	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Total of all Movements	Peak Hour Volume Determination	
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total			
14:00 - 14:15	1	0	1	3	0	3	4	0	4	0	0	0	3	0	3	11	1	12	115	9	124	1	0	1	157	7	164	7	0	7	28	1	29	5	0	5	14	0	14	9	1	10	3	0	3	0	0	0	380	14:00 - 15:00	1674
14:15 - 14:30	0	0	0	5	0	5	1	0	1	0	0	0	1	0	1	10	4	14	122	13	135	0	0	0	160	9	169	4	0	4	27	0	27	3	1	4	18	2	20	13	8	21	0	0	0	0	0	0	401	14:15 - 15:15	1748
14:30 - 14:45	0	0	0	7	0	7	2	0	2	0	0	0	3	0	3	16	1	17	144	8	152	0	0	0	165	5	170	5	0	5	28	3	31	3	1	4	24	4	28	14	0	14	0	0	0	0	0	0	433	14:30 - 15:30	1839
14:45 - 15:00	0	0	0	7	0	7	2	0	2	0	0	0	2	0	2	15	2	17	138	17	155	0	0	0	178	8	186	7	0	7	37	1	38	2	0	2	24	1	25	15	3	18	1	0	1	0	0	0	460	14:45 - 15:45	1939
15:00 - 15:15	0	0	0	7	1	8	2	0	2	0	0	0	1	0	1	14	7	21	133	7	140	2	0	2	182	9	191	6	0	6	35	0	35	4	0	4	23	1	24	19	1	20	0	0	0	0	0	0	454	15:00 - 16:00	2016
15:15 - 15:30	1	0	1	12	1	13	0	0	0	0	0	0	1	0	1	28	2	30	157	7	164	1	0	1	194	4	198	3	1	4	29	0	29	1	0	1	27	6	33	13	4	17	0	0	0	0	0	0	492	15:15 - 16:15	2113
15:30 - 15:45	0	0	0	2	0	2	2	0	2	0	0	0	2	0	2	23	4	27	153	9	162	1	0	1	259	8	267	3	0	3	24	2	26	2	0	2	23	1	24	13	2	15	0	0	0	0	0	0	533	15:30 - 16:30	2117
15:45 - 16:00	0	0	0	3	0	3	0	0	0	0	0	0	3	0	3	19	1	20	154	7	161	0	0	0	247	13	260	5	1	6	40	2	42	4	0	4	21	3	24	13	1	14	0	0	0	0	0	0	537	15:45 - 16:45	2095
16:00 - 16:15	2	0	2	7	0	7	4	0	4	0	0	0	2	0	2	20	3	23	142	7	149	1	0	1	273	8	281	6	0	6	35	1	36	6	0	6	17	0	17	17	0	17	0	0	0	0	0	0	551	16:00 - 17:00	2002
16:15 - 16:30	0	0	0	11	0	11	1	0	1	1	0	1	6	0	6	27	1	28	142	7	149	0	0	0	218	6	224	6	0	6	30	0	30	4	0	4	21	1	22	13	1	14	0	0	0	0	0	0	496	16:15 - 17:15	1993
16:30 - 16:45	1	0	1	7	0	7	2	0	2	1	0	1	0	0	0	21	1	22	134	9	143	0	0	0	235	6	241	8	0	8	41	1	42	3	0	3	16	1	17	23	1	24	0	0	0	0	0	0	511	16:30 - 17:30	2004
16:45 - 17:00	0	0	0	4	0	4	4	0	4	0	0	0	1	0	1	18	0	18	120	7	127	0	0	0	219	5	224	3	0	3	26	0	26	2	0	2	13	1	14	20	1	21	0	0	0	0	0	0	444	16:45 - 17:45	1928
17:00 - 17:15	1	0	1	9	0	9	4	0	4	0	0	0	2	0	2	22	1	23	117	8	125	1	0	1	269	5	274	2	0	2	53	0	53	2	0	2	26	1	27	14	4	18	1	0	1	0	0	0	542	17:00 - 18:00	1799
17:15 - 17:30	1	0	1	7	0	7	0	0	0	0	0	0	0	0	0	21	0	21	110	5	115	0	0	0	283	3	286	4	1	5	42	0	42	1	0	1	14	0	14	14	1	15	0	0	0	0	0	0	507	PM Peak	2117
17:30 - 17:45	2	0	2	8	0	8	3	0	3	0	0	0	2	0	2	20	1	21	120	4	124	0	0	0	192	5	197	3	0	3	34	0	34	5	0	5	17	0	17	19	0	19	0	0	0	0	0	0	435		
17:45 - 18:00	0	0	0	2	0	2	3	0	3	0	0	0	1	0	1	15	0	15	78	5	83	0	0	0	156	5	161	1	0	1	21	0	21	1	0	1	9	2	11	14	1	15	1	0	1	0	0	0	315		
Total	9	0	9	101	2	103	34	0	34	2	0	2	30	0	30	300	29	329	2079	129	2208	7	0	7	3387	106	3493	73	3	76	530	11	541	48	2	50	307	24	331	243	29	272	6	0	6	0	0	0	7491		
PM Peak	2	0	2	23	0	23	7	0	7	1	0	1	13	0	13	89	9	98	591	30	621	2	0	2	997	35	1032	20	1	21	129	5	134	16	0	16	82	5	87	56	4	60	0	0	0	0	0	0	2117		

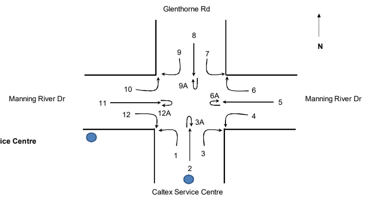
HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 7:00	1	0	1	3	0	3	0	0	0	0	0	0	1	0	1	25	4	29	392	24	416	1	0	1	216	37	253	2	0	2	16	6	22	2	1	3	56	4	60	45	11	56	1	0	1	0	0	0	761	87	848
6:15 - 7:15	1	0	1	4	0	4	1	0	1	0	0	0	0	0	0	27	6	33	446	29	475	1	0	1	223	45	268	4	0	4	16	9	25	1	1	2	60	3	63	45	8	53	1	0	1	0	0	0	830	101	931
6:30 - 7:30	1	0	1	3	0	3	2	0	2	0	0	0	0	0	0	35	11	46	505	30	535	0	0	0	255	49	304	3	0	3	20	10	30	1	1	2	65	3	68	48	8	56	2	0	2	0	0	0	940	112	1052
6:45 - 7:45	2	0	2	3	0	3	2	1	3	0	0	0	0	0	0	37	13	50	585	30	615	0	0	0	299	58	357	5	2	7	25	11	36	4	0	4	78	6	84	56	8	64	1	0	1	0	0	0	1097	129	1226
7:00 - 8:00	1	0	1	3	0	3	2	1	3	1	0	1	3	0	3	40	15	55	744	29	773	0	0	0	335	58	393	11	2	13	33	13	46	6	1	7	101	9	110	75	9	84	2	0	2	0	0	0	1357	137	1494
7:15 - 8:15	1	0	1	4	1	5	3	1	4	1	0	1	3	0	3	48	13	61	936	28	964	1	0	1	375	54	429	15	2	17	47	11	58	7	2	9	124	10	134	98	10	108	2	0	2	0	0	0	1665	132	1797
7:30 - 8:30	1	0	1	5	1	6	4	1	5	1	0	1	8	0	8	62	12	74	1087	36	1123	1	0	1	364	53	417	22	2	24	50	7	57	9	2	11	151	11	162	105	9	114	3	0	3	0	0	0	1873	134	2007
7:45 - 8:45	0	0	0	6	2	8	6	0	6	1	0	1	13	0	13	72	12	84	1112	35	1147	1	0	1	368	44	412	29	1	30	53	9	62	12	2	14	166	11	177	108	7	115	4	0	4	0	0	0	1951	123	2074
8:00 - 9:00	0	0	0	11	2	13	8	0	8	0	0	0	12	0	12	82	10	92	1013	34	1047	1	0	1	375	43	418	29	2	31	61	8	69	16	1	17	158	9	167	97	6	103	3	0	3	0	0	0	1866	115	1981

HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 15:00	1	0	1	22	0	22	9	0	9	0	0	0	9	0	9	52	8	60	519	47	566	1	0	1	660	29	689	23	0	23	120	5	125	13	2	15	80	7	87	51	12	63	4	0	4	0	0	0	1564	110	1674
14:15 - 15:15	0	0	0	26	1	27	7	0	7	0	0	0	7	0	7	55	14	69	537	45	582	2	0	2	685	31	716	22	0	22	127	4	131	12	2	14	89	8	97	61	12	73	1	0	1	0	0	0	1631	117	1748
14:30 - 15:30	1	0	1	33	2	35	6	0	6	0	0	0	7	0	7	73	12	85	572	39	611	3	0	3	719	26	745	21	1	22	129	4	133	10	1	11	98	12	110	61	8	69	1	0	1	0	0	0	1734	105	1839
14:45 - 15:45	1	0	1	28	2	30	6	0	6	0	0	0	6	0	6	80	15	95	581	40	621	4	0	4	813	29	842	19	1	20	125	3	128	9	0	9	97	9	106	60	10	70	1	0	1	0	0	0	1830	109	1939
15:00 - 16:00	1	0	1	24	2	26	4	0	4	0	0	0	7	0	7	84	14	98	597	30	627	4	0	4	882	34	916	17	2	19	128	4	132	11	0	11	94	11	105	58	8	66	0	0	0	0	0	0	1911	105	2016
15:15 - 16:15	3	0	3	24	1	25	6	0	6	0	0	0	8	0	8	90	10	100	606	30	636	3	0	3	973	33	1006	17	2	19	128	5	133	13	0	13	88	10	98	56	7	63	0	0	0	0	0	0	2015	98	2113
15:30 - 16:30	2	0	2	23	0	23	7	0	7	1	0	1	13	0	13	89	9	98	591	30	621	2	0	2	997	35	1032	20	1	21	129	5	134	16	0	16	82	5	87	56	4	60	0	0	0	0	0	0	2028	89	2117
15:45 - 16:45	3	0	3	28	0	28	7	0	7	2	0	2	11	0	11	87	6	93	572	30	602	1	0	1	973	33	1006	25	1	26	146	4	150	17	0	17	75	5	80	66	3	69	0	0	0	0	0	0	2013	82	2095
16:00 - 17:00	3	0	3	29	0	29	11	0	11	2	0	2	9	0	9	86	5	91	538	30	568	1	0	1	945	25	970	23	0	23	132	2	134	15	0	15	67	3	70	73	3	76	0	0	0	0	0	0	1934	68	2002
16:15 - 17:15	2	0	2	31	0	31	11	0	11	2	0	2	9	0	9	88	3	91	513	31	544	1	0	1	941	22	963	19	0	19	150	1	151	11	0	11	76	4	80	70	7	77	1	0	1	0	0	0	1925	68	1993
16:30 - 17:30	3	0	3	27	0	27	10	0	10	1	0	1	3	0	3	82	2	84	481	29	510	1	0	1	1006	19	1025	17	1	18	162	1	163	8	0	8	69	3	72	71	7	78	1	0	1	0	0	0	1942	62	2004
16:45 - 17:45	4	0	4	28	0	28	11	0	11	0	0	0	5	0	5	81	2	83	467	24	491	1	0	1	963	18	981	12	1	13	155	0	155	10	0	10	70	2	72	67	6	73	1	0	1	0	0	0	1875	53	1928
17:00 - 18:00	4	0	4	26	0	26	10	0	10	0	0	0	5	0	5	78	2	80	425	22	447	1	0	1	900	18	918	10	1	11	150	0	150	9	0	9	66	3	69	61	6	67	2	0	2	0	0	0	1747	52	1799

Client : SLR Consulting
Job : SLR Taree Traffic Counts Counts Survey
Day/Date : Thursday, 26 July 2018
Survey Location : Manning River Dr & Glenthorne Rd & McDonalds & Caltex Service Centre
Weather : Fine



AM

Time Period	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Total of all Movements	Peak Hour Volume Determination	
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total			
6:00 - 6:15	5	1	6	0	0	0	21	7	28	0	1	1	20	4	24	43	4	47	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	48	8	56	16	3	19	0	0	0	182	6:00 - 7:00	993
6:15 - 6:30	18	2	20	0	0	0	21	8	29	0	0	0	25	6	31	65	4	69	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	50	11	61	15	4	19	0	0	0	231	6:15 - 7:15	1076
6:30 - 6:45	16	4	20	0	0	0	27	6	33	0	0	0	36	6	42	117	3	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	56	12	68	15	1	16	0	0	0	299	6:30 - 7:30	1181
6:45 - 7:00	23	4	27	0	0	0	21	7	28	0	0	0	26	2	28	123	7	130	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	9	47	19	1	20	1	0	1	281	6:45 - 7:45	1334
7:00 - 7:15	12	2	14	0	0	0	17	4	21	0	0	0	26	4	30	101	9	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	15	76	13	1	14	0	0	0	265	7:00 - 8:00	1577
7:15 - 7:30	9	1	10	0	0	0	22	2	24	0	0	0	29	5	34	141	10	151	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	82	14	96	18	2	20	0	0	0	336	7:15 - 8:15	1856
7:30 - 7:45	15	2	17	0	0	0	42	5	47	0	0	0	30	3	33	199	9	208	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	95	18	113	28	4	32	0	0	0	452	7:30 - 8:30	2046
7:45 - 8:00	20	3	23	0	0	0	34	6	40	0	0	0	41	3	44	281	8	289	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	94	12	106	17	2	19	0	0	0	524	7:45 - 8:45	2076
8:00 - 8:15	30	0	30	0	0	0	33	4	37	0	0	0	37	2	39	284	9	293	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	114	10	124	19	0	19	1	0	1	544	8:00 - 9:00	1972
8:15 - 8:30	21	2	23	2	0	2	34	3	37	0	0	0	30	1	31	293	17	310	0	1	1	1	0	1	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	91	18	109	10	0	10	0	0	0	526	AM Peak	2076
8:30 - 8:45	14	2	16	1	0	1	25	3	28	0	0	0	34	7	41	249	7	256	0	0	0	1	0	1	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	107	11	118	18	0	18	0	0	0	482		
8:45 - 9:00	12	2	14	0	0	0	25	2	27	0	0	0	37	2	39	205	6	211	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	106	6	112	12	3	15	0	0	0	420		
Total	195	25	220	3	0	3	322	57	379	0	1	1	371	45	416	2101	93	2194	3	1	4	3	0	3	4	0	4	1	0	1	5	0	5	0	0	0	3	0	3	942	144	1086	200	21	221	2	0	2	4542		
AM Peak	85	7	92	3	0	3	126	16	142	0	0	0	142	13	155	1107	41	1148	0	1	1	2	0	2	4	0	4	0	0	0	4	0	4	0	0	0	1	0	1	406	51	457	64	2	66	1	0	1	2076		

PM

Time Period	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Total of all Movements	Peak Hour Volume Determination	
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total			
14:00 - 14:15	23	0	23	0	0	0	51	4	55	0	0	0	39	2	41	108	10	118	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	140	6	146	30	2	32	1	0	1	419	14:00 - 15:00	1767
14:15 - 14:30	13	0	13	0	0	0	44	3	47	0	0	0	37	5	42	115	16	131	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	152	12	164	20	3	23	1	0	1	423	14:15 - 15:15	1820
14:30 - 14:45	19	1	20	0	0	0	44	5	49	0	0	0	41	5	46	144	8	152	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0	171	6	177	14	1	15	0	0	0	461	14:30 - 15:30	1870
14:45 - 15:00	9	2	11	0	0	0	48	5	53	0	0	0	25	5	30	144	16	160	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	174	10	184	25	1	26	0	0	0	464	14:45 - 15:45	1960
15:00 - 15:15	13	3	16	0	0	0	48	8	56	0	0	0	25	4	29	138	13	151	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	1	0	1	185	6	191	22	4	26	0	0	0	472	15:00 - 16:00	2057
15:15 - 15:30	19	2	21	0	0	0	39	2	41	0	0	0	24	6	30	159	7	166	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	184	6	190	19	2	21	1	0	1	473	15:15 - 16:15	2135
15:30 - 15:45	19	4	23	0	0	0	46	4	50	0	0	0	37	0	37	149	6	155	0	0	0	0	0	0	1	0	1	0	0	0	2	0	2	0	0	0	5	0	5	231	10	241	37	0	37	0	0	0	551	15:30 - 16:30	2166
15:45 - 16:00	14	0	14	0	0	0	51	0	51	0	0	0	41	2	43	162	11	173	0	0	0	0	0	0	1	0	1	0	0	0	2	0	2	0	0	0	0	0	0	227	14	241	35	0	35	1	0	1	561	15:45 - 16:45	2115
16:00 - 16:15	18	1	19	0	0	0	49	0	49	0	0	0	28	4	32	152	8	160	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	248	7	255	32	1	33	1	0	1	550	16:00 - 17:00	2034
16:15 - 16:30	19	0	19	0	0	0	50	1	51	0	0	0	27	2	29	149	8	157	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	207	6	213	30	0	30	1	0	1	504	16:15 - 17:15	1999
16:30 - 16:45	19	1	20	0	0	0	35	1	36	0	0	0	33	5	38	136	10	146	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	228	8	236	21	0	21	1	0	1	500	16:30 - 17:30	2014
16:45 - 17:00	22	1	23	0	0	0	51	7	58	0	0	0	29	4	33	119	5	124	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	206	6	212	29	0	29	0	0	0	480	16:45 - 17:45	1953
17:00 - 17:15	17	0	17	0	0	0	31	1	32	0	0	0	21	4	25	124	10	134	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	2	0	2	272	9	281	23	0	23	0	0	0	515	17:00 - 18:00	1804
17:15 - 17:30	12	0	12	0	0	0	43	4	47	0	0	0	38	6	44	116	4	120	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	262	3	265	29	1	30	0	0	0	519	PM Peak	2166
17:30 - 17:45	18	1	19	0	0	0	30	6	36	0	0	0	34	2	36	122	5	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	190	5	195	26	0	26	0	0	0	439		
17:45 - 18:00	14	0	14	0	0	0	35	3	38	0	0	0	19	1	20	80	4	84	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	146	6	152	22	0	22	0	0	0	331		
Total	268	16	284	0	0	0	695	54	749	0	0	0	498	57	555	2117	141	2258	2	0	2	3	0	3	5	1	6	0	0	0	11	0	11	0	0	0	15	0	15	3223	120	3343	414	15	429	7	0	7	7662		
PM Peak	70	5	75	0	0	0	196	5	201	0	0	0	133	8	141	612	33	645	1	0	1	0	0	0	2	1	3	0	0	0	4	0	4	0	0	0	8	0	8	913	37	950	134	1	135	3	0	3	2166		

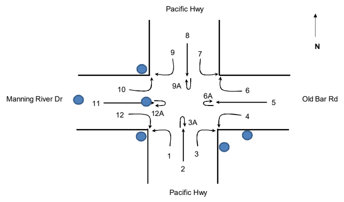
HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 7:00	62	11	73	0	0	0	90	28	118	0	1	1	107	18	125	348	18	366	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	1	0	1	192	40	232	65	9	74	1	0	1	868	125	993
6:15 - 7:15	69	12	81	0	0	0	86	25	111	0	0	0	113	18	131	406	23	429	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	205	47	252	62	7	69	1	0	1	944	132	1076
6:30 - 7:30	60	11	71	0	0	0	87	19	106	0	0	0	117	17	134	482	29	511	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	237	50	287	65	5	70	1	0	1	1050	131	1181
6:45 - 7:45	59	9	68	0	0	0	102	18	120	0	0	0	111	14	125	564	35	599	2	0	2	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	276	56	332	78	8	86	1	0	1	1194	140	1334
7:00 - 8:00	56	8	64	0	0	0	115	17	132	0	0	0	126	15	141	722	36	758	2	0	2	1	0	1	1	0	1	0	0	0	1	0	1	0	0	0	1	0	1	332	59	391	76	9	85	0	0	0	1433	144	1577
7:15 - 8:15	74	6	80	0	0	0	131	17	148	0	0	0	137	13	150	905	36	941	2	0	2	1	0	1	1	0	1	0	0	0	2	0	2	0	0	0	1	0	1	385	54	439	82	8	90	1	0	1	1722	134	1856
7:30 - 8:30	86	7	93	2	0	2	143	18	161	0	0	0	138	9	147	1057	43	1100	1	1	2	2	0	2	1	0	1	0	0	0	4	0	4	0	0	0	1	0	1	394	58	452	74	6	80	1	0	1	1904	142	2046
7:45 - 8:45	85	7	92	3	0	3	126	16	142	0	0	0	142	13	155	1107	41	1148	0	1	1	2	0	2	4	0	4	0	0	0	4	0	4	0	0	0	1	0	1	406	51	457	64	2	66	1	0	1	1945	131	2076
8:00 - 9:00	77	6	83	3	0	3	117	12	129	0	0	0	138	12	150	1031	39	1070	1	1	2	2	0	2	3	0	3	0	0	0	3	0	3	0	0	0	1	0	1	418	45	463	59	3	62	1	0	1	1854	118	1972

HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 15:00	64	3	67	0	0	0	187	17	204	0	0	0	142	17	159	511	50	561	1	0	1	1	0	1	2	0	2	0	0	0	1	0	1	0	0	0	2	0	2	637	34	671	89	7	96	2	0	2	1639	128	1767
14:15 - 15:15	54	6	60	0	0	0	184	21	205	0	0	0	128	19	147	541	53	594	1	0	1	0	0	0	2	0	2	0	0	0	3	0	3	0	0	0	1	0	1	682	34	716	81	9	90	1	0	1	1678	142	1820
14:30 - 15:30	60	8	68	0	0	0	179	20	199	0	0	0	115	20	135	585	44	629	0	0	0	2	0	2	1	0	1	0	0	0	3	0	3	0	0	0	2	0	2	714	28	742	80	8	88	1	0	1	1742	128	1870
14:45 - 15:45	60	11	71	0	0	0	181	19	200	0	0	0	111	15	126	590	42	632	0	0	0	2	0	2	1	0	1	0	0	0	4	0	4	0	0	0	7	0	7	774	32	806	103	7	110	1	0	1	1834	126	1960
15:00 - 16:00	65	9	74	0	0	0	184	14	198	0	0	0	127	12	139	608	37	645	0	0	0	2	0	2	2	0	2	0	0	0	6	0	6	0	0	0	7	0	7	827	36	863	113	6	119	2	0	2	1943	114	2057
15:15 - 16:15	70	7	77	0	0	0	185	6	191	0	0	0	130	12	142	622	32	654	0	0	0	2	0	2	2	1	3	0	0	0	4	0	4	0	0	0	6	0	6	890	37	927	123	3	126	3	0	3	2037	98	2135
15:30 - 16:30	70	5	75	0	0	0	196	5	201	0	0	0	133	8	141	612	33	645	1	0	1	0	0	0	2	1	3	0	0	0	4	0	4	0	0	0	8	0	8	913	37	950	134	1	135	3	0	3	2076	90	2166
15:45 - 16:45	70	2	72	0	0	0	185	2	187	0	0	0	129	13	142	599	37	636	1	0	1	0	0	0	1	1	2	0	0	0	4	0	4	0	0	0	3	0	3	910	35	945	118	1	119	4	0	4	2024	91	2115
16:00 - 17:00	78	3	81	0	0	0	185	9	194	0	0	0	117	15	132	556	31	587	1	0	1	0	0	0	0	1	1	0	0	0	3	0	3	0	0	0	3	0	3	889	27	916	112	1	113	3	0	3	1947	87	2034
16:15 - 17:15	77	2	79	0	0	0	167	10	177	0	0	0	110	15	125	528	33	561	1	0	1	0	0	0	0	0	0	0	0	0	4	0	4	0	0	0	5	0	5	913	29	942	103	0	103	2	0	2	1910	89	1999
16:30 - 17:30	70	2	72	0	0	0	160	13	173	0	0	0	121	19	140	495	29	524	0	0	0	0	0	0	1	0	1	0	0	0	4	0	4	0	0	0	2	0	2	968	26	994	102	1	103	1	0	1	1924	90	2014
16:45 - 17:45	69	2	71	0	0	0	155	18	173	0	0	0	122	16	138	481	24	505	0	0	0	0	0	0	1	0	1	0	0	0	2	0	2	0	0	0	2	0	2	930	23	953	107	1	108	0	0	0	1869	84	1953
17:00 - 18:00	61	1	62	0	0	0	139	14	153	0	0	0	112	13	125	442	23	465	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	3	0	3	870	23	893	100	1	101	0	0	0	1729	75	1804

Client : SLR Consulting
Job : SLR Taree Traffic Counts Counts Survey
Day/Date : Thursday, 26 July 2018
Survey Location : Manning River Dr & Old Bar Rd & Pacific Hwy
Weather : Fine



AM

Time	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A		
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 6:15	26	5	31	0	0	0	1	1	2	0	0	0	14	0	14	23	1	24	12	3	15	0	0	0
6:15 - 6:30	49	7	56	0	0	0	3	0	3	0	0	0	7	0	7	37	2	39	6	0	6	0	0	0
6:30 - 6:45	71	3	74	0	0	0	1	0	1	0	0	0	15	0	15	65	4	69	8	0	8	0	0	0
6:45 - 7:00	66	7	73	0	0	0	3	2	5	0	0	0	10	0	10	62	1	63	7	0	7	0	0	0
7:00 - 7:15	60	11	71	0	0	0	3	2	5	0	0	0	15	0	15	54	2	56	12	1	13	0	0	0
7:15 - 7:30	79	8	87	0	0	0	7	0	7	0	0	0	15	0	15	83	3	86	9	1	10	0	0	0
7:30 - 7:45	122	7	129	0	0	0	4	2	6	0	0	0	24	0	24	102	2	104	8	0	8	0	0	0
7:45 - 8:00	154	5	159	0	0	0	9	2	11	0	0	0	15	2	17	144	2	146	21	1	22	0	0	0
8:00 - 8:15	167	6	173	0	0	0	11	2	13	0	0	0	24	2	26	137	4	141	21	1	22	0	0	0
8:15 - 8:30	157	8	165	0	0	0	4	2	6	0	0	0	15	3	18	156	12	168	31	1	32	0	0	0
8:30 - 8:45	132	8	140	0	0	0	10	1	11	0	0	0	14	1	15	115	1	116	17	0	17	0	0	0
8:45 - 9:00	136	6	142	0	0	0	5	1	6	0	0	0	12	0	12	97	1	98	16	1	17	0	0	0
Total	1219	81	1300	0	0	0	61	15	76	0	0	0	180	8	188	1075	35	1110	168	9	177	0	0	0
AM Peak	610	27	637	0	0	0	34	7	41	0	0	0	68	8	76	552	19	571	90	3	93	0	0	0

Time	Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A					
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Total of all Movements	Peak Hour Volume Determination	
6:00 - 6:15	1	0	1	0	0	0	15	1	16	0	0	0	18	7	25	18	0	18	41	7	48	0	0	0	194	6:00 - 7:00	962
6:15 - 6:30	3	0	3	0	0	0	11	2	13	0	0	0	8	3	11	10	4	14	55	13	68	0	0	0	220	6:15 - 7:15	1040
6:30 - 6:45	3	0	3	0	0	0	21	3	24	0	0	0	11	7	18	22	5	27	51	7	58	0	0	0	297	6:30 - 7:30	1173
6:45 - 7:00	3	0	3	0	0	0	15	0	15	0	0	0	9	5	14	20	5	25	30	6	36	0	0	0	251	6:45 - 7:45	1337
7:00 - 7:15	4	1	5	0	0	0	12	1	13	0	0	0	12	5	17	16	0	16	48	13	61	0	0	0	272	7:00 - 8:00	1627
7:15 - 7:30	6	1	7	0	0	0	14	1	15	0	0	0	12	2	14	31	6	37	66	9	75	0	0	0	353	7:15 - 8:15	1925
7:30 - 7:45	6	0	6	0	0	0	20	3	23	0	0	0	22	3	25	29	9	38	87	11	98	0	0	0	461	7:30 - 8:30	2137
7:45 - 8:00	9	3	12	0	0	0	27	4	31	0	0	0	21	1	22	27	4	31	79	11	90	0	0	0	541	7:45 - 8:45	2159
8:00 - 8:15	5	3	8	0	0	0	18	1	19	0	0	0	29	6	35	44	2	46	79	8	87	0	0	0	570	8:00 - 9:00	2055
8:15 - 8:30	12	0	12	0	0	0	17	3	20	0	0	0	35	4	39	19	3	22	71	12	83	0	0	0	565	AM Peak	2159
8:30 - 8:45	9	1	10	0	0	0	19	2	21	0	0	0	36	2	38	48	1	49	54	12	66	0	0	0	483		
8:45 - 9:00	7	0	7	0	0	0	17	2	19	0	0	0	15	1	16	36	2	38	76	6	82	0	0	0	437		
Total	68	9	77	0	0	0	206	23	229	0	0	0	228	46	274	320	41	361	737	115	852	0	0	0	4644		
AM Peak	35	7	42	0	0	0	81	10	91	0	0	0	121	13	134	138	10	148	283	43	326	0	0	0	2159		

PM

Time	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A		
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 14:15	86	8	94	0	0	0	12	0	12	0	0	0	14	1	15	38	4	42	7	0	7	0	0	0
14:15 - 14:30	103	14	117	0	0	0	13	0	13	0	0	0	4	0	4	42	4	46	6	0	6	0	0	0
14:30 - 14:45	104	10	114	0	0	0	13	2	15	0	0	0	8	0	8	62	2	64	15	2	17	0	0	0
14:45 - 15:00	94	15	109	0	0	0	18	1	19	0	0	0	8	2	10	52	6	58	12	0	12	0	0	0
15:00 - 15:15	78	6	84	0	0	0	16	2	18	0	0	0	6	0	6	71	4	75	7	0	7	0	0	0
15:15 - 15:30	105	6	111	0	0	0	18	0	18	0	0	0	10	0	10	65	4	69	9	0	9	0	0	0
15:30 - 15:45	113	4	117	0	0	0	14	1	15	0	0	0	14	2	16	61	2	63	5	0	5	0	0	0
15:45 - 16:00	106	7	113	0	0	0	29	0	29	0	0	0	7	1	8	61	2	63	6	2	8	0	0	0
16:00 - 16:15	95	6	101	0	0	0	12	1	13	0	0	0	12	0	12	60	5	65	10	1	11	0	0	0
16:15 - 16:30	113	5	118	0	0	0	19	4	23	0	0	0	9	2	11	49	4	53	8	0	8	0	0	0
16:30 - 16:45	100	11	111	0	0	0	17	2	19	0	0	0	9	0	9	42	4	46	11	0	11	0	0	0
16:45 - 17:00	83	9	92	0	0	0	20	0	20	0	0	0	10	0	10	37	1	38	12	0	12	0	0	0
17:00 - 17:15	91	5	96	0	0	0	20	2	22	0	0	0	6	1	7	45	4	49	5	1	6	0	0	0
17:15 - 17:30	85	6	91	0	0	0	17	0	17	0	0	0	12	0	12	49	1	50	10	0	10	0	0	0
17:30 - 17:45	89	4	93	0	0	0	13	0	13	0	0	0	11	0	11	48	1	49	12	0	12	0	0	0
17:45 - 18:00	57	3	60	0	0	0	13	0	13	0	0	0	6	0	6	26	1	27	5	2	7	0	0	0
Total	1502	119	1621	0	0	0	264	15	279	0	0	0	146	9	155	808	49	857	140	8	148	0	0	0
PM Peak	427	22	449	0	0	0	74	6	80	0	0	0	42	5	47	231	13	244	29	3	32	0	0	0

Time	Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A					
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Total of all Movements	Peak Hour Volume Determination	
14:00 - 14:15	8	2	10	0	0	0	22	1	23	0	0	0	31	3	34	64	2	66	103	6	109	0	0	0	412	14:00 - 15:00	1779
14:15 - 14:30	9	2	11	0	0	0	15	3	18	0	0	0	35	10	45	73	5	78	95	3	98	0	0	0	436	14:15 - 15:15	1831
14:30 - 14:45	10	2	12	0	0	0	21	4	25	0	0	0	29	2	31	70	0	70	98	5	103	0	0	0	459	14:30 - 15:30	1885
14:45 - 15:00	14	0	14	0	0	0	20	1	21	0	0	0	29	6	35	74	4	78	110	6	116	0	0	0	472	14:45 - 15:45	1983
15:00 - 15:15	8	0	8	0	0	0	13	4	17	0	0	0	33	3	36	89	0	89	114	10	124	0	0	0	464	15:00 - 16:00	2058
15:15 - 15:30	21	3	24	0	0	0	19	3	22	0	0	0	22	2	24	77	2	79	120	4	124	0	0	0	490	15:15 - 16:15	2147
15:30 - 15:45	19	0	19	0	0	0	19	2	21	0	0	0	40	4	44	130	3	133	117	7	124	0	0	0	557	15:30 - 16:30	2159
15:45 - 16:00	17	0	17	0	0	0	26	1	27	0	0	0	17	3	20	113	5	118	137	7	144	0	0	0	547	15:45 - 16:45	2108
16:00 - 16:15	9	1	10	0	0	0	17	2	19	0	0	0	37	1	38	126	5	131	150	3	153	0	0	0	553	16:00 - 17:00	2047
16:15 - 16:30	18	1	19	0	0	0	15	1	16	0	0	0	19	1	20	104	0	104	124	6	130	0	0	0	502	16:15 - 17:15	2021
16:30 - 16:45	9	2	11	0	0	0	23	0	23	0	0	0	30	1	31	101	5	106	137	2	139	0	0	0	506	16:30 - 17:30	2053
16:45 - 17:00	16	0	16	0	0	0	20	0	20	0	0	0	27	6	33	118	2	120	119	6	125	0	0	0	486	16:45 - 17:45	1984
17:00 - 17:15	16	1	17	0	0	0	15	4	19	0	0	0	18	5	23	117	0	117	165	6	171	0	0	0	527	17:00 - 18:00	1835
17:15 - 17:30	17	0	17	0	0	0	18	3	21	0	0	0	26	0	26	145	1	146	140	4	144	0	0	0	534	PM Peak	2159
17:30 - 17:45	15	0	15	0	0	0	14	2	16	0	0	0	16	6	22	91	1	92	110	4	114	0	0	0	437		
17:45 - 18:00	11	0	11	0	0	0	23	1	24	0	0	0	25	5	30	80	0	80	74	5	79	0	0	0	337		
Total	217	14	231	0	0	0	300	32	332	0	0	0	434	58	492	1572	35	1607	1913	84	1997	0	0	0	7719		
PM Peak	63	2	65	0	0	0	77	6	83	0	0	0	113	9	122	473	13	486	528	23	551	0	0	0	2159		

HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 7:00	212	22	234	0	0	0	8	3	11	0	0	0	46	0	46	187	8	195	33	3	36	0	0	0
6:15 - 7:15	246	28	274	0	0	0	10	4	14	0	0	0	47	0	47	218	9	227	33	1	34	0	0	0
6:30 - 7:30	276	29	305	0	0	0	14	4	18	0	0	0	55	0	55	264	10	274	36	2	38	0	0	0
6:45 - 7:45	327	33	360	0	0	0	17	6	23	0	0	0	64	0	64	301	8	309	36	2	38	0	0	0
7:00 - 8:00	415	31	446	0	0	0	23	6	29	0	0	0	69	2	71	383	9	392	50	3	53	0	0	0
7:15 - 8:15	522	26	548	0	0	0	31	6	37	0	0	0	78	4	82	466	11	477	59	3	62	0	0	0
7:30 - 8:30	600	26	626	0	0	0	28	8	36	0	0	0	78	7	85	539	20	559	81	3	84	0	0	0
7:45 - 8:45	610	27	637	0	0	0	34	7	41	0	0	0	68	8	76	552	19	571	90	3	93	0	0	0
8:00 - 9:00	592	28	620	0	0	0	30	6	36	0	0	0	65	6	71	505	18	523	85	3	88	0	0	0

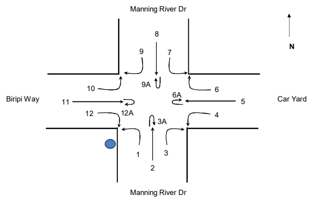
TIME PERIOD	Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 7:00	10	0	10	0	0	0	62	6	68	0	0	0	46	22	68	70	14	84	177	33	210	0	0	0	851	111	962
6:15 - 7:15	13	1	14	0	0	0	59	6	65	0	0	0	40	20	60	68	14	82	184	39	223	0	0	0	918	122	1040
6:30 - 7:30	16	2	18	0	0	0	62	5	67	0	0	0	44	19	63	89	16	105	195	35	230	0	0	0	1051	122	1173
6:45 - 7:45	19	2	21	0	0	0	61	5	66	0	0	0	55	15	70	96	20	116	231	39	270	0	0	0	1207	130	1337
7:00 - 8:00	25	5	30	0	0	0	73	9	82	0	0	0	67	11	78	103	19	122	280	44	324	0	0	0	1488	139	1627
7:15 - 8:15	26	7	33	0	0	0	79	9	88	0	0	0	84	12	96	131	21	152	311	39	350	0	0	0	1787	138	1925
7:30 - 8:30	32	6	38	0	0	0	82	11	93	0	0	0	107	14	121	119	18	137	316	42	358	0	0	0	1982	155	2137
7:45 - 8:45	35	7	42	0	0	0	81	10	91	0	0	0	121	13	134	138	10	148	283	43	326	0	0	0	2012	147	2159
8:00 - 9:00	33	4	37	0	0	0	71	8	79	0	0	0	115	13	128	147	8	155	280	38	318	0	0	0	1923	132	2055

HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 15:00	387	47	434	0	0	0	56	3	59	0	0	0	34	3	37	194	16	210	40	2	42	0	0	0
14:15 - 15:15	379	45	424	0	0	0	60	5	65	0	0	0	26	2	28	227	16	243	40	2	42	0	0	0
14:30 - 15:30	381	37	418	0	0	0	65	5	70	0	0	0	32	2	34	250	16	266	43	2	45	0	0	0
14:45 - 15:45	390	31	421	0	0	0	66	4	70	0	0	0	38	4	42	249	16	265	33	0	33	0	0	0
15:00 - 16:00	402	23	425	0	0	0	77	3	80	0	0	0	37	3	40	258	12	270	27	2	29	0	0	0
15:15 - 16:15	419	23	442	0	0	0	73	2	75	0	0	0	43	3	46	247	13	260	30	3	33	0	0	0
15:30 - 16:30	427	22	449	0	0	0	74	6	80	0	0	0	42	5	47	231	13	244	29	3	32	0	0	0
15:45 - 16:45	414	29	443	0	0	0	77	7	84	0	0	0	37	3	40	212	15	227	35	3	38	0	0	0
16:00 - 17:00	391	31	422	0	0	0	68	7	75	0	0	0	40	2	42	188	14	202	41	1	42	0	0	0
16:15 - 17:15	387	30	417	0	0	0	76	8	84	0	0	0	34	3	37	173	13	186	36	1	37	0	0	0
16:30 - 17:30	359	31	390	0	0	0	74	4	78	0	0	0	37	1	38	173	10	183	38	1	39	0	0	0
16:45 - 17:45	348	24	372	0	0	0	70	2	72	0	0	0	39	1	40	179	7	186	39	1	40	0	0	0
17:00 - 18:00	322	18	340	0	0	0	63	2	65	0	0	0	35	1	36	168	7	175	32	3	35	0	0	0

TIME PERIOD	Movement 7			Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 15:00	41	6	47	0	0	0	78	9	87	0	0	0	124	21	145	281	11	292	406	20	426	0	0	0	1641	138	1779
14:15 - 15:15	41	4	45	0	0	0	69	12	81	0	0	0	126	21	147	306	9	315	417	24	441	0	0	0	1691	140	1831
14:30 - 15:30	53	5	58	0	0	0	73	12	85	0	0	0	113	13	126	310	6	316	442	25	467	0	0	0	1762	123	1885
14:45 - 15:45	62	3	65	0	0	0	71	10	81	0	0	0	124	15	139	370	9	379	461	27	488	0	0	0	1864	119	1983
15:00 - 16:00	65	3	68	0	0	0	77	10	87	0	0	0	112	12	124	409	10	419	488	28	516	0	0	0	1952	106	2058
15:15 - 16:15	66	4	70	0	0	0	81	8	89	0	0	0	116	10	126	446	15	461	524	21	545	0	0	0	2045	102	2147
15:30 - 16:30	63	2	65	0	0	0	77	6	83	0	0	0	113	9	122	473	13	486	528	23	551	0	0	0	2057	102	2159
15:45 - 16:45	53	4	57	0	0	0	81	4	85	0	0	0	103	6	109	444	15	459	548	18	566	0	0	0	2004	104	2108
16:00 - 17:00	52	4	56	0	0	0	75	3	78	0	0	0	113	9	122	449	12	461	530	17	547	0	0	0	1947	100	2047
16:15 - 17:15	59	4	63	0	0	0	73	5	78	0	0	0	94	13	107	440	7	447	545	20	565	0	0	0	1917	104	2021
16:30 - 17:30	58	3	61	0	0	0	76	7	83	0	0	0	101	12	113	481	8	489	561	18	579	0	0	0	1958	95	2053
16:45 - 17:45	64	1	65	0	0	0	67	9	76	0	0	0	87	17	104	471	4	475	534	20	554	0	0	0	1898	86	1984
17:00 - 18:00	59	1	60	0	0	0	70	10	80	0	0	0	85	16	101	433	2	435	489	19	508	0	0	0	1756	79	1835

austraffic



Client : SLR Consulting
Job : SLR Taree Traffic Counts Counts Survey
Day/Date : Thursday, 26 July 2018
Survey Location : Biripi Way& Manning River Dr at Masters Site & Car Yard
Weather : Fine

AM

Time	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7		
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 6:15	0	0	0	51	5	56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:15 - 6:30	0	0	0	101	8	109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6:30 - 6:45	0	0	0	156	7	163	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
6:45 - 7:00	0	0	0	148	8	156	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:00 - 7:15	0	0	0	112	9	121	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
7:15 - 7:30	0	0	0	154	7	161	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
7:30 - 7:45	1	0	1	245	9	254	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	4
7:45 - 8:00	1	0	1	309	10	319	14	0	14	0	0	0	1	0	1	0	0	0	2	0	2	0	0	0	9	0	9
8:00 - 8:15	0	0	0	330	10	340	4	0	4	0	0	0	0	0	0	0	0	0	3	0	3	0	0	0	2	1	3
8:15 - 8:30	0	0	0	319	17	336	1	0	1	1	0	1	0	0	0	0	0	0	2	0	2	0	0	0	1	0	1
8:30 - 8:45	0	0	0	271	11	282	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
8:45 - 9:00	0	0	0	251	8	259	4	1	5	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	4	0	4
Total	2	0	2	2447	109	2556	31	1	32	4	2	6	1	0	1	0	0	0	9	0	9	0	0	0	25	1	26
AM Peak	1	0	1	1229	48	1277	19	0	19	3	0	3	1	0	1	0	0	0	7	0	7	0	0	0	14	1	15

Time	Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Total of all Movements	Peak Hour Volume Determination	
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total			
6:00 - 6:15	52	8	60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	116	6:00 - 7:00	760
6:15 - 6:30	54	14	68	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	177	6:15 - 7:15	866
6:30 - 6:45	78	15	93	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	260	6:30 - 7:30	969
6:45 - 7:00	45	4	49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	207	6:45 - 7:45	1104
7:00 - 7:15	75	24	99	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	222	7:00 - 8:00	1370
7:15 - 7:30	95	20	115	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	280	7:15 - 8:15	1627
7:30 - 7:45	109	21	130	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	395	7:30 - 8:30	1815
7:45 - 8:00	114	7	121	0	0	0	4	0	4	1	0	1	0	0	0	1	0	1	0	0	0	473	7:45 - 8:45	1844
8:00 - 8:15	110	13	123	1	0	1	4	0	4	1	0	1	0	0	0	0	0	0	0	0	0	479	8:00 - 9:00	1764
8:15 - 8:30	106	18	124	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	468	AM Peak	1844
8:30 - 8:45	122	15	137	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	424		
8:45 - 9:00	115	8	123	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	393		
Total	1075	167	1242	1	0	1	16	0	16	2	0	2	0	0	0	1	0	1	0	0	0	3894		
AM Peak	452	53	505	1	0	1	12	0	12	2	0	2	0	0	0	1	0	1	0	0	0	1844		

PM

Time	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7		
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 14:15	0	0	0	144	11	155	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	2
14:15 - 14:30	0	1	1	136	15	151	0	0	0	0	1	1	2	0	2	0	0	0	7	0	7	0	0	0	3	0	3
14:30 - 14:45	0	0	0	173	10	183	1	0	1	1	0	1	1	0	1	0	0	0	3	0	3	0	0	0	1	0	1
14:45 - 15:00	0	0	0	166	19	185	0	0	0	2	0	2	1	0	1	0	0	0	1	0	1	0	0	0	0	0	0
15:00 - 15:15	0	0	0	169	10	179	1	0	1	2	0	2	2	0	2	0	0	0	1	0	1	0	0	0	2	0	2
15:15 - 15:30	0	0	0	180	12	192	2	0	2	2	0	2	1	0	1	0	0	0	3	0	3	0	0	0	1	0	1
15:30 - 15:45	0	0	0	179	9	188	1	0	1	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	2	0	2
15:45 - 16:00	0	0	0	182	10	192	3	0	3	0	0	0	1	0	1	0	0	0	3	0	3	0	0	0	2	0	2
16:00 - 16:15	0	0	0	165	8	173	4	0	4	1	0	1	3	0	3	0	0	0	3	0	3	0	0	0	2	0	2
16:15 - 16:30	0	0	0	173	8	181	1	0	1	0	0	0	2	0	2	0	0	0	3	0	3	0	0	0	1	0	1
16:30 - 16:45	0	0	0	159	11	170	1	0	1	1	0	1	1	0	1	0	0	0	3	0	3	0	0	0	1	0	1
16:45 - 17:00	0	0	0	142	7	149	0	0	0	1	0	1	2	0	2	0	0	0	4	0	4	0	0	0	0	0	0
17:00 - 17:15	0	0	0	153	9	162	0	0	0	2	0	2	1	0	1	0	0	0	6	0	6	0	0	0	0	0	0
17:15 - 17:30	0	0	0	138	4	142	0	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17:30 - 17:45	0	0	0	141	4	145	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
17:45 - 18:00	0	0	0	96	4	100	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0
Total	0	1	1	2496	151	2647	15	1	16	14	1	15	17	0	17	0	0	0	40	1	41	0	0	0	17	0	17
PM Peak	0	0	0	699	35	734	9	0	9	1	0	1	6	0	6	0	0	0	11	0	11	0	0	0	7	0	7

Time	Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Total of all Movements	Peak Hour Volume Determination	
Period	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total			
14:00 - 14:15	178	10	188	0	0	0	2	0	2	0	0	0	0	0	0	1	0	1	0	0	0	350	14:00 - 15:00	1532
14:15 - 14:30	197	9	206	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	373	14:15 - 15:15	1606
14:30 - 14:45	196	7	203	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	0	395	14:30 - 15:30	1682
14:45 - 15:00	214	10	224	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	414	14:45 - 15:45	1784
15:00 - 15:15	226	6	232	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	424	15:00 - 16:00	1885
15:15 - 15:30	240	5	245	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	449	15:15 - 16:15	1973
15:30 - 15:45	281	15	296	0	0	0	8	0	8	0	0	0	0	0	0	0	0	0	0	0	0	497	15:30 - 16:30	1977
15:45 - 16:00	297	11	308	0	0	0	6	0	6	0	0	0	0	0	0	0	0	0	0	0	0	515	15:45 - 16:45	1941
16:00 - 16:15	313	8	321	0	0	0	5	0	5	0	0	0	0	0	0	0	0	0	0	0	0	512	16:00 - 17:00	1838
16:15 - 16:30	261	4	265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	453	16:15 - 17:15	1838
16:30 - 16:45	273	9	282	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	461	16:30 - 17:30	1839
16:45 - 17:00	249	4	253	1	0	1	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	412	16:45 - 17:45	1754
17:00 - 17:15	328	5	333	0	0	0	8	0	8	0	0	0	0	0	0	0	0	0	0	0	0	512	17:00 - 18:00	1609
17:15 - 17:30	296	3	299	0	0	0	11	0	11	0	0	0	0	0	0	0	0	0	0	0	0	454	PM Peak	1977
17:30 - 17:45	223	5	228	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	376		
17:45 - 18:00	156	6	162	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	267		
Total	3928	117	4045	1	0	1	62	0	62	0	0	0	0	0	0	2	0	2	0	0	0	6864		
PM Peak	1152	38	1190	0	0	0	19	0	19	0	0	0	0	0	0	0	0	0	0	0	0	1977		

HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 7:00	0	0	0	456	28	484	2	0	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
6:15 - 7:15	0	0	0	517	32	549	2	0	2	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1
6:30 - 7:30	0	0	0	570	31	601	3	0	3	0	2	2	0	0	0	0	0	0	1	0	1	0	0	0	3	0	3
6:45 - 7:45	1	0	1	659	33	692	8	0	8	0	1	1	0	0	0	0	0	0	1	0	1	0	0	0	6	0	6
7:00 - 8:00	2	0	2	820	35	855	20	0	20	0	1	1	1	0	1	0	0	0	3	0	3	0	0	0	15	0	15
7:15 - 8:15	2	0	2	1038	36	1074	24	0	24	0	1	1	1	0	1	0	0	0	5	0	5	0	0	0	17	1	18
7:30 - 8:30	2	0	2	1203	46	1249	24	0	24	1	0	1	1	0	1	0	0	0	7	0	7	0	0	0	16	1	17
7:45 - 8:45	1	0	1	1229	48	1277	19	0	19	3	0	3	1	0	1	0	0	0	7	0	7	0	0	0	14	1	15
8:00 - 9:00	0	0	0	1171	46	1217	9	1	10	4	0	4	0	0	0	0	0	0	6	0	6	0	0	0	9	1	10

TIME PERIOD	Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
6:00 - 7:00	229	41	270	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	690	70	760
6:15 - 7:15	252	57	309	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	776	90	866
6:30 - 7:30	293	63	356	0	0	0	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0	873	96	969
6:45 - 7:45	324	69	393	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1001	103	1104
7:00 - 8:00	393	72	465	0	0	0	6	0	6	1	0	1	0	0	0	1	0	1	0	0	0	1262	108	1370
7:15 - 8:15	428	61	489	1	0	1	9	0	9	2	0	2	0	0	0	1	0	1	0	0	0	1528	99	1627
7:30 - 8:30	439	59	498	1	0	1	12	0	12	2	0	2	0	0	0	1	0	1	0	0	0	1709	106	1815
7:45 - 8:45	452	53	505	1	0	1	12	0	12	2	0	2	0	0	0	1	0	1	0	0	0	1742	102	1844
8:00 - 9:00	453	54	507	1	0	1	8	0	8	1	0	1	0	0	0	0	0	0	0	0	0	1662	102	1764

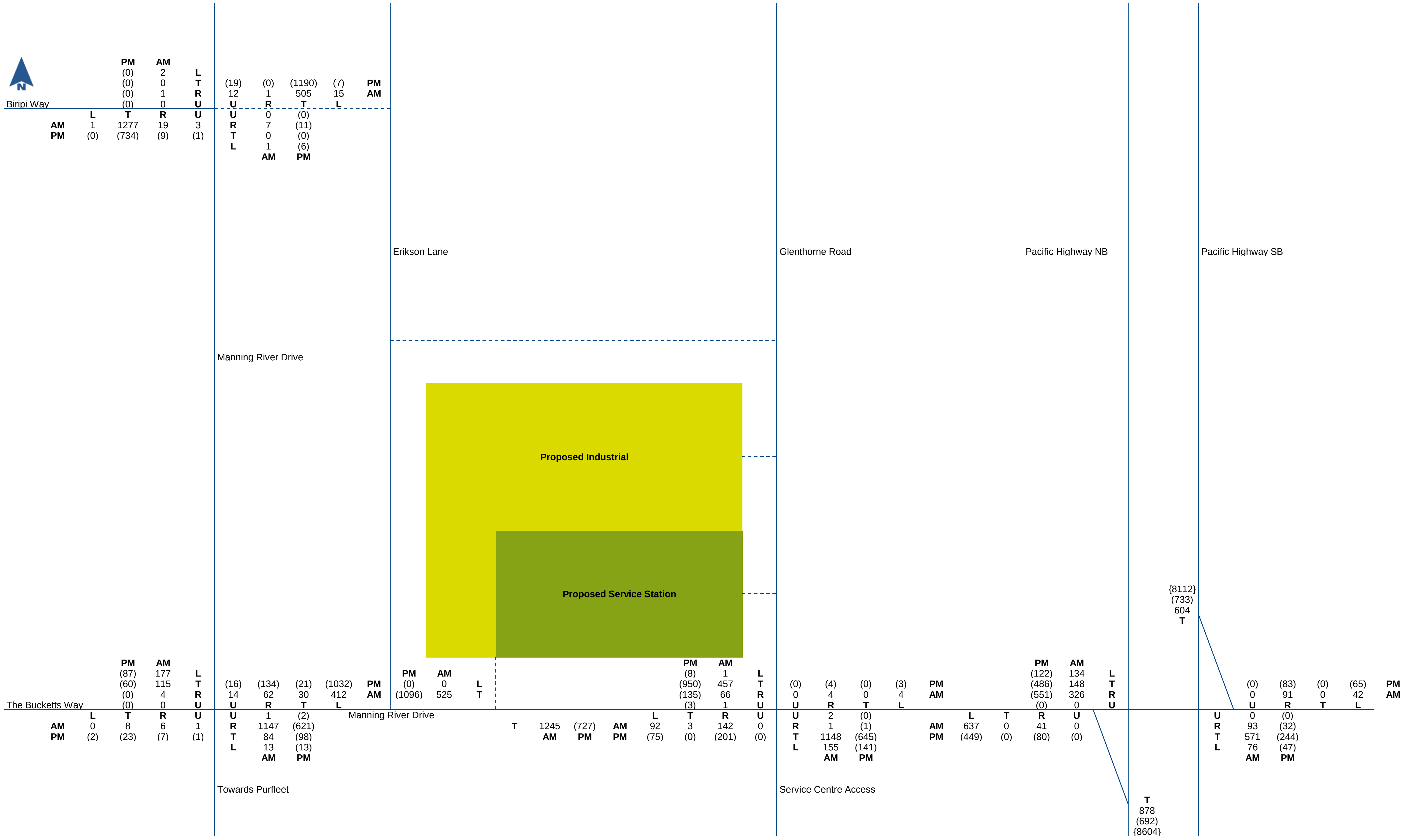
HOURLY FLOW

TIME PERIOD	Movement 1			Movement 2			Movement 3			Movement 3A			Movement 4			Movement 5			Movement 6			Movement 6A			Movement 7		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 15:00	0	1	1	619	55	674	2	0	2	4	1	5	4	0	4	0	0	0	11	0	11	0	0	0	6	0	6
14:15 - 15:15	0	1	1	644	54	698	2	0	2	5	1	6	6	0	6	0	0	0	12	0	12	0	0	0	6	0	6
14:30 - 15:30	0	0	0	688	51	739	4	0	4	7	0	7	5	0	5	0	0	0	8	0	8	0	0	0	4	0	4
14:45 - 15:45	0	0	0	694	50	744	4	0	4	6	0	6	4	0	4	0	0	0	7	0	7	0	0	0	5	0	5
15:00 - 16:00	0	0	0	710	41	751	7	0	7	4	0	4	4	0	4	0	0	0	9	0	9	0	0	0	7	0	7
15:15 - 16:15	0	0	0	706	39	745	10	0	10	3	0	3	5	0	5	0	0	0	11	0	11	0	0	0	7	0	7
15:30 - 16:30	0	0	0	699	35	734	9	0	9	1	0	1	6	0	6	0	0	0	11	0	11	0	0	0	7	0	7
15:45 - 16:45	0	0	0	679	37	716	9	0	9	2	0	2	7	0	7	0	0	0	12	0	12	0	0	0	6	0	6
16:00 - 17:00	0	0	0	639	34	673	6	0	6	3	0	3	8	0	8	0	0	0	13	0	13	0	0	0	4	0	4
16:15 - 17:15	0	0	0	627	35	662	2	0	2	4	0	4	6	0	6	0	0	0	16	0	16	0	0	0	2	0	2
16:30 - 17:30	0	0	0	592	31	623	1	1	2	5	0	5	4	0	4	0	0	0	13	0	13	0	0	0	1	0	1
16:45 - 17:45	0	0	0	574	24	598	0	1	1	4	0	4	3	0	3	0	0	0	10	1	11	0	0	0	0	0	0
17:00 - 18:00	0	0	0	528	21	549	0	1	1	3	0	3	1	0	1	0	0	0	7	1	8	0	0	0	0	0	0

TIME PERIOD	Movement 8			Movement 9			Movement 9A			Movement 10			Movement 11			Movement 12			Movement 12A			Grand Total		
	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total	Light	Heavy	Total
14:00 - 15:00	785	36	821	0	0	0	6	0	6	0	0	0	0	0	0	2	0	2	0	0	0	1439	93	1532
14:15 - 15:15	833	32	865	0	0	0	9	0	9	0	0	0	0	0	0	1	0	1	0	0	0	1518	88	1606
14:30 - 15:30	876	28	904	0	0	0	10	0	10	0	0	0	0	0	0	1	0	1	0	0	0	1603	79	1682
14:45 - 15:45	961	36	997	0	0	0	17	0	17	0	0	0	0	0	0	0	0	0	0	0	0	1698	86	1784
15:00 - 16:00	1044	37	1081	0	0	0	22	0	22	0	0	0	0	0	0	0	0	0	0	0	0	1807	78	1885
15:15 - 16:15	1131	39	1170	0	0	0	22	0	22	0	0	0	0	0	0	0	0	0	0	0	0	1895	78	1973
15:30 - 16:30	1152	38	1190	0	0	0	19	0	19	0	0	0	0	0	0	0	0	0	0	0	0	1904	73	1977
15:45 - 16:45	1144	32	1176	0	0	0	13	0	13	0	0	0	0	0	0	0	0	0	0	0	0	1872	69	1941
16:00 - 17:00	1096	25	1121	1	0	1	9	0	9	0	0	0	0	0	0	0	0	0	0	0	0	1779	59	1838
16:15 - 17:15	1111	22	1133	1	0	1	12	0	12	0	0	0	0	0	0	0	0	0	0	0	0	1781	57	1838
16:30 - 17:30	1146	21	1167	1	0	1	23	0	23	0	0	0	0	0	0	0	0	0	0	0	0	1786	53	1839
16:45 - 17:45	1096	17	1113	1	0	1	23	0	23	0	0	0	0	0	0	0	0	0	0	0	0	1711	43	1754
17:00 - 18:00	1003	19	1022	0	0	0	25	0	25	0	0	0	0	0	0	0	0	0	0	0	0	1567	42	1609

APPENDIX C

Assessed Traffic Volumes



Legend

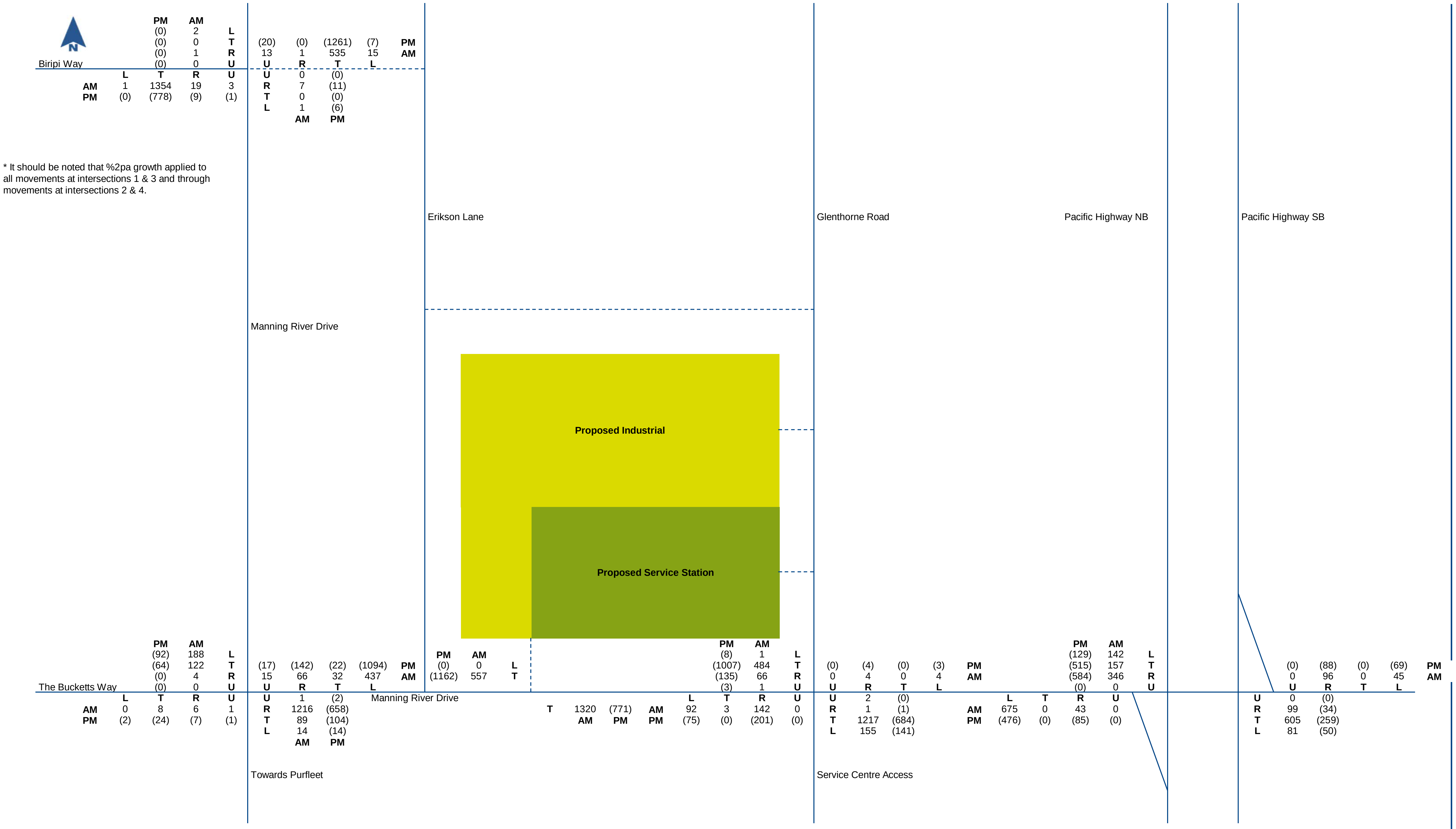
L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2018 Total Survey Traffic Volumes

Taree Glenthorne Service Station and Industrial

26-07-2020

SLR



* It should be noted that %2pa growth applied to all movements at intersections 1 & 3 and through movements at intersections 2 & 4.

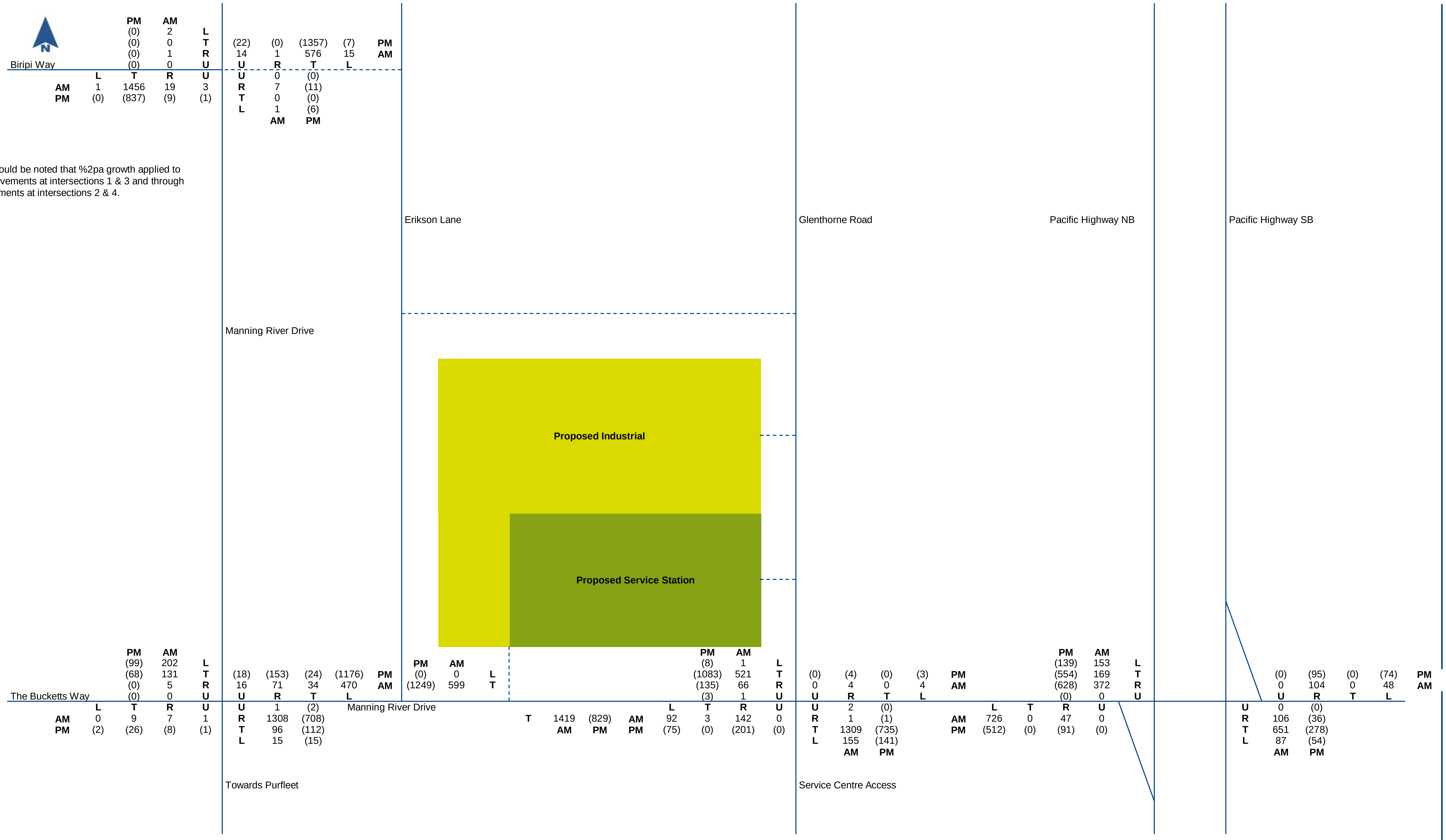
Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2021 Background Growth

Taree Glenthorne Service Station and Industrial

27-07-2020



* It should be noted that %2pa growth applied to all movements at intersections 1 & 3 and through movements at intersections 2 & 4.

Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2025 Background Growth

Taree Glenthorne Service Station and Industrial

27-07-2020

SLR

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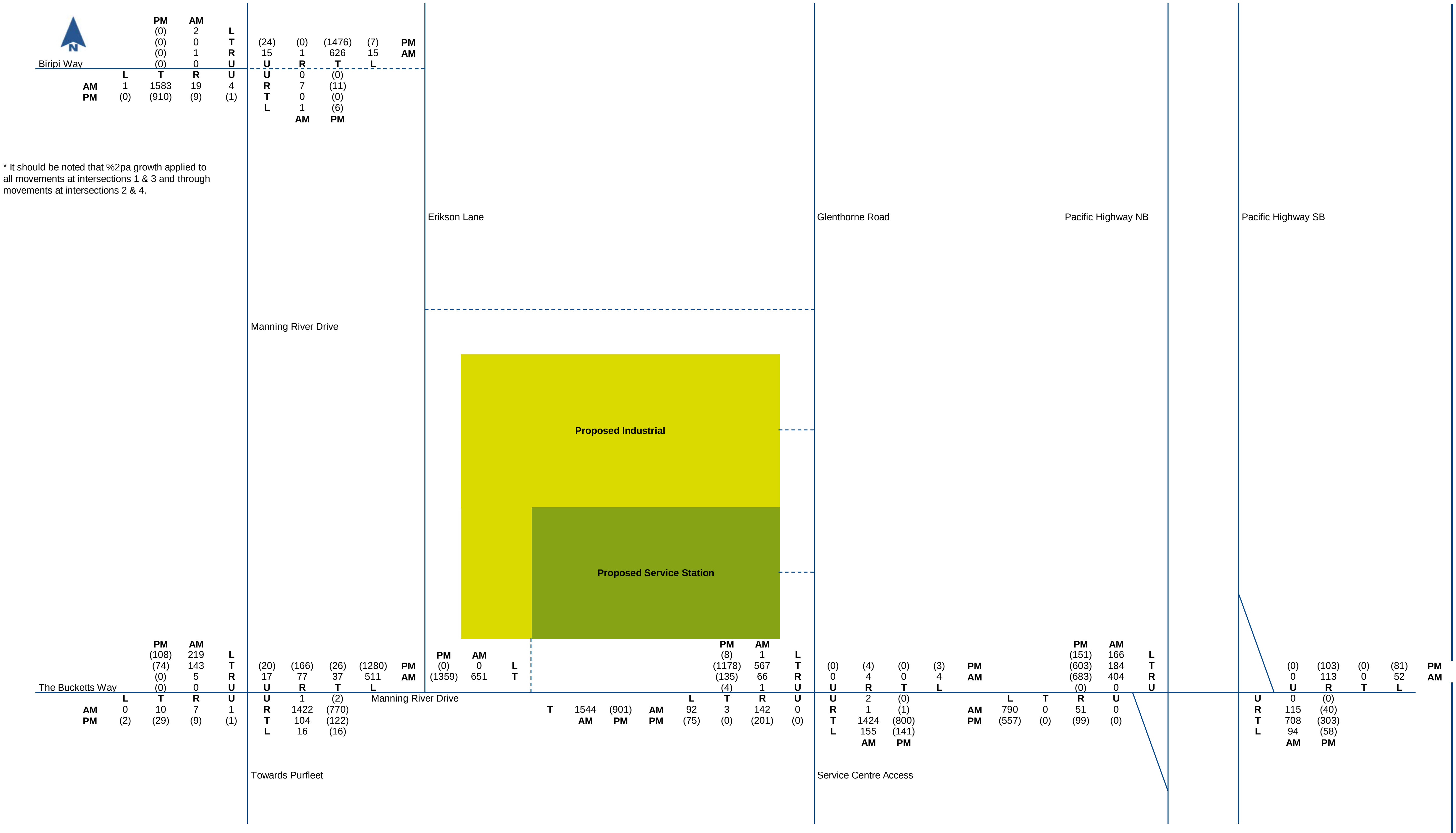


* It should be noted that %2pa growth applied to all movements at intersections 1 & 3 and through movements at intersections 2 & 4.

Legend

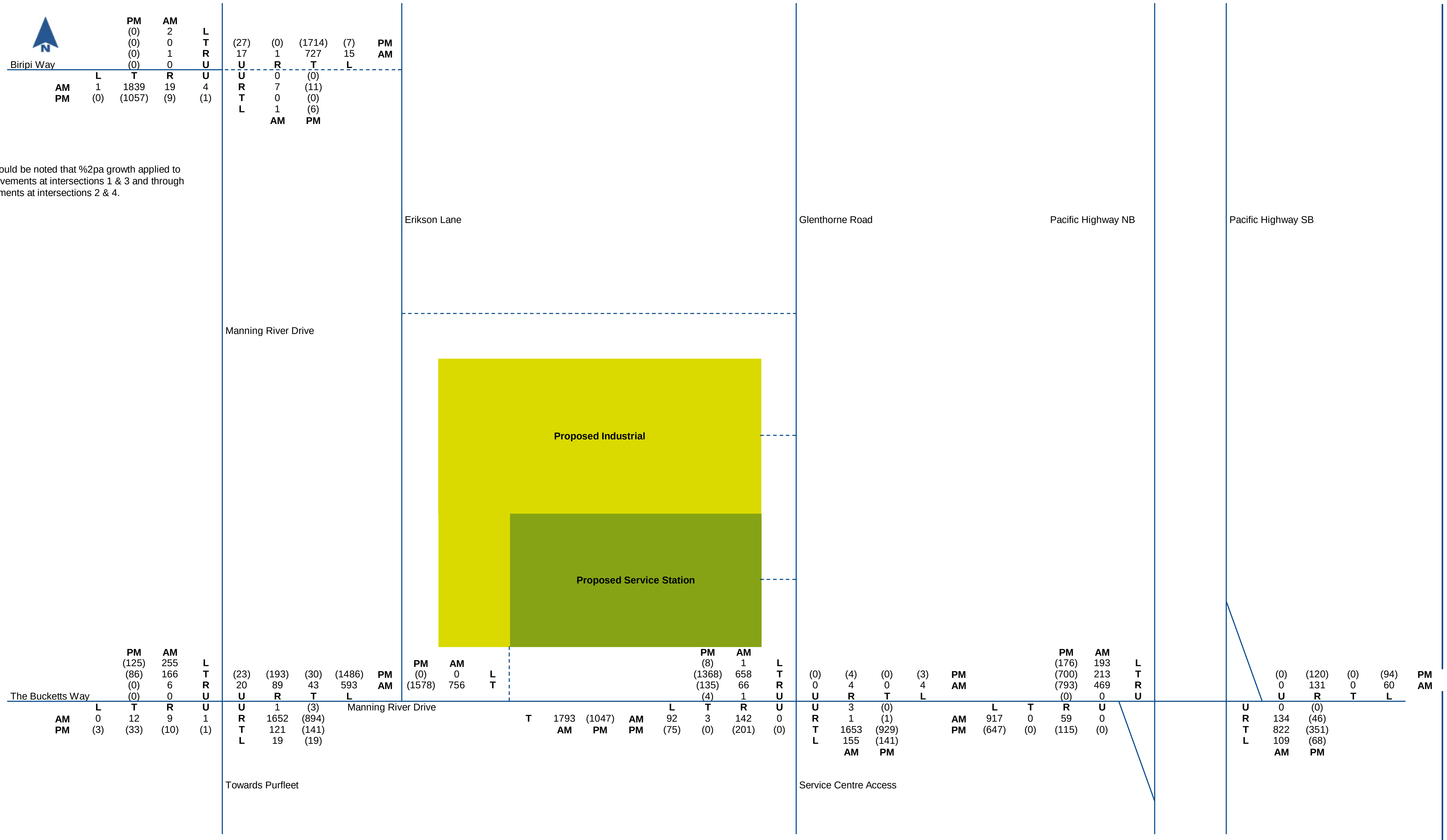
L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2030 Background Growth

Taree Glenthorne Service Station and Industrial

27-07-2020

SLR



* It should be noted that %2pa growth applied to all movements at intersections 1 & 3 and through movements at intersections 2 & 4.

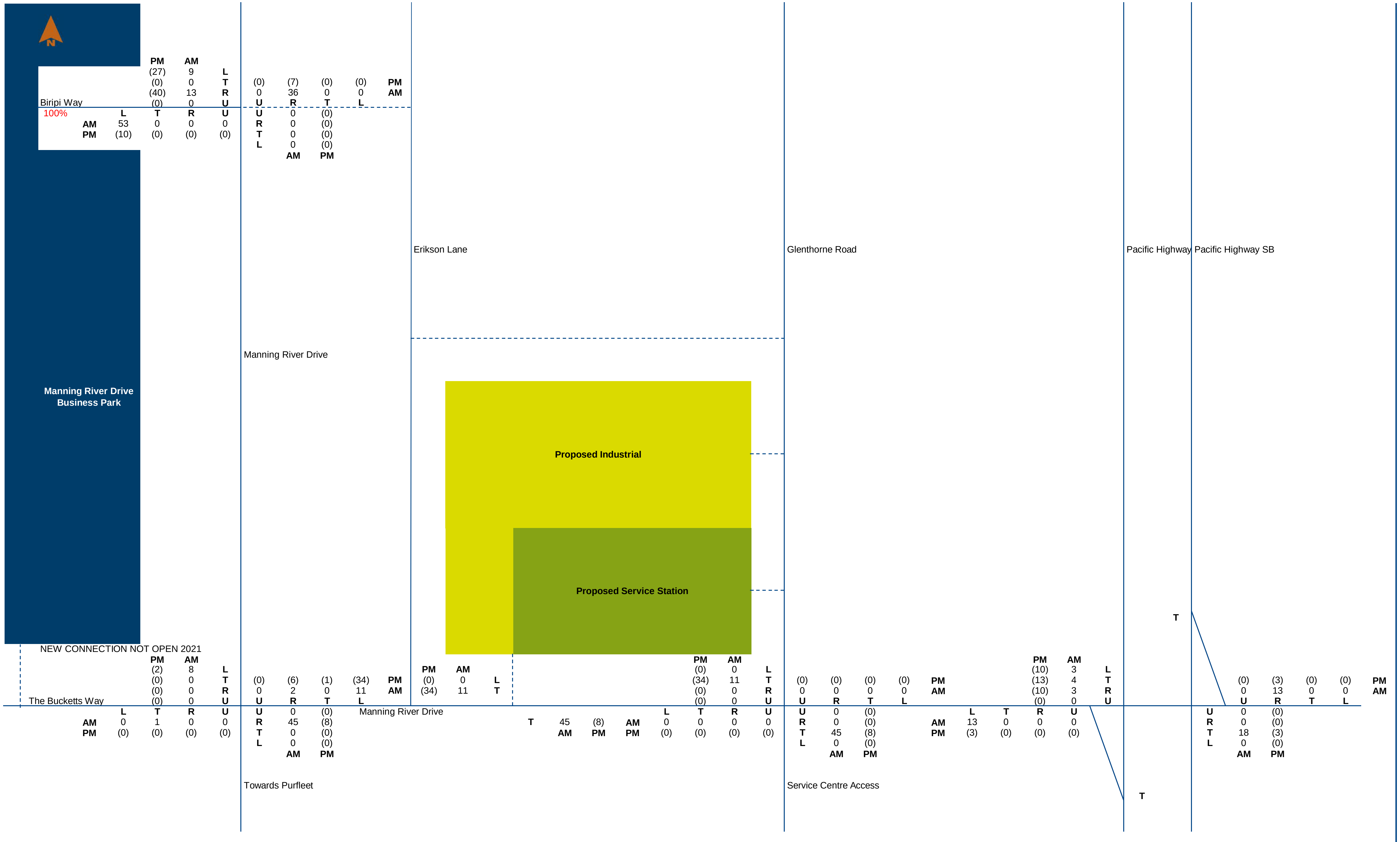
Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2040 Background Growth

Taree Glenthorne Service Station and Industrial

27-07-2020



Legend

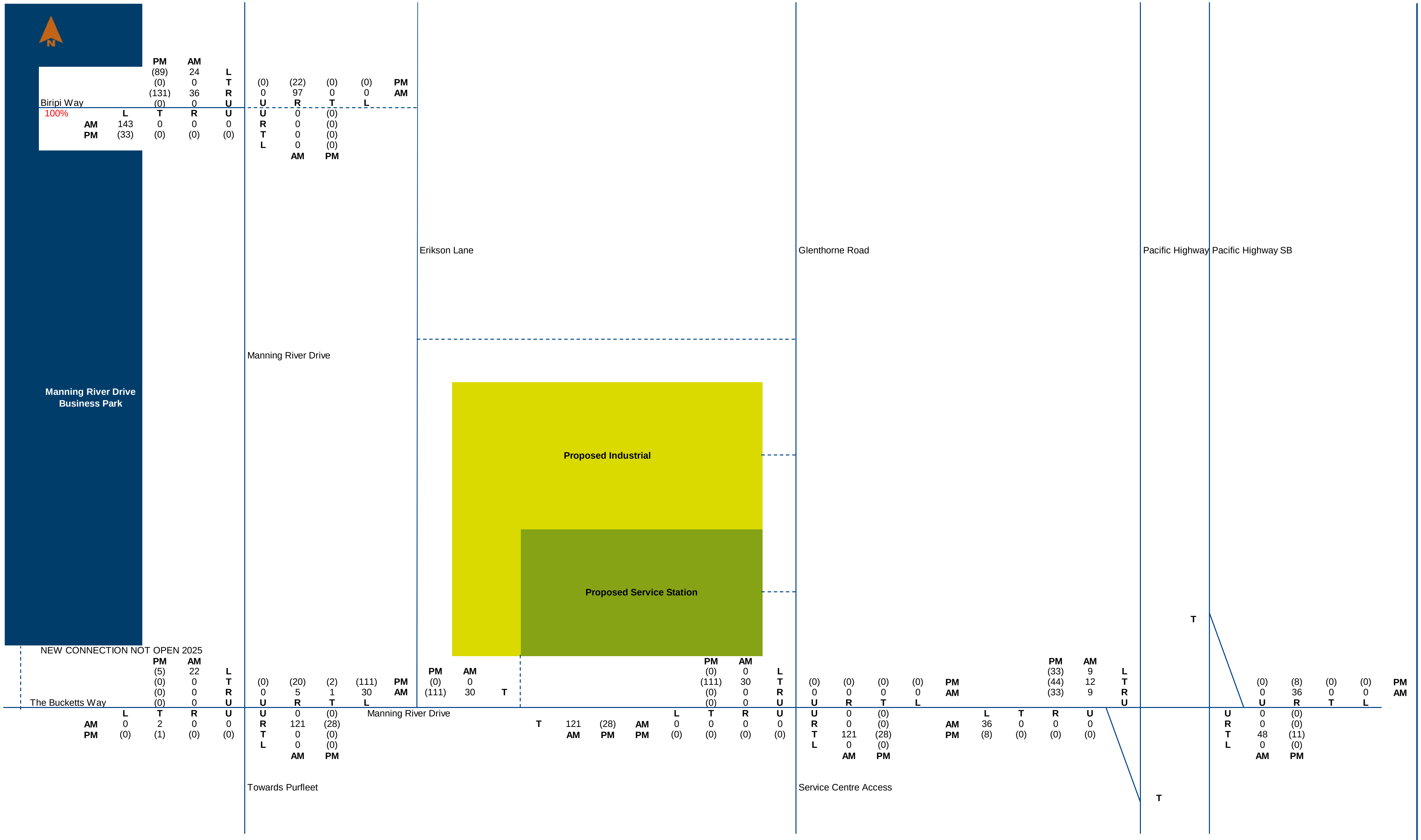
L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2021 Background Development

Taree Glenthorne Service Station and Industrial

SLR

27-07-2020



Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2025 Background Development

Taree Glenthorne Service Station and Industrial

27-07-2020

SLR

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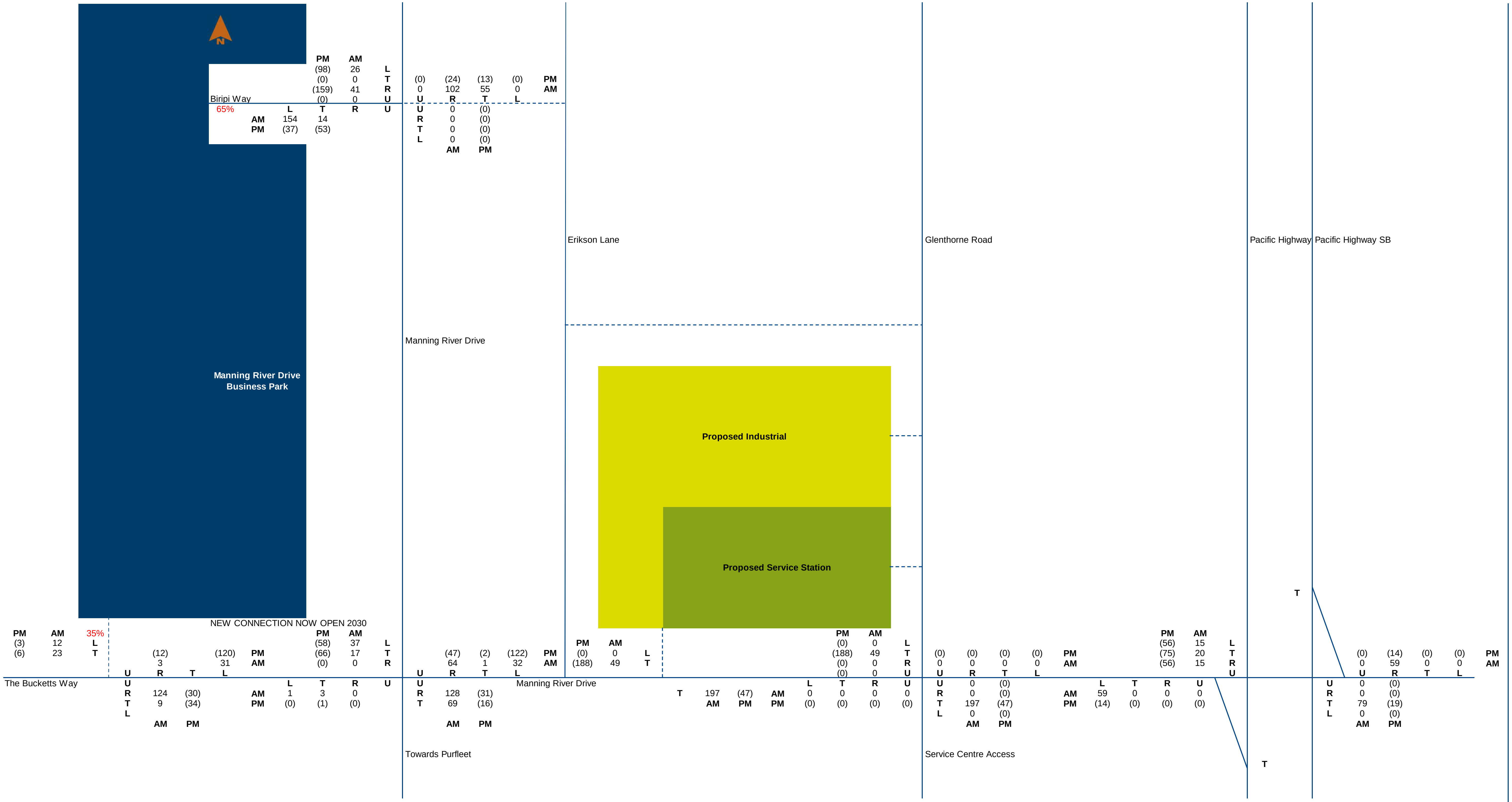

Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2030 Background Development

Taree Glenthorne Service Station and Industrial

27-07-2020

SLR

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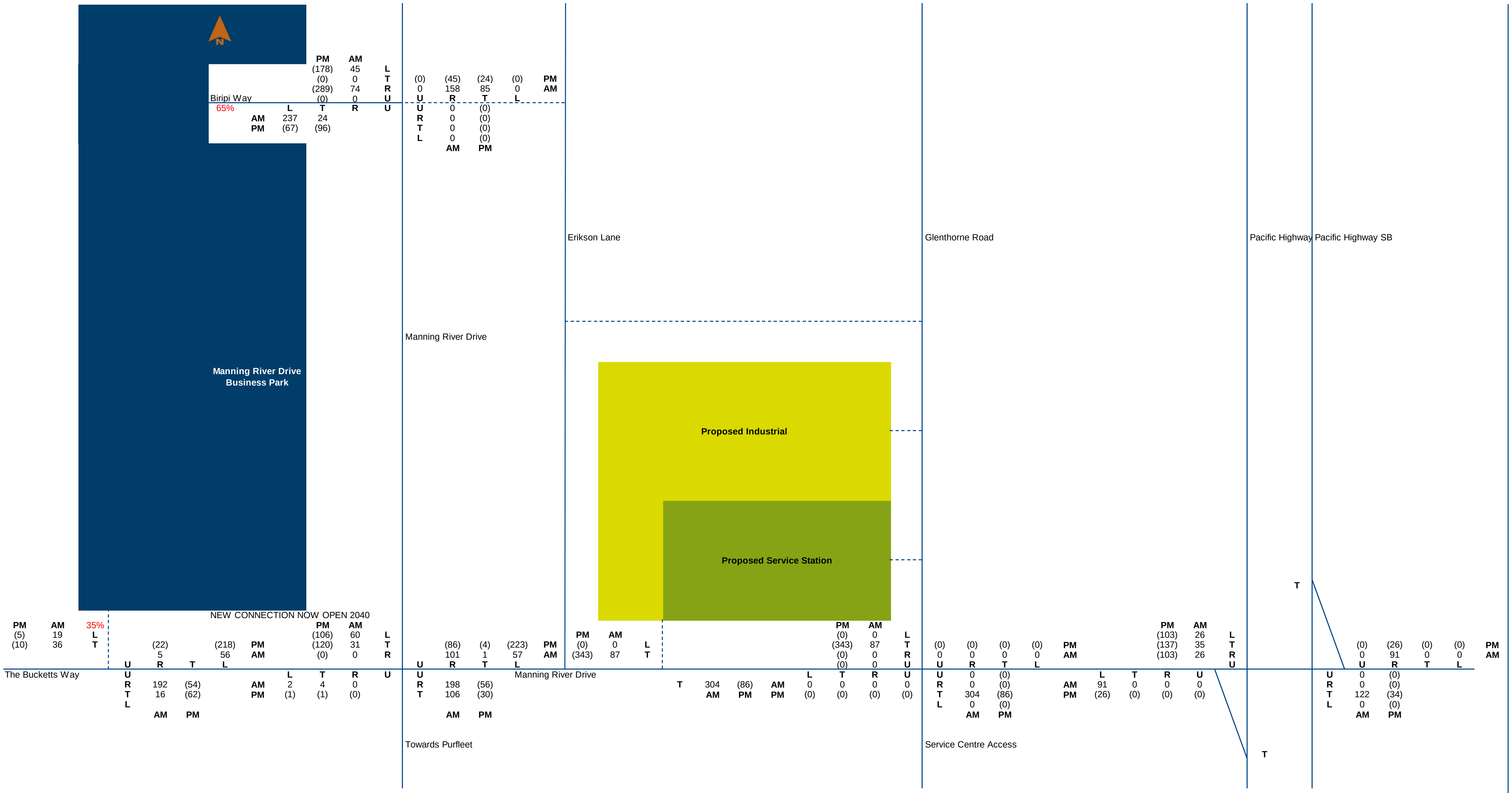

Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2040 Background Development

Taree Glenthorne Service Station and Industrial

27-07-2020

SLR

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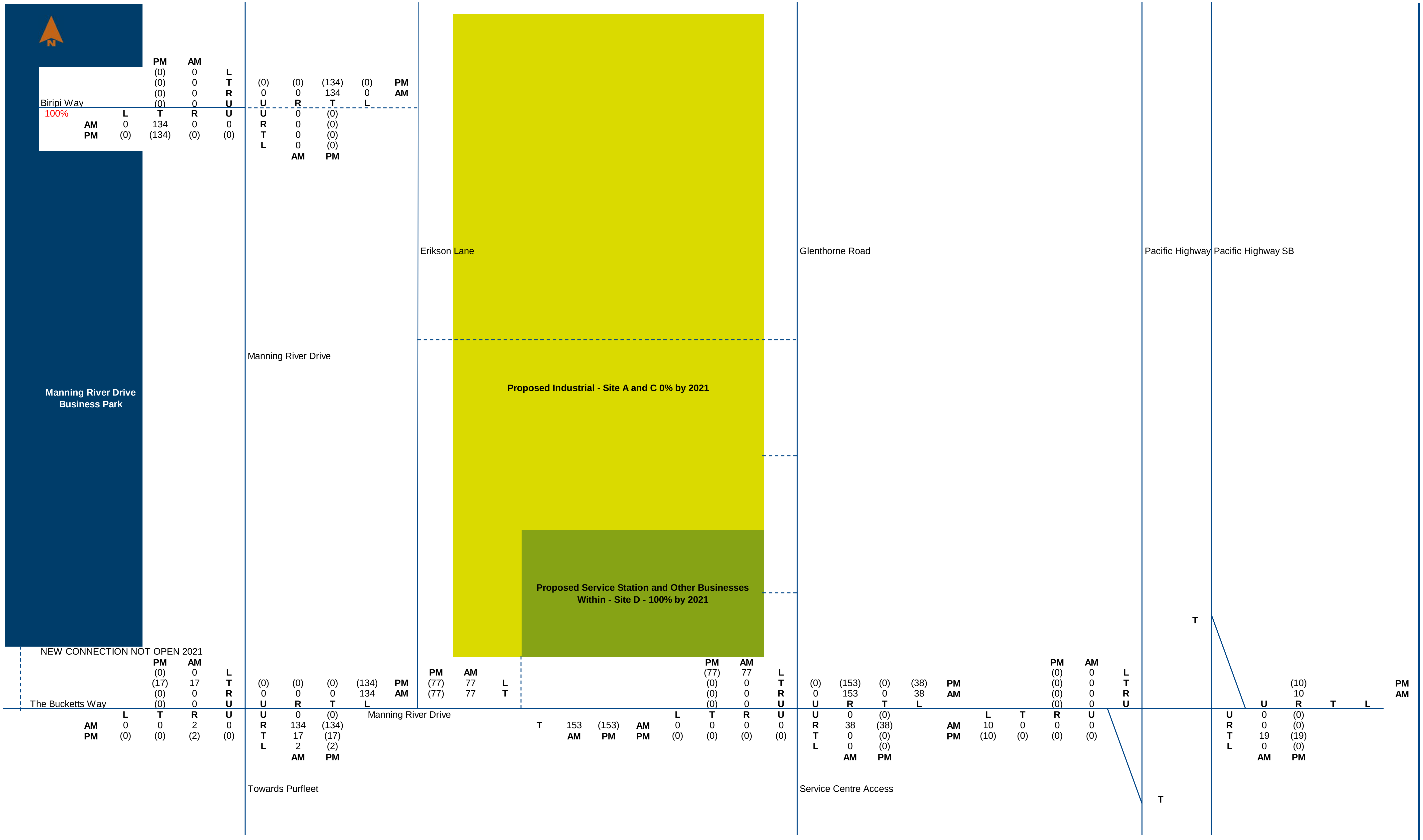
SLR Consulting Australia Pty Ltd



Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2021 Proposed Subdivision

Taree Glenthorne Service Station and Industrial

27-07-2020

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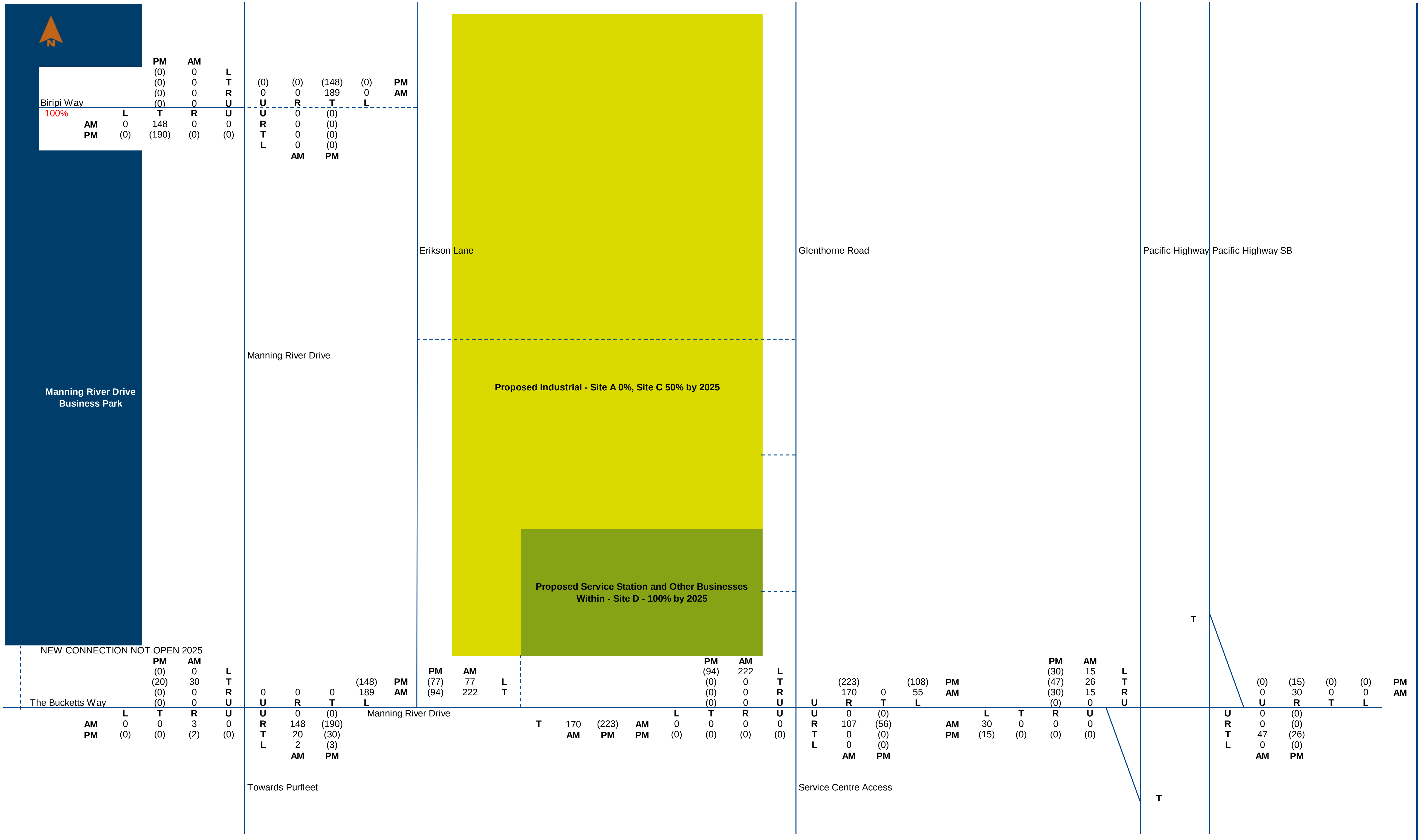


Legend

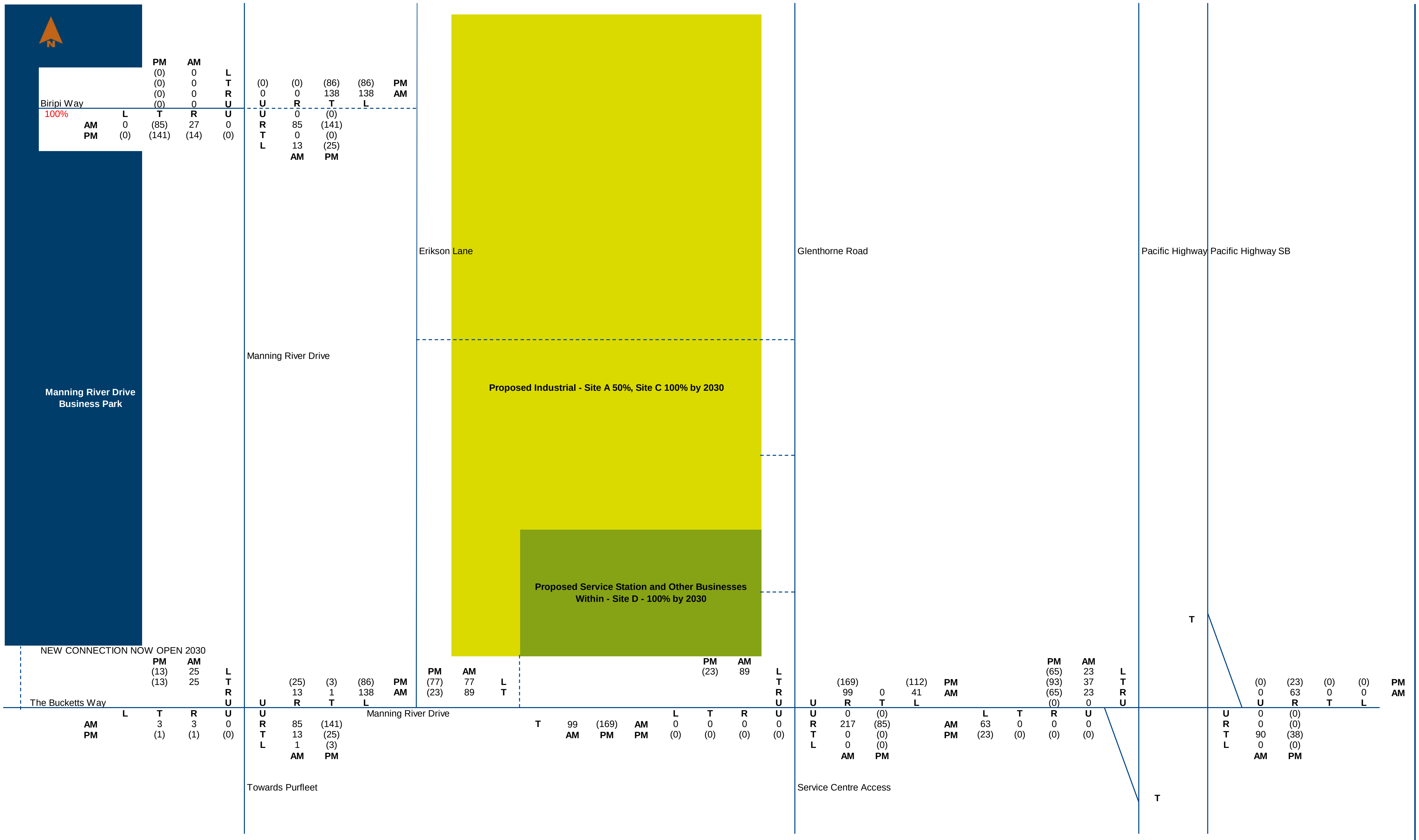
L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2025 Proposed Subdivision

Taree Glenthorne Service Station and Industrial

27-07-2020

SLR



Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2030 Proposed Subdivision

Taree Glenthorne Service Station and Industrial

27-07-2020

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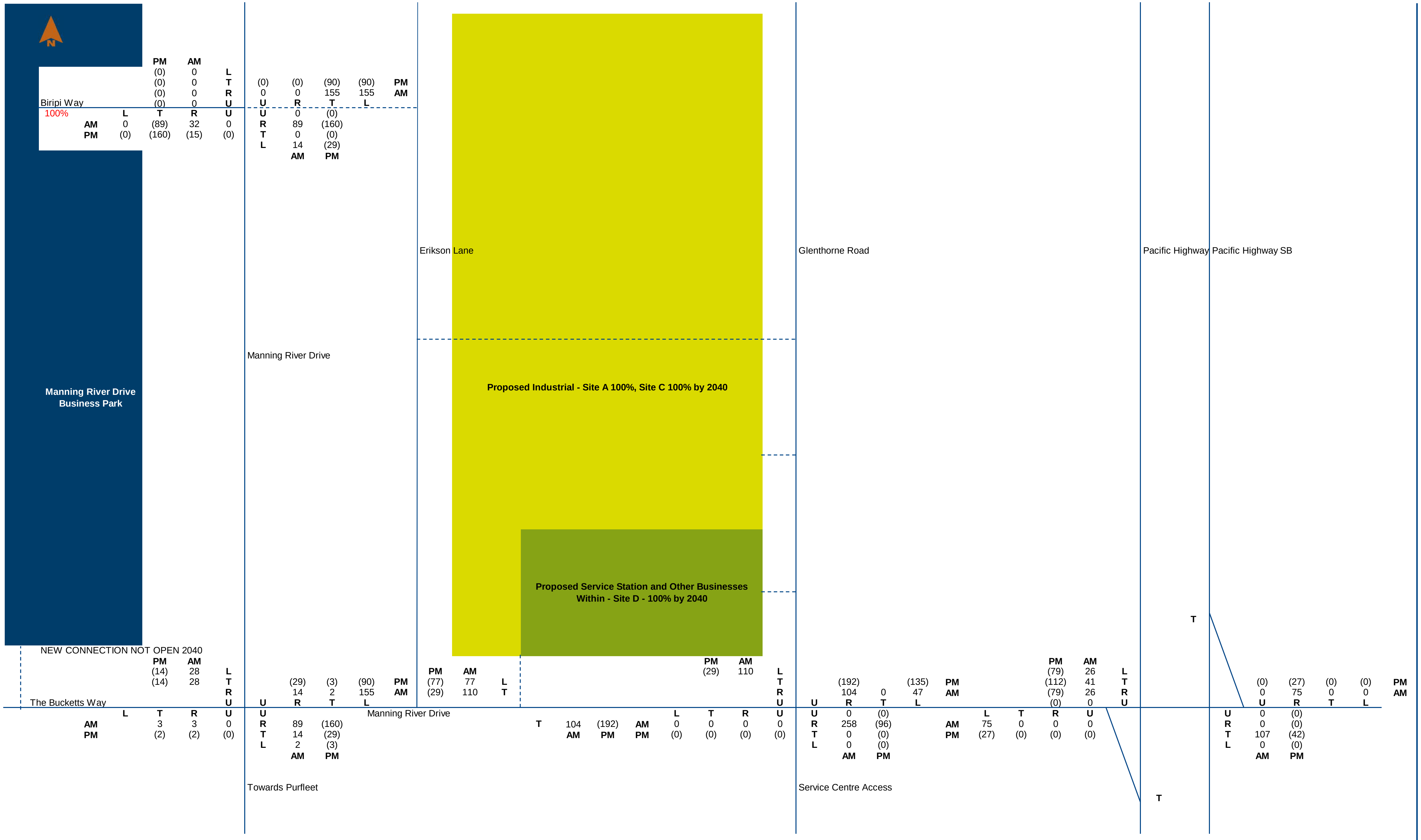

Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

2040 Proposed Subdivision

Taree Glenthorne Service Station and Industrial

27-07-2020

SLR

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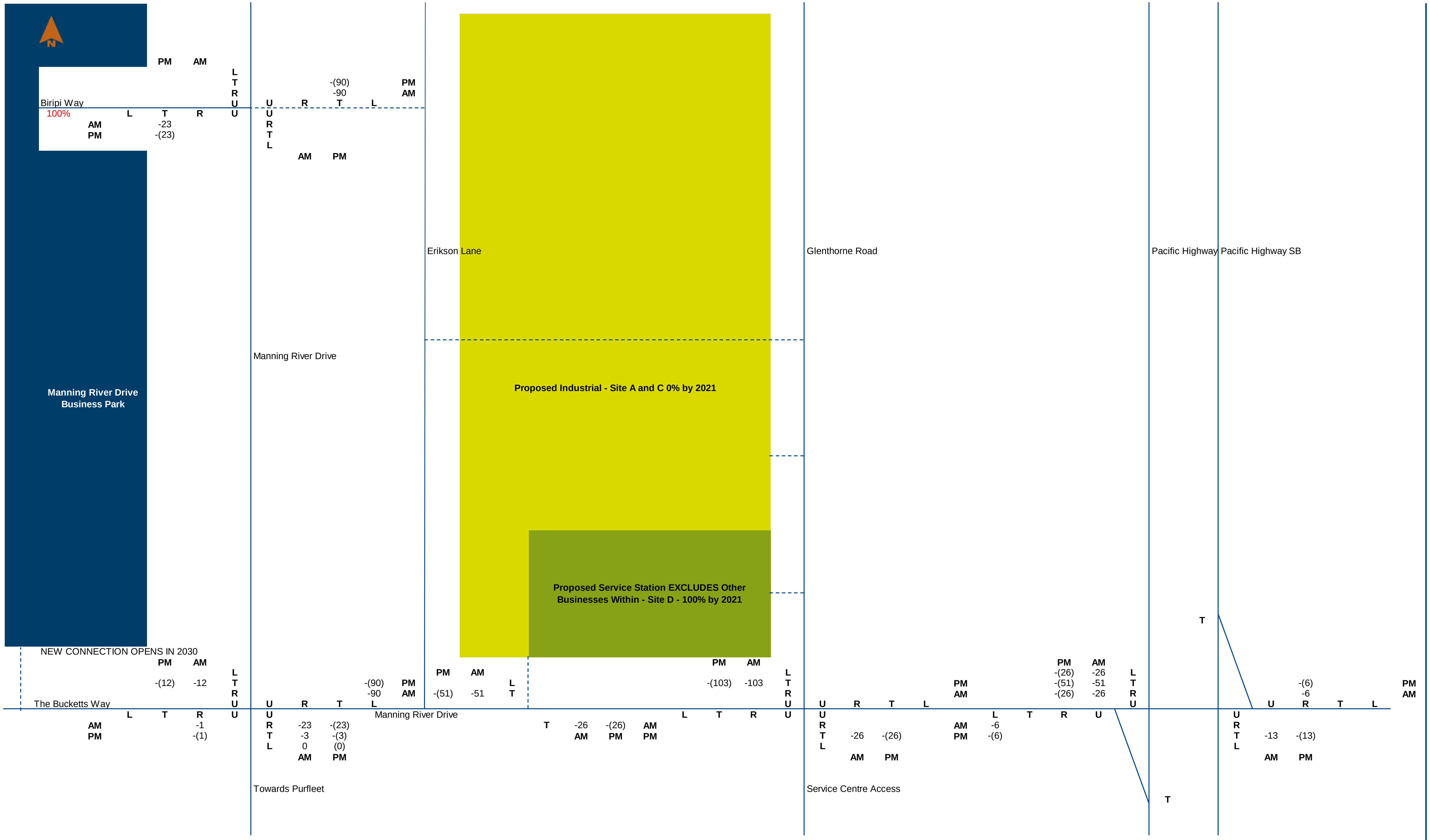

Legend

L	Left Turn	00	Weekday AM Peak Hour Volumes
T	Through	(00)	Weekday PM Peak Hour Volumes
R	Right turn		
U	U-turn		

Passing Trade (Drop-in Traffic) All Years

Taree Glenthorne Service Station and Industrial

SLR

27-07-2020

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APPENDIX D

SIDRA Assessment Outputs
Glenthorne Road / Manning River Drive

MOVEMENT SUMMARY

Site: INT2 [2018 EX-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access (South)												
1	L2	97	7.0	0.313	6.6	LOS A	1.2	9.1	0.61	0.84	0.63	47.1
2	T1	3	7.0	0.313	6.7	LOS A	1.2	9.1	0.61	0.84	0.63	51.4
3	R2	149	7.0	0.313	12.4	LOS B	1.2	9.1	0.61	0.84	0.63	48.7
3u	U	1	7.0	0.313	14.8	LOS B	1.2	9.1	0.61	0.84	0.63	50.0
Approach		251	7.0	0.313	10.1	LOS B	1.2	9.1	0.61	0.84	0.63	48.1
East: Manning River Drive (East)												
4	L2	163	7.0	0.474	4.0	LOS A	2.5	18.4	0.21	0.39	0.21	51.6
5	T1	1208	7.0	0.474	3.8	LOS A	2.5	18.4	0.22	0.38	0.22	55.8
6	R2	1	7.0	0.474	9.6	LOS A	2.5	18.3	0.22	0.38	0.22	56.8
6u	U	2	7.0	0.474	11.9	LOS B	2.5	18.3	0.22	0.38	0.22	57.1
Approach		1375	7.0	0.474	3.9	LOS A	2.5	18.4	0.22	0.38	0.22	55.3
North: Glenthorne Road (North)												
7	L2	4	7.0	0.011	4.8	LOS A	0.0	0.2	0.40	0.62	0.40	51.5
8	T1	1	7.0	0.011	4.9	LOS A	0.0	0.2	0.40	0.62	0.40	52.2
9	R2	4	7.0	0.011	10.5	LOS B	0.0	0.2	0.40	0.62	0.40	52.8
9u	U	1	7.0	0.011	12.9	LOS B	0.0	0.2	0.40	0.62	0.40	56.1
Approach		11	7.0	0.011	7.9	LOS A	0.0	0.2	0.40	0.62	0.40	52.6
West: Manning River Drive (West)												
10	L2	1	7.0	0.218	4.3	LOS A	1.2	8.8	0.33	0.40	0.33	53.6
11	T1	481	7.0	0.218	4.2	LOS A	1.2	8.8	0.34	0.44	0.34	54.3
12	R2	69	7.0	0.218	9.9	LOS A	1.2	8.6	0.34	0.49	0.34	52.3
12u	U	1	7.0	0.218	12.3	LOS B	1.2	8.6	0.34	0.49	0.34	54.7
Approach		553	7.0	0.218	4.9	LOS A	1.2	8.8	0.34	0.45	0.34	54.0
All Vehicles		2188	7.0	0.474	4.9	LOS A	2.5	18.4	0.29	0.45	0.30	54.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2018 EX-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	79	7.0	0.307	5.2	LOS A	1.1	8.1	0.48	0.76	0.48	47.5
2	T1	1	7.0	0.307	5.3	LOS A	1.1	8.1	0.48	0.76	0.48	51.7
3	R2	212	7.0	0.307	11.0	LOS B	1.1	8.1	0.48	0.76	0.48	49.1
3u	U	1	7.0	0.307	13.4	LOS B	1.1	8.1	0.48	0.76	0.48	50.5
Approach		293	7.0	0.307	9.4	LOS A	1.1	8.1	0.48	0.76	0.48	48.7
East: Manning River Drive (e)												
4	L2	148	7.0	0.311	4.2	LOS A	1.4	10.5	0.27	0.42	0.27	51.1
5	T1	679	7.0	0.311	4.0	LOS A	1.4	10.5	0.28	0.41	0.28	55.3
6	R2	1	7.0	0.311	9.7	LOS A	1.4	10.3	0.28	0.40	0.28	56.5
6u	U	1	7.0	0.311	12.1	LOS B	1.4	10.3	0.28	0.40	0.28	56.6
Approach		829	7.0	0.311	4.1	LOS A	1.4	10.5	0.28	0.41	0.28	54.6
North: Glenthorne Road												
7	L2	3	7.0	0.014	6.4	LOS A	0.1	0.4	0.61	0.72	0.61	50.3
8	T1	1	7.0	0.014	6.4	LOS A	0.1	0.4	0.61	0.72	0.61	50.8
9	R2	4	7.0	0.014	12.1	LOS B	0.1	0.4	0.61	0.72	0.61	51.4
9u	U	1	7.0	0.014	14.5	LOS B	0.1	0.4	0.61	0.72	0.61	54.8
Approach		9	7.0	0.014	9.8	LOS A	0.1	0.4	0.61	0.72	0.61	51.4
West: Manning River Drive (w)												
10	L2	8	7.0	0.470	4.8	LOS A	3.2	23.6	0.48	0.46	0.48	52.7
11	T1	1000	7.0	0.470	4.7	LOS A	3.2	23.6	0.49	0.49	0.49	53.2
12	R2	142	7.0	0.470	10.5	LOS B	3.1	23.1	0.50	0.54	0.50	51.3
12u	U	3	7.0	0.470	12.9	LOS B	3.1	23.1	0.50	0.54	0.50	53.6
Approach		1154	7.0	0.470	5.5	LOS A	3.2	23.6	0.49	0.50	0.49	53.0
All Vehicles		2285	7.0	0.470	5.5	LOS A	3.2	23.6	0.41	0.50	0.41	53.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2021 BG GR+BG DEV-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	97	7.0	0.331	7.1	LOS A	1.4	10.0	0.64	0.86	0.68	46.6
2	T1	3	7.0	0.331	7.2	LOS A	1.4	10.0	0.64	0.86	0.68	51.0
3	R2	149	7.0	0.331	12.9	LOS B	1.4	10.0	0.64	0.86	0.68	48.2
3u	U	1	7.0	0.331	15.2	LOS B	1.4	10.0	0.64	0.86	0.68	49.5
Approach		251	7.0	0.331	10.6	LOS B	1.4	10.0	0.64	0.86	0.68	47.6
East: Manning River Drive (e)												
4	L2	163	7.0	0.515	4.1	LOS A	2.9	21.3	0.23	0.39	0.23	51.5
5	T1	1328	7.0	0.515	3.9	LOS A	2.9	21.3	0.23	0.38	0.23	55.7
6	R2	1	7.0	0.515	9.6	LOS A	2.8	21.1	0.24	0.38	0.24	56.8
6u	U	2	7.0	0.515	12.0	LOS B	2.8	21.1	0.24	0.38	0.24	57.0
Approach		1495	7.0	0.515	3.9	LOS A	2.9	21.3	0.23	0.38	0.23	55.2
North: Glenthorne Road												
7	L2	4	7.0	0.011	4.9	LOS A	0.0	0.2	0.41	0.62	0.41	51.5
8	T1	1	7.0	0.011	4.9	LOS A	0.0	0.2	0.41	0.62	0.41	52.2
9	R2	4	7.0	0.011	10.6	LOS B	0.0	0.2	0.41	0.62	0.41	52.7
9u	U	1	7.0	0.011	13.0	LOS B	0.0	0.2	0.41	0.62	0.41	56.1
Approach		11	7.0	0.011	8.0	LOS A	0.0	0.2	0.41	0.62	0.41	52.5
West: Manning River Drive (w)												
10	L2	1	7.0	0.235	4.3	LOS A	1.3	9.7	0.34	0.41	0.34	53.6
11	T1	522	7.0	0.235	4.2	LOS A	1.3	9.7	0.35	0.44	0.35	54.2
12	R2	69	7.0	0.235	10.0	LOS A	1.3	9.5	0.35	0.49	0.35	52.3
12u	U	1	7.0	0.235	12.3	LOS B	1.3	9.5	0.35	0.49	0.35	54.7
Approach		594	7.0	0.235	4.9	LOS A	1.3	9.7	0.35	0.44	0.35	54.0
All Vehicles		2349	7.0	0.515	4.9	LOS A	2.9	21.3	0.31	0.45	0.31	54.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2021 BG GR+BG DEV-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	79	7.0	0.312	5.3	LOS A	1.1	8.3	0.49	0.77	0.49	47.4
2	T1	1	7.0	0.312	5.4	LOS A	1.1	8.3	0.49	0.77	0.49	51.7
3	R2	212	7.0	0.312	11.1	LOS B	1.1	8.3	0.49	0.77	0.49	49.0
3u	U	1	7.0	0.312	13.5	LOS B	1.1	8.3	0.49	0.77	0.49	50.4
Approach		293	7.0	0.312	9.5	LOS A	1.1	8.3	0.49	0.77	0.49	48.6
East: Manning River Drive (e)												
4	L2	148	7.0	0.330	4.2	LOS A	1.5	11.5	0.28	0.42	0.28	51.1
5	T1	728	7.0	0.330	4.0	LOS A	1.5	11.5	0.29	0.41	0.29	55.3
6	R2	1	7.0	0.330	9.8	LOS A	1.5	11.2	0.29	0.40	0.29	56.4
6u	U	1	7.0	0.330	12.1	LOS B	1.5	11.2	0.29	0.40	0.29	56.6
Approach		879	7.0	0.330	4.1	LOS A	1.5	11.5	0.29	0.41	0.29	54.6
North: Glenthorne Road												
7	L2	3	7.0	0.015	6.7	LOS A	0.1	0.4	0.64	0.74	0.64	50.0
8	T1	1	7.0	0.015	6.7	LOS A	0.1	0.4	0.64	0.74	0.64	50.6
9	R2	4	7.0	0.015	12.4	LOS B	0.1	0.4	0.64	0.74	0.64	51.2
9u	U	1	7.0	0.015	14.8	LOS B	0.1	0.4	0.64	0.74	0.64	54.6
Approach		9	7.0	0.015	10.1	LOS B	0.1	0.4	0.64	0.74	0.64	51.2
West: Manning River Drive (w)												
10	L2	8	7.0	0.509	4.8	LOS A	3.6	26.9	0.50	0.46	0.50	52.6
11	T1	1096	7.0	0.509	4.8	LOS A	3.6	26.9	0.51	0.49	0.51	53.1
12	R2	142	7.0	0.509	10.6	LOS B	3.5	26.2	0.52	0.54	0.52	51.2
12u	U	3	7.0	0.509	13.0	LOS B	3.5	26.2	0.52	0.54	0.52	53.6
Approach		1249	7.0	0.509	5.5	LOS A	3.6	26.9	0.51	0.50	0.51	52.9
All Vehicles		2431	7.0	0.509	5.5	LOS A	3.6	26.9	0.43	0.50	0.43	52.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2021 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	97	7.0	0.406	8.9	LOS A	2.0	15.0	0.75	0.94	0.87	45.0
2	T1	3	7.0	0.406	8.9	LOS A	2.0	15.0	0.75	0.94	0.87	49.5
3	R2	149	7.0	0.406	14.6	LOS B	2.0	15.0	0.75	0.94	0.87	46.5
3u	U	1	7.0	0.406	17.0	LOS B	2.0	15.0	0.75	0.94	0.87	47.5
Approach		251	7.0	0.406	12.3	LOS B	2.0	15.0	0.75	0.94	0.87	46.0
East: Manning River Drive (e)												
4	L2	163	7.0	0.587	4.8	LOS A	3.6	26.8	0.45	0.47	0.45	49.9
5	T1	1301	7.0	0.587	4.7	LOS A	3.6	26.8	0.46	0.48	0.46	53.8
6	R2	41	7.0	0.587	10.4	LOS B	3.5	26.1	0.47	0.48	0.47	55.0
6u	U	2	7.0	0.587	12.8	LOS B	3.5	26.1	0.47	0.48	0.47	54.9
Approach		1507	7.0	0.587	4.8	LOS A	3.6	26.8	0.46	0.48	0.46	53.4
North: Glenthorne Road												
7	L2	44	7.0	0.221	5.1	LOS A	0.8	5.7	0.45	0.75	0.45	50.3
8	T1	1	7.0	0.221	5.1	LOS A	0.8	5.7	0.45	0.75	0.45	50.8
9	R2	165	7.0	0.221	10.8	LOS B	0.8	5.7	0.45	0.75	0.45	51.4
9u	U	1	7.0	0.221	13.2	LOS B	0.8	5.7	0.45	0.75	0.45	54.8
Approach		212	7.0	0.221	9.6	LOS A	0.8	5.7	0.45	0.75	0.45	51.2
West: Manning River Drive (w)												
10	L2	82	7.0	0.233	4.4	LOS A	1.3	9.4	0.38	0.44	0.38	53.4
11	T1	414	7.0	0.233	4.4	LOS A	1.3	9.4	0.38	0.47	0.38	53.9
12	R2	69	7.0	0.233	10.1	LOS B	1.2	9.2	0.39	0.51	0.39	52.0
12u	U	1	7.0	0.233	12.5	LOS B	1.2	9.2	0.39	0.51	0.39	54.4
Approach		566	7.0	0.233	5.1	LOS A	1.3	9.4	0.38	0.47	0.38	53.6
All Vehicles		2536	7.0	0.587	6.0	LOS A	3.6	26.8	0.47	0.54	0.48	52.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: INT2 [2021 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	79	7.0	0.348	6.1	LOS A	1.4	10.8	0.59	0.84	0.61	46.9
2	T1	1	7.0	0.348	6.2	LOS A	1.4	10.8	0.59	0.84	0.61	51.2
3	R2	212	7.0	0.348	11.9	LOS B	1.4	10.8	0.59	0.84	0.61	48.5
3u	U	1	7.0	0.348	14.2	LOS B	1.4	10.8	0.59	0.84	0.61	49.9
Approach		293	7.0	0.348	10.3	LOS B	1.4	10.8	0.59	0.84	0.61	48.1
East: Manning River Drive (e)												
4	L2	148	7.0	0.372	4.8	LOS A	1.8	13.5	0.42	0.48	0.42	50.1
5	T1	701	7.0	0.372	4.7	LOS A	1.8	13.5	0.42	0.49	0.42	54.0
6	R2	41	7.0	0.372	10.4	LOS B	1.8	13.1	0.43	0.49	0.43	55.2
6u	U	1	7.0	0.372	12.8	LOS B	1.8	13.1	0.43	0.49	0.43	55.0
Approach		892	7.0	0.372	5.0	LOS A	1.8	13.5	0.42	0.49	0.42	53.4
North: Glenthorne Road												
7	L2	43	7.0	0.323	7.4	LOS A	1.5	10.9	0.71	0.90	0.74	48.8
8	T1	1	7.0	0.323	7.4	LOS A	1.5	10.9	0.71	0.90	0.74	49.2
9	R2	165	7.0	0.323	13.1	LOS B	1.5	10.9	0.71	0.90	0.74	49.9
9u	U	1	7.0	0.323	15.5	LOS B	1.5	10.9	0.71	0.90	0.74	53.4
Approach		211	7.0	0.323	11.9	LOS B	1.5	10.9	0.71	0.90	0.74	49.7
West: Manning River Drive (w)												
10	L2	89	7.0	0.516	5.1	LOS A	3.7	27.3	0.55	0.50	0.55	52.4
11	T1	987	7.0	0.516	5.1	LOS A	3.7	27.3	0.56	0.53	0.56	52.8
12	R2	142	7.0	0.516	10.9	LOS B	3.6	26.5	0.56	0.57	0.56	50.9
12u	U	3	7.0	0.516	13.3	LOS B	3.6	26.5	0.56	0.57	0.56	53.2
Approach		1222	7.0	0.516	5.7	LOS A	3.7	27.3	0.56	0.53	0.56	52.5
All Vehicles		2617	7.0	0.516	6.5	LOS A	3.7	27.3	0.53	0.58	0.53	52.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2025 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	97	7.0	0.495	11.6	LOS B	2.8	20.5	0.83	1.00	1.06	42.7
2	T1	3	7.0	0.495	11.6	LOS B	2.8	20.5	0.83	1.00	1.06	47.3
3	R2	149	7.0	0.495	17.3	LOS B	2.8	20.5	0.83	1.00	1.06	44.1
3u	U	1	7.0	0.495	19.7	LOS B	2.8	20.5	0.83	1.00	1.06	44.7
Approach		251	7.0	0.495	15.0	LOS B	2.8	20.5	0.83	1.00	1.06	43.6
East: Manning River Drive (e)												
4	L2	163	7.0	0.693	5.5	LOS A	5.6	41.9	0.56	0.55	0.59	49.1
5	T1	1478	7.0	0.693	5.4	LOS A	5.7	42.1	0.57	0.57	0.60	52.8
6	R2	114	7.0	0.693	11.3	LOS B	5.7	42.1	0.58	0.61	0.62	54.1
6u	U	2	7.0	0.693	13.7	LOS B	5.7	42.1	0.58	0.61	0.62	53.7
Approach		1757	7.0	0.693	5.8	LOS A	5.7	42.1	0.57	0.57	0.60	52.6
North: Glenthorne Road												
7	L2	62	7.0	0.272	5.4	LOS A	1.1	7.8	0.51	0.77	0.51	50.2
8	T1	1	7.0	0.272	5.5	LOS A	1.1	7.8	0.51	0.77	0.51	50.8
9	R2	183	7.0	0.272	11.2	LOS B	1.1	7.8	0.51	0.77	0.51	51.4
9u	U	1	7.0	0.272	13.5	LOS B	1.1	7.8	0.51	0.77	0.51	54.8
Approach		247	7.0	0.272	9.7	LOS A	1.1	7.8	0.51	0.77	0.51	51.1
West: Manning River Drive (w)												
10	L2	235	7.0	0.336	4.9	LOS A	2.0	14.6	0.47	0.52	0.47	53.1
11	T1	472	7.0	0.336	4.9	LOS A	2.0	14.6	0.48	0.53	0.48	53.4
12	R2	69	7.0	0.336	10.6	LOS B	1.9	14.2	0.48	0.53	0.48	51.7
12u	U	1	7.0	0.336	13.0	LOS B	1.9	14.2	0.48	0.53	0.48	54.1
Approach		777	7.0	0.336	5.4	LOS A	2.0	14.6	0.48	0.53	0.48	53.1
All Vehicles		3032	7.0	0.693	6.8	LOS A	5.7	42.1	0.56	0.61	0.60	51.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2025 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	79	7.0	0.391	7.1	LOS A	1.8	13.7	0.67	0.89	0.74	46.1
2	T1	1	7.0	0.391	7.1	LOS A	1.8	13.7	0.67	0.89	0.74	50.4
3	R2	212	7.0	0.391	12.8	LOS B	1.8	13.7	0.67	0.89	0.74	47.6
3u	U	1	7.0	0.391	15.2	LOS B	1.8	13.7	0.67	0.89	0.74	48.8
Approach		293	7.0	0.391	11.2	LOS B	1.8	13.7	0.67	0.89	0.74	47.2
East: Manning River Drive (e)												
4	L2	148	7.0	0.438	5.2	LOS A	2.5	18.2	0.52	0.52	0.52	49.4
5	T1	776	7.0	0.438	5.1	LOS A	2.5	18.2	0.53	0.53	0.53	53.2
6	R2	60	7.0	0.438	10.9	LOS B	2.4	17.5	0.53	0.54	0.53	54.4
6u	U	1	7.0	0.438	13.2	LOS B	2.4	17.5	0.53	0.54	0.53	54.1
Approach		985	7.0	0.438	5.5	LOS A	2.5	18.2	0.53	0.53	0.53	52.7
North: Glenthorne Road												
7	L2	117	7.0	0.625	11.2	LOS B	3.9	29.0	0.84	1.04	1.15	46.5
8	T1	1	7.0	0.625	11.3	LOS B	3.9	29.0	0.84	1.04	1.15	46.7
9	R2	239	7.0	0.625	17.0	LOS B	3.9	29.0	0.84	1.04	1.15	47.4
9u	U	1	7.0	0.625	19.4	LOS B	3.9	29.0	0.84	1.04	1.15	51.1
Approach		358	7.0	0.625	15.1	LOS B	3.9	29.0	0.84	1.04	1.15	47.1
West: Manning River Drive (w)												
10	L2	107	7.0	0.601	5.4	LOS A	4.9	36.2	0.63	0.54	0.63	52.0
11	T1	1148	7.0	0.601	5.5	LOS A	4.9	36.4	0.63	0.58	0.65	52.2
12	R2	142	7.0	0.601	11.5	LOS B	4.9	36.4	0.64	0.63	0.67	50.4
12u	U	3	7.0	0.601	13.9	LOS B	4.9	36.4	0.64	0.63	0.67	52.7
Approach		1401	7.0	0.601	6.2	LOS A	4.9	36.4	0.63	0.58	0.65	52.0
All Vehicles		3037	7.0	0.625	7.5	LOS A	4.9	36.4	0.63	0.65	0.68	51.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2030 BG GR+BG DEV-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	97	7.0	0.394	9.1	LOS A	1.9	13.8	0.74	0.93	0.87	44.8
2	T1	3	7.0	0.394	9.1	LOS A	1.9	13.8	0.74	0.93	0.87	49.3
3	R2	149	7.0	0.394	14.8	LOS B	1.9	13.8	0.74	0.93	0.87	46.3
3u	U	1	7.0	0.394	17.2	LOS B	1.9	13.8	0.74	0.93	0.87	47.2
Approach		251	7.0	0.394	12.5	LOS B	1.9	13.8	0.74	0.93	0.87	45.7
East: Manning River Drive (e)												
4	L2	163	7.0	0.641	4.1	LOS A	4.5	33.6	0.28	0.39	0.28	51.1
5	T1	1705	7.0	0.641	4.0	LOS A	4.5	33.6	0.29	0.39	0.29	55.2
6	R2	1	7.0	0.641	9.7	LOS A	4.5	33.5	0.30	0.39	0.30	56.3
6u	U	2	7.0	0.641	12.1	LOS B	4.5	33.5	0.30	0.39	0.30	56.5
Approach		1872	7.0	0.641	4.0	LOS A	4.5	33.6	0.29	0.39	0.29	54.8
North: Glenthorne Road												
7	L2	4	7.0	0.012	5.1	LOS A	0.0	0.3	0.45	0.64	0.45	51.3
8	T1	1	7.0	0.012	5.2	LOS A	0.0	0.3	0.45	0.64	0.45	52.0
9	R2	4	7.0	0.012	10.8	LOS B	0.0	0.3	0.45	0.64	0.45	52.5
9u	U	1	7.0	0.012	13.2	LOS B	0.0	0.3	0.45	0.64	0.45	55.9
Approach		11	7.0	0.012	8.2	LOS A	0.0	0.3	0.45	0.64	0.45	52.4
West: Manning River Drive (w)												
10	L2	1	7.0	0.285	4.3	LOS A	1.7	12.6	0.37	0.41	0.37	53.4
11	T1	648	7.0	0.285	4.2	LOS A	1.7	12.6	0.37	0.44	0.37	54.1
12	R2	69	7.0	0.285	10.0	LOS A	1.7	12.3	0.38	0.48	0.38	52.4
12u	U	1	7.0	0.285	12.4	LOS B	1.7	12.3	0.38	0.48	0.38	54.8
Approach		720	7.0	0.285	4.8	LOS A	1.7	12.6	0.37	0.44	0.37	54.0
All Vehicles		2853	7.0	0.641	5.0	LOS A	4.5	33.6	0.35	0.45	0.36	53.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2030 BG GR+BG DEV-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	79	7.0	0.335	5.8	LOS A	1.3	9.5	0.55	0.81	0.56	47.1
2	T1	1	7.0	0.335	5.9	LOS A	1.3	9.5	0.55	0.81	0.56	51.4
3	R2	212	7.0	0.335	11.5	LOS B	1.3	9.5	0.55	0.81	0.56	48.7
3u	U	1	7.0	0.335	13.9	LOS B	1.3	9.5	0.55	0.81	0.56	50.1
Approach		293	7.0	0.335	10.0	LOS A	1.3	9.5	0.55	0.81	0.56	48.3
East: Manning River Drive (e)												
4	L2	148	7.0	0.391	4.3	LOS A	2.0	15.2	0.31	0.42	0.31	50.8
5	T1	892	7.0	0.391	4.1	LOS A	2.0	15.2	0.32	0.41	0.32	55.0
6	R2	1	7.0	0.391	9.8	LOS A	2.0	14.8	0.32	0.40	0.32	56.2
6u	U	1	7.0	0.391	12.2	LOS B	2.0	14.8	0.32	0.40	0.32	56.3
Approach		1042	7.0	0.391	4.1	LOS A	2.0	15.2	0.32	0.41	0.32	54.4
North: Glenthorne Road												
7	L2	3	7.0	0.019	7.9	LOS A	0.1	0.6	0.73	0.79	0.73	49.1
8	T1	1	7.0	0.019	8.0	LOS A	0.1	0.6	0.73	0.79	0.73	49.5
9	R2	4	7.0	0.019	13.7	LOS B	0.1	0.6	0.73	0.79	0.73	50.2
9u	U	1	7.0	0.019	16.1	LOS B	0.1	0.6	0.73	0.79	0.73	53.7
Approach		9	7.0	0.019	11.4	LOS B	0.1	0.6	0.73	0.79	0.73	50.2
West: Manning River Drive (w)												
10	L2	8	7.0	0.647	5.1	LOS A	5.6	41.8	0.61	0.49	0.61	52.0
11	T1	1438	7.0	0.647	5.2	LOS A	5.7	42.2	0.62	0.53	0.62	52.4
12	R2	142	7.0	0.647	11.1	LOS B	5.7	42.2	0.63	0.58	0.64	50.6
12u	U	4	7.0	0.647	13.5	LOS B	5.7	42.2	0.63	0.58	0.64	53.0
Approach		1593	7.0	0.647	5.7	LOS A	5.7	42.2	0.62	0.53	0.62	52.2
All Vehicles		2937	7.0	0.647	5.6	LOS A	5.7	42.2	0.51	0.52	0.51	52.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2030 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	97	7.0	0.554	14.1	LOS B	3.3	24.2	0.87	1.04	1.19	40.8
2	T1	3	7.0	0.554	14.1	LOS B	3.3	24.2	0.87	1.04	1.19	45.5
3	R2	149	7.0	0.554	19.8	LOS B	3.3	24.2	0.87	1.04	1.19	42.1
3u	U	1	7.0	0.554	22.2	LOS C	3.3	24.2	0.87	1.04	1.19	42.4
Approach		251	7.0	0.554	17.5	LOS B	3.3	24.2	0.87	1.04	1.19	41.6
East: Manning River Drive (e)												
4	L2	163	7.0	0.770	5.2	LOS A	7.1	52.9	0.55	0.50	0.56	49.2
5	T1	1679	7.0	0.770	5.1	LOS A	7.4	54.8	0.56	0.54	0.58	52.7
6	R2	229	7.0	0.770	11.1	LOS B	7.4	54.8	0.58	0.59	0.61	53.8
6u	U	2	7.0	0.770	13.5	LOS B	7.4	54.8	0.58	0.59	0.61	53.3
Approach		2074	7.0	0.770	5.8	LOS A	7.4	54.8	0.56	0.54	0.58	52.6
North: Glenthorne Road												
7	L2	47	7.0	0.178	5.2	LOS A	0.6	4.7	0.50	0.76	0.50	50.5
8	T1	1	7.0	0.178	5.3	LOS A	0.6	4.7	0.50	0.76	0.50	51.1
9	R2	108	7.0	0.178	11.0	LOS B	0.6	4.7	0.50	0.76	0.50	51.7
9u	U	1	7.0	0.178	13.4	LOS B	0.6	4.7	0.50	0.76	0.50	55.1
Approach		158	7.0	0.178	9.2	LOS A	0.6	4.7	0.50	0.76	0.50	51.3
West: Manning River Drive (w)												
10	L2	95	7.0	0.331	5.4	LOS A	1.9	14.1	0.54	0.55	0.54	52.5
11	T1	540	7.0	0.331	5.5	LOS A	1.9	14.1	0.54	0.57	0.54	52.9
12	R2	69	7.0	0.331	11.3	LOS B	1.8	13.7	0.55	0.60	0.55	51.0
12u	U	1	7.0	0.331	13.7	LOS B	1.8	13.7	0.55	0.60	0.55	53.4
Approach		705	7.0	0.331	6.0	LOS A	1.9	14.1	0.54	0.57	0.54	52.6
All Vehicles		3187	7.0	0.770	6.9	LOS A	7.4	54.8	0.58	0.60	0.62	51.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2030 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Service Centre Access												
1	L2	79	7.0	0.399	7.2	LOS A	1.9	14.0	0.68	0.90	0.76	45.9
2	T1	1	7.0	0.399	7.3	LOS A	1.9	14.0	0.68	0.90	0.76	50.3
3	R2	212	7.0	0.399	13.0	LOS B	1.9	14.0	0.68	0.90	0.76	47.5
3u	U	1	7.0	0.399	15.4	LOS B	1.9	14.0	0.68	0.90	0.76	48.6
Approach		293	7.0	0.399	11.4	LOS B	1.9	14.0	0.68	0.90	0.76	47.1
East: Manning River Drive (e)												
4	L2	148	7.0	0.468	5.0	LOS A	2.6	19.5	0.49	0.50	0.49	49.6
5	T1	864	7.0	0.468	4.9	LOS A	2.6	19.5	0.49	0.52	0.49	53.3
6	R2	91	7.0	0.468	10.7	LOS B	2.5	18.8	0.50	0.54	0.50	54.5
6u	U	1	7.0	0.468	13.0	LOS B	2.5	18.8	0.50	0.54	0.50	54.1
Approach		1104	7.0	0.468	5.4	LOS A	2.6	19.5	0.49	0.52	0.49	53.0
North: Glenthorne Road												
7	L2	121	7.0	0.598	11.7	LOS B	3.6	26.6	0.85	1.03	1.15	46.4
8	T1	1	7.0	0.598	11.7	LOS B	3.6	26.6	0.85	1.03	1.15	46.6
9	R2	182	7.0	0.598	17.4	LOS B	3.6	26.6	0.85	1.03	1.15	47.4
9u	U	1	7.0	0.598	19.8	LOS B	3.6	26.6	0.85	1.03	1.15	51.0
Approach		305	7.0	0.598	15.1	LOS B	3.6	26.6	0.85	1.03	1.15	47.0
West: Manning River Drive (w)												
10	L2	33	7.0	0.661	6.4	LOS A	6.3	46.8	0.69	0.64	0.75	51.5
11	T1	1329	7.0	0.661	6.5	LOS A	6.3	46.8	0.70	0.68	0.77	51.7
12	R2	142	7.0	0.661	12.5	LOS B	6.3	46.6	0.71	0.74	0.79	49.8
12u	U	4	7.0	0.661	14.9	LOS B	6.3	46.6	0.71	0.74	0.79	52.2
Approach		1508	7.0	0.661	7.1	LOS A	6.3	46.8	0.70	0.69	0.77	51.5
All Vehicles		3211	7.0	0.661	7.7	LOS A	6.3	46.8	0.64	0.68	0.71	51.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2040 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	97	7.0	0.939	64.3	LOS E	10.2	75.4	0.99	1.53	2.71	21.4
2	T1	3	7.0	0.939	64.3	LOS E	10.2	75.4	0.99	1.53	2.71	25.5
3	R2	149	7.0	0.939	70.0	LOS E	10.2	75.4	0.99	1.53	2.71	21.9
3u	U	1	7.0	0.939	72.4	LOS F	10.2	75.4	0.99	1.53	2.71	20.9
Approach		251	7.0	0.939	67.7	LOS E	10.2	75.4	0.99	1.53	2.71	21.8
East: Manning River Drive (e)												
4	L2	163	7.0	0.919	8.0	LOS A	18.3	136.0	0.87	0.72	0.99	47.1
5	T1	2033	7.0	0.919	8.3	LOS A	18.3	136.0	0.89	0.75	1.04	50.3
6	R2	273	7.0	0.919	14.6	LOS B	18.2	134.8	0.93	0.79	1.10	51.5
6u	U	3	7.0	0.919	17.0	LOS B	18.2	134.8	0.93	0.79	1.10	50.5
Approach		2472	7.0	0.919	9.0	LOS A	18.3	136.0	0.90	0.75	1.04	50.2
North: Glenthorne Road												
7	L2	54	7.0	0.211	5.6	LOS A	0.8	6.2	0.57	0.79	0.57	50.3
8	T1	1	7.0	0.211	5.7	LOS A	0.8	6.2	0.57	0.79	0.57	50.9
9	R2	114	7.0	0.211	11.4	LOS B	0.8	6.2	0.57	0.79	0.57	51.5
9u	U	1	7.0	0.211	13.8	LOS B	0.8	6.2	0.57	0.79	0.57	54.9
Approach		169	7.0	0.211	9.5	LOS A	0.8	6.2	0.57	0.79	0.57	51.1
West: Manning River Drive (w)												
10	L2	117	7.0	0.432	5.8	LOS A	2.9	21.4	0.65	0.59	0.65	51.9
11	T1	676	7.0	0.432	5.9	LOS A	2.9	21.4	0.65	0.61	0.65	52.2
12	R2	69	7.0	0.432	11.8	LOS B	2.8	20.5	0.66	0.63	0.66	50.4
12u	U	1	7.0	0.432	14.2	LOS B	2.8	20.5	0.66	0.63	0.66	52.8
Approach		863	7.0	0.432	6.4	LOS A	2.9	21.4	0.65	0.61	0.65	52.0
All Vehicles		3755	7.0	0.939	12.3	LOS B	18.3	136.0	0.83	0.77	1.04	47.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2040 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	79	7.0	0.463	8.7	LOS A	2.4	18.1	0.76	0.96	0.91	44.6
2	T1	1	7.0	0.463	8.7	LOS A	2.4	18.1	0.76	0.96	0.91	49.1
3	R2	212	7.0	0.463	14.4	LOS B	2.4	18.1	0.76	0.96	0.91	46.1
3u	U	1	7.0	0.463	16.8	LOS B	2.4	18.1	0.76	0.96	0.91	47.0
Approach		293	7.0	0.463	12.9	LOS B	2.4	18.1	0.76	0.96	0.91	45.7
East: Manning River Drive (e)												
4	L2	148	7.0	0.561	5.4	LOS A	3.8	28.2	0.58	0.54	0.59	49.0
5	T1	1041	7.0	0.561	5.4	LOS A	3.8	28.2	0.58	0.57	0.60	52.7
6	R2	102	7.0	0.561	11.2	LOS B	3.7	27.7	0.59	0.60	0.62	54.0
6u	U	1	7.0	0.561	13.6	LOS B	3.7	27.7	0.59	0.60	0.62	53.5
Approach		1293	7.0	0.561	5.8	LOS A	3.8	28.2	0.58	0.57	0.60	52.4
North: Glenthorne Road												
7	L2	145	7.0	0.987	60.5	LOS E	14.6	108.3	1.00	1.76	3.42	27.0
8	T1	1	7.0	0.987	60.6	LOS E	14.6	108.3	1.00	1.76	3.42	26.2
9	R2	206	7.0	0.987	66.2	LOS E	14.6	108.3	1.00	1.76	3.42	27.2
9u	U	1	7.0	0.987	68.6	LOS E	14.6	108.3	1.00	1.76	3.42	30.8
Approach		354	7.0	0.987	63.9	LOS E	14.6	108.3	1.00	1.76	3.42	27.2
West: Manning River Drive (w)												
10	L2	39	7.0	0.829	9.5	LOS A	13.0	96.6	0.89	0.88	1.13	50.4
11	T1	1693	7.0	0.829	9.8	LOS A	13.0	96.6	0.90	0.90	1.16	49.9
12	R2	142	7.0	0.829	16.1	LOS B	12.8	95.1	0.92	0.94	1.20	47.5
12u	U	4	7.0	0.829	18.5	LOS B	12.8	95.1	0.92	0.94	1.20	49.8
Approach		1878	7.0	0.829	10.3	LOS B	13.0	96.6	0.90	0.91	1.16	49.7
All Vehicles		3817	7.0	0.987	14.0	LOS B	14.6	108.3	0.79	0.88	1.16	45.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2040 BG GR+BG DEV-REZ-UP-AM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	97	7.0	0.667	24.2	LOS C	4.6	33.9	0.93	1.16	1.55	34.5
2	T1	3	7.0	0.667	24.3	LOS C	4.6	33.9	0.93	1.16	1.55	39.3
3	R2	149	7.0	0.667	30.0	LOS C	4.6	33.9	0.93	1.16	1.55	35.5
3u	U	1	7.0	0.667	32.4	LOS C	4.6	33.9	0.93	1.16	1.55	35.1
Approach		251	7.0	0.667	27.7	LOS C	4.6	33.9	0.93	1.16	1.55	35.1
East: Manning River Drive (e)												
4	L2	163	7.0	0.139	4.7	LOS A	0.4	3.3	0.23	0.50	0.23	50.6
5	T1	2033	7.0	0.762	4.6	LOS A	6.5	48.5	0.48	0.48	0.49	53.3
6	R2	273	7.0	0.762	10.6	LOS B	6.5	48.5	0.52	0.55	0.54	54.1
6u	U	3	7.0	0.762	13.0	LOS B	6.5	48.5	0.52	0.55	0.54	53.6
Approach		2472	7.0	0.762	5.3	LOS A	6.5	48.5	0.47	0.49	0.48	53.2
North: Glenthorne Road												
7	L2	54	7.0	0.202	5.4	LOS A	0.7	5.4	0.54	0.77	0.54	50.4
8	T1	1	7.0	0.202	5.5	LOS A	0.7	5.4	0.54	0.77	0.54	51.0
9	R2	114	7.0	0.202	11.2	LOS B	0.7	5.4	0.54	0.77	0.54	51.6
9u	U	1	7.0	0.202	13.6	LOS B	0.7	5.4	0.54	0.77	0.54	55.0
Approach		169	7.0	0.202	9.4	LOS A	0.7	5.4	0.54	0.77	0.54	51.2
West: Manning River Drive (w)												
10	L2	117	7.0	0.118	5.7	LOS A	0.6	4.2	0.50	0.60	0.50	52.8
11	T1	676	7.0	0.304	5.2	LOS A	1.9	13.8	0.55	0.53	0.55	52.8
12	R2	69	7.0	0.304	11.2	LOS B	1.7	12.8	0.56	0.59	0.56	51.0
12u	U	1	7.0	0.304	13.6	LOS B	1.7	12.8	0.56	0.59	0.56	53.4
Approach		863	7.0	0.304	5.8	LOS A	1.9	13.8	0.54	0.55	0.54	52.7
All Vehicles		3755	7.0	0.762	7.1	LOS A	6.5	48.5	0.52	0.56	0.57	51.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT2 [2040 BG GR+BG DEV-REZ-UP-PM+]

Manning River Drive / Glenthorne Road / Service Centre Access
Site Category: Roundabout
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Service Centre Access												
1	L2	79	7.0	0.422	7.8	LOS A	2.0	14.8	0.71	0.92	0.82	45.4
2	T1	1	7.0	0.422	7.8	LOS A	2.0	14.8	0.71	0.92	0.82	49.8
3	R2	212	7.0	0.422	13.5	LOS B	2.0	14.8	0.71	0.92	0.82	47.0
3u	U	1	7.0	0.422	15.9	LOS B	2.0	14.8	0.71	0.92	0.82	48.0
Approach		293	7.0	0.422	11.9	LOS B	2.0	14.8	0.71	0.92	0.82	46.6
East: Manning River Drive (e)												
4	L2	148	7.0	0.136	5.1	LOS A	0.5	3.8	0.37	0.56	0.37	49.9
5	T1	1041	7.0	0.420	4.5	LOS A	2.3	17.3	0.46	0.47	0.46	53.6
6	R2	102	7.0	0.420	10.4	LOS B	2.1	15.9	0.46	0.52	0.46	54.6
6u	U	1	7.0	0.420	12.8	LOS B	2.1	15.9	0.46	0.52	0.46	54.3
Approach		1293	7.0	0.420	5.1	LOS A	2.3	17.3	0.45	0.48	0.45	53.3
North: Glenthorne Road												
7	L2	145	7.0	0.819	22.2	LOS C	6.4	47.8	0.95	1.23	1.77	40.2
8	T1	1	7.0	0.819	22.3	LOS C	6.4	47.8	0.95	1.23	1.77	39.9
9	R2	206	7.0	0.819	27.9	LOS C	6.4	47.8	0.95	1.23	1.77	40.9
9u	U	1	7.0	0.819	30.3	LOS C	6.4	47.8	0.95	1.23	1.77	44.7
Approach		354	7.0	0.819	25.6	LOS C	6.4	47.8	0.95	1.23	1.77	40.6
West: Manning River Drive (w)												
10	L2	39	7.0	0.038	5.1	LOS A	0.2	1.3	0.42	0.52	0.42	53.2
11	T1	1693	7.0	0.705	6.5	LOS A	7.6	56.1	0.72	0.68	0.80	51.6
12	R2	142	7.0	0.705	12.8	LOS B	7.6	56.1	0.75	0.76	0.85	49.7
12u	U	4	7.0	0.705	15.2	LOS B	7.6	56.1	0.75	0.76	0.85	52.0
Approach		1878	7.0	0.705	6.9	LOS A	7.6	56.1	0.72	0.68	0.79	51.5
All Vehicles		3817	7.0	0.819	8.4	LOS A	7.6	56.1	0.65	0.68	0.77	50.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX E

SIDRA Assessment Outputs
Old Bar Road / Manning River Drive / Pacific Hwy

MOVEMENT SUMMARY

Site: 101 [2018 EX-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Pacific Highway Ramp (South)												
1	L2	671	7.0	0.233	3.1	LOS A	2.2	16.5	0.32	0.37	0.32	58.4
2	T1	1	7.0	0.233	5.5	LOS A	2.2	16.5	0.89	0.63	0.89	55.9
3	R2	43	7.0	0.233	12.4	LOS B	2.2	16.5	0.89	0.63	0.89	65.5
Approach		715	7.0	0.233	3.7	LOS A	2.2	16.5	0.36	0.38	0.36	58.8
East: Old Bar Road (West)												
4	L2	80	7.0	0.579	4.6	LOS A	5.0	37.0	0.69	0.56	0.74	55.7
5	T1	601	7.0	0.579	4.9	LOS A	5.0	37.0	0.69	0.56	0.74	55.8
6	R2	98	7.0	0.579	11.8	LOS B	5.0	37.0	0.69	0.56	0.74	66.3
Approach		779	7.0	0.579	5.7	LOS A	5.0	37.0	0.69	0.56	0.74	57.1
North: Pacific Highway Ramp (North)												
7	L2	44	7.0	0.128	3.4	LOS A	0.5	3.9	0.47	0.60	0.47	54.8
8	T1	1	7.0	0.128	3.6	LOS A	0.5	3.9	0.47	0.60	0.47	55.5
9	R2	96	7.0	0.128	10.5	LOS B	0.5	3.9	0.47	0.60	0.47	63.6
Approach		141	7.0	0.128	8.2	LOS A	0.5	3.9	0.47	0.60	0.47	60.2
West: Manning River Drive (East)												
10	L2	141	7.0	0.205	2.5	LOS A	1.3	9.4	0.34	0.28	0.34	58.2
11	T1	156	7.0	0.205	2.7	LOS A	1.3	9.4	0.34	0.28	0.34	59.2
12	R2	343	7.0	0.176	9.4	LOS A	1.1	8.3	0.30	0.53	0.30	62.9
Approach		640	7.0	0.205	6.2	LOS A	1.3	9.4	0.32	0.42	0.32	61.1
All Vehicles		2275	7.0	0.579	5.4	LOS A	5.0	37.0	0.47	0.47	0.48	59.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2018 EX-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	473	7.0	0.157	2.3	LOS A	1.1	8.2	0.20	0.30	0.20	58.7
2	T1	1	7.0	0.157	3.2	LOS A	1.1	8.2	0.52	0.43	0.52	57.0
3	R2	84	7.0	0.157	10.1	LOS B	1.1	8.2	0.52	0.43	0.52	66.8
Approach		558	7.0	0.157	3.5	LOS A	1.1	8.2	0.25	0.32	0.25	60.0
East: Old Bar Road												
4	L2	49	7.0	0.298	4.9	LOS A	2.1	15.6	0.72	0.56	0.72	55.7
5	T1	257	7.0	0.298	5.2	LOS A	2.1	15.6	0.72	0.56	0.72	55.8
6	R2	34	7.0	0.298	12.0	LOS B	2.1	15.6	0.72	0.56	0.72	66.3
Approach		340	7.0	0.298	5.8	LOS A	2.1	15.6	0.72	0.56	0.72	56.8
North: Pacific Highway NB Ramps												
7	L2	68	7.0	0.176	4.6	LOS A	0.8	5.7	0.63	0.68	0.63	54.7
8	T1	1	7.0	0.176	4.8	LOS A	0.8	5.7	0.63	0.68	0.63	55.3
9	R2	87	7.0	0.176	11.7	LOS B	0.8	5.7	0.63	0.68	0.63	63.6
Approach		157	7.0	0.176	8.5	LOS A	0.8	5.7	0.63	0.68	0.63	58.9
West: Manning River Drive												
10	L2	128	7.0	0.323	2.3	LOS A	2.3	16.8	0.30	0.26	0.30	58.4
11	T1	512	7.0	0.323	2.5	LOS A	2.3	16.8	0.30	0.26	0.30	59.4
12	R2	580	7.0	0.392	9.7	LOS A	2.8	21.1	0.37	0.55	0.37	62.5
Approach		1220	7.0	0.392	5.9	LOS A	2.8	21.1	0.33	0.40	0.33	60.9
All Vehicles		2275	7.0	0.392	5.5	LOS A	2.8	21.1	0.39	0.42	0.39	59.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	725	7.0	0.262	3.3	LOS A	2.7	20.0	0.33	0.39	0.33	58.3
2	T1	1	7.0	0.262	6.2	LOS A	2.7	20.0	0.97	0.71	0.97	55.4
3	R2	45	7.0	0.262	13.1	LOS B	2.7	20.0	0.97	0.71	0.97	64.9
Approach		772	7.0	0.262	3.9	LOS A	2.7	20.0	0.37	0.41	0.37	58.8
East: Old Bar Road												
4	L2	85	7.0	0.646	5.9	LOS A	6.7	49.8	0.77	0.71	0.89	55.3
5	T1	656	7.0	0.646	6.1	LOS A	6.7	49.8	0.77	0.71	0.89	55.3
6	R2	104	7.0	0.646	13.0	LOS B	6.7	49.8	0.77	0.71	0.89	65.7
Approach		845	7.0	0.646	6.9	LOS A	6.7	49.8	0.77	0.71	0.89	56.5
North: Pacific Highway NB Ramps												
7	L2	47	7.0	0.152	3.5	LOS A	0.6	4.8	0.49	0.62	0.49	54.6
8	T1	1	7.0	0.152	3.7	LOS A	0.6	4.8	0.49	0.62	0.49	55.3
9	R2	116	7.0	0.152	10.6	LOS B	0.6	4.8	0.49	0.62	0.49	63.2
Approach		164	7.0	0.152	8.5	LOS A	0.6	4.8	0.49	0.62	0.49	60.1
West: Manning River Drive												
10	L2	153	7.0	0.225	2.5	LOS A	1.4	10.6	0.36	0.29	0.36	58.1
11	T1	169	7.0	0.225	2.8	LOS A	1.4	10.6	0.36	0.29	0.36	59.1
12	R2	367	7.0	0.190	9.4	LOS A	1.2	9.2	0.32	0.53	0.32	62.8
Approach		689	7.0	0.225	6.3	LOS A	1.4	10.6	0.34	0.42	0.34	61.0
All Vehicles		2471	7.0	0.646	5.9	LOS A	6.7	49.8	0.50	0.53	0.55	58.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Pacific Highway SB Ramps												
1	L2	503	7.0	0.169	2.4	LOS A	1.2	9.1	0.21	0.31	0.21	58.7
2	T1	1	7.0	0.169	3.3	LOS A	1.2	9.1	0.56	0.44	0.56	56.8
3	R2	89	7.0	0.169	10.2	LOS B	1.2	9.1	0.56	0.44	0.56	66.5
Approach		594	7.0	0.169	3.5	LOS A	1.2	9.1	0.26	0.33	0.26	59.9
East: Old Bar Road												
4	L2	53	7.0	0.336	5.4	LOS A	2.5	18.4	0.77	0.61	0.77	55.4
5	T1	276	7.0	0.336	5.6	LOS A	2.5	18.4	0.77	0.61	0.77	55.4
6	R2	36	7.0	0.336	12.5	LOS B	2.5	18.4	0.77	0.61	0.77	65.9
Approach		364	7.0	0.336	6.3	LOS A	2.5	18.4	0.77	0.61	0.77	56.4
North: Pacific Highway NB Ramps												
7	L2	73	7.0	0.199	4.8	LOS A	0.9	6.6	0.66	0.71	0.66	54.5
8	T1	1	7.0	0.199	5.0	LOS A	0.9	6.6	0.66	0.71	0.66	55.2
9	R2	96	7.0	0.199	11.9	LOS B	0.9	6.6	0.66	0.71	0.66	63.3
Approach		169	7.0	0.199	8.8	LOS A	0.9	6.6	0.66	0.71	0.66	58.8
West: Manning River Drive												
10	L2	146	7.0	0.357	2.3	LOS A	2.6	19.4	0.32	0.26	0.32	58.2
11	T1	557	7.0	0.357	2.5	LOS A	2.6	19.4	0.32	0.26	0.32	59.2
12	R2	625	7.0	0.425	9.7	LOS A	3.2	23.9	0.39	0.55	0.39	62.3
Approach		1328	7.0	0.425	5.9	LOS A	3.2	23.9	0.36	0.40	0.36	60.7
All Vehicles		2456	7.0	0.425	5.6	LOS A	3.2	23.9	0.42	0.43	0.42	59.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	728	7.0	0.264	3.3	LOS A	2.7	20.1	0.33	0.39	0.33	58.3
2	T1	1	7.0	0.264	6.3	LOS A	2.7	20.1	0.97	0.72	0.97	55.4
3	R2	45	7.0	0.264	13.2	LOS B	2.7	20.1	0.97	0.72	0.97	64.9
Approach		775	7.0	0.264	3.9	LOS A	2.7	20.1	0.37	0.41	0.37	58.8
East: Old Bar Road												
4	L2	85	7.0	0.641	5.5	LOS A	6.5	48.0	0.75	0.67	0.85	55.4
5	T1	662	7.0	0.641	5.8	LOS A	6.5	48.0	0.75	0.67	0.85	55.5
6	R2	104	7.0	0.641	12.6	LOS B	6.5	48.0	0.75	0.67	0.85	65.8
Approach		852	7.0	0.641	6.6	LOS A	6.5	48.0	0.75	0.67	0.85	56.7
North: Pacific Highway NB Ramps												
7	L2	47	7.0	0.150	3.3	LOS A	0.6	4.7	0.47	0.60	0.47	54.7
8	T1	1	7.0	0.150	3.5	LOS A	0.6	4.7	0.47	0.60	0.47	55.3
9	R2	119	7.0	0.150	10.4	LOS B	0.6	4.7	0.47	0.60	0.47	63.3
Approach		167	7.0	0.150	8.4	LOS A	0.6	4.7	0.47	0.60	0.47	60.2
West: Manning River Drive												
10	L2	126	7.0	0.167	2.5	LOS A	1.0	7.5	0.34	0.28	0.34	58.2
11	T1	116	7.0	0.167	2.7	LOS A	1.0	7.5	0.34	0.28	0.34	59.2
12	R2	340	7.0	0.175	9.4	LOS A	1.1	8.4	0.32	0.53	0.32	62.8
Approach		582	7.0	0.175	6.6	LOS A	1.1	8.4	0.33	0.43	0.33	61.2
All Vehicles		2376	7.0	0.641	5.8	LOS A	6.5	48.0	0.50	0.52	0.54	58.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	507	7.0	0.171	2.4	LOS A	1.2	9.2	0.22	0.31	0.22	58.7
2	T1	1	7.0	0.171	3.3	LOS A	1.2	9.2	0.56	0.45	0.56	56.8
3	R2	89	7.0	0.171	10.2	LOS B	1.2	9.2	0.56	0.45	0.56	66.5
Approach		598	7.0	0.171	3.5	LOS A	1.2	9.2	0.27	0.33	0.27	59.9
East: Old Bar Road												
4	L2	53	7.0	0.334	5.2	LOS A	2.4	18.1	0.75	0.59	0.75	55.5
5	T1	282	7.0	0.334	5.5	LOS A	2.4	18.1	0.75	0.59	0.75	55.6
6	R2	36	7.0	0.334	12.4	LOS B	2.4	18.1	0.75	0.59	0.75	66.0
Approach		371	7.0	0.334	6.1	LOS A	2.4	18.1	0.75	0.59	0.75	56.5
North: Pacific Highway NB Ramps												
7	L2	73	7.0	0.195	4.6	LOS A	0.9	6.4	0.64	0.69	0.64	54.5
8	T1	1	7.0	0.195	4.8	LOS A	0.9	6.4	0.64	0.69	0.64	55.2
9	R2	99	7.0	0.195	11.7	LOS B	0.9	6.4	0.64	0.69	0.64	63.4
Approach		173	7.0	0.195	8.7	LOS A	0.9	6.4	0.64	0.69	0.64	58.9
West: Manning River Drive												
10	L2	120	7.0	0.315	2.3	LOS A	2.2	16.5	0.31	0.26	0.31	58.3
11	T1	502	7.0	0.315	2.5	LOS A	2.2	16.5	0.31	0.26	0.31	59.3
12	R2	598	7.0	0.408	9.7	LOS A	3.0	22.5	0.39	0.55	0.39	62.4
Approach		1220	7.0	0.408	6.0	LOS A	3.0	22.5	0.35	0.40	0.35	60.8
All Vehicles		2361	7.0	0.408	5.6	LOS A	3.0	22.5	0.41	0.43	0.41	59.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2025 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	827	7.0	0.328	3.7	LOS A	3.8	28.4	0.27	0.38	0.27	58.6
2	T1	1	7.0	0.328	8.6	LOS A	3.8	28.4	1.00	0.81	1.00	54.9
3	R2	49	7.0	0.328	15.5	LOS B	3.8	28.4	1.00	0.81	1.00	64.2
Approach		878	7.0	0.328	4.4	LOS A	3.8	28.4	0.32	0.41	0.32	59.0
East: Old Bar Road												
4	L2	92	7.0	0.782	9.8	LOS A	12.1	89.6	0.91	1.01	1.31	53.5
5	T1	772	7.0	0.782	10.0	LOS B	12.1	89.6	0.91	1.01	1.31	53.2
6	R2	112	7.0	0.782	16.9	LOS B	12.1	89.6	0.91	1.01	1.31	63.2
Approach		975	7.0	0.782	10.8	LOS B	12.1	89.6	0.91	1.01	1.31	54.3
North: Pacific Highway NB Ramps												
7	L2	51	7.0	0.210	3.6	LOS A	0.9	7.0	0.52	0.64	0.52	54.2
8	T1	1	7.0	0.210	3.9	LOS A	0.9	7.0	0.52	0.64	0.52	54.8
9	R2	173	7.0	0.210	10.8	LOS B	0.9	7.0	0.52	0.64	0.52	62.4
Approach		224	7.0	0.210	9.1	LOS A	0.9	7.0	0.52	0.64	0.52	60.0
West: Manning River Drive												
10	L2	159	7.0	0.227	2.6	LOS A	1.5	11.0	0.39	0.29	0.39	57.9
11	T1	163	7.0	0.227	2.8	LOS A	1.5	11.0	0.39	0.29	0.39	58.9
12	R2	389	7.0	0.203	9.4	LOS A	1.4	10.3	0.35	0.54	0.35	62.6
Approach		712	7.0	0.227	6.4	LOS A	1.5	11.0	0.37	0.43	0.37	60.8
All Vehicles		2788	7.0	0.782	7.5	LOS A	12.1	89.6	0.55	0.64	0.69	57.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2025 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Pacific Highway SB Ramps												
1	L2	557	7.0	0.191	2.4	LOS A	1.5	11.0	0.23	0.31	0.23	58.6
2	T1	1	7.0	0.191	3.6	LOS A	1.5	11.0	0.63	0.47	0.63	56.5
3	R2	96	7.0	0.191	10.4	LOS B	1.5	11.0	0.63	0.47	0.63	66.0
Approach		654	7.0	0.191	3.6	LOS A	1.5	11.0	0.29	0.34	0.29	59.8
East: Old Bar Road												
4	L2	57	7.0	0.421	6.5	LOS A	3.4	25.2	0.87	0.72	0.87	54.8
5	T1	319	7.0	0.421	6.7	LOS A	3.4	25.2	0.87	0.72	0.87	54.7
6	R2	38	7.0	0.421	13.6	LOS B	3.4	25.2	0.87	0.72	0.87	65.1
Approach		414	7.0	0.421	7.3	LOS A	3.4	25.2	0.87	0.72	0.87	55.7
North: Pacific Highway NB Ramps												
7	L2	78	7.0	0.245	5.3	LOS A	1.2	8.6	0.71	0.75	0.71	54.2
8	T1	1	7.0	0.245	5.5	LOS A	1.2	8.6	0.71	0.75	0.71	54.8
9	R2	117	7.0	0.245	12.4	LOS B	1.2	8.6	0.71	0.75	0.71	62.7
Approach		196	7.0	0.245	9.5	LOS A	1.2	8.6	0.71	0.75	0.71	58.6
West: Manning River Drive												
10	L2	186	7.0	0.414	2.4	LOS A	3.3	24.2	0.36	0.27	0.36	58.0
11	T1	625	7.0	0.414	2.6	LOS A	3.3	24.2	0.36	0.27	0.36	59.0
12	R2	701	7.0	0.481	9.8	LOS A	3.9	29.2	0.44	0.56	0.44	62.0
Approach		1513	7.0	0.481	5.9	LOS A	3.9	29.2	0.40	0.40	0.40	60.4
All Vehicles		2776	7.0	0.481	5.8	LOS A	3.9	29.2	0.46	0.46	0.46	59.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Pacific Highway SB Ramps												
1	L2	894	7.0	0.365	3.7	LOS A	4.4	32.5	0.25	0.37	0.25	58.6
2	T1	1	7.0	0.365	9.3	LOS A	4.4	32.5	1.00	0.82	1.00	54.4
3	R2	54	7.0	0.365	16.2	LOS B	4.4	32.5	1.00	0.82	1.00	63.5
Approach		948	7.0	0.365	4.5	LOS A	4.4	32.5	0.29	0.40	0.29	58.9
East: Old Bar Road												
4	L2	99	7.0	0.852	12.8	LOS B	16.7	123.9	0.98	1.16	1.60	51.4
5	T1	828	7.0	0.852	13.0	LOS B	16.7	123.9	0.98	1.16	1.60	50.7
6	R2	121	7.0	0.852	19.9	LOS B	16.7	123.9	0.98	1.16	1.60	60.3
Approach		1048	7.0	0.852	13.8	LOS B	16.7	123.9	0.98	1.16	1.60	51.9
North: Pacific Highway NB Ramps												
7	L2	55	7.0	0.176	3.8	LOS A	0.8	5.8	0.55	0.64	0.55	54.4
8	T1	1	7.0	0.176	4.0	LOS A	0.8	5.8	0.55	0.64	0.55	55.1
9	R2	123	7.0	0.176	10.9	LOS B	0.8	5.8	0.55	0.64	0.55	63.0
Approach		179	7.0	0.176	8.7	LOS A	0.8	5.8	0.55	0.64	0.55	59.7
West: Manning River Drive												
10	L2	191	7.0	0.291	2.7	LOS A	2.0	15.0	0.43	0.31	0.43	57.6
11	T1	214	7.0	0.291	2.9	LOS A	2.0	15.0	0.43	0.31	0.43	58.5
12	R2	441	7.0	0.232	9.5	LOS A	1.7	12.3	0.38	0.54	0.38	62.4
Approach		845	7.0	0.291	6.3	LOS A	2.0	15.0	0.40	0.43	0.40	60.5
All Vehicles		3021	7.0	0.852	8.5	LOS A	16.7	123.9	0.58	0.69	0.79	56.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Pacific Highway SB Ramps												
1	L2	601	7.0	0.209	2.5	LOS A	1.7	12.6	0.24	0.32	0.24	58.5
2	T1	1	7.0	0.209	3.7	LOS A	1.7	12.6	0.67	0.49	0.67	56.2
3	R2	104	7.0	0.209	10.6	LOS B	1.7	12.6	0.67	0.49	0.67	65.7
Approach		706	7.0	0.209	3.7	LOS A	1.7	12.6	0.31	0.34	0.31	59.7
East: Old Bar Road												
4	L2	61	7.0	0.497	8.9	LOS A	4.8	35.8	0.95	0.94	1.08	54.1
5	T1	338	7.0	0.497	9.2	LOS A	4.8	35.8	0.95	0.94	1.08	53.9
6	R2	42	7.0	0.497	16.0	LOS B	4.8	35.8	0.95	0.94	1.08	64.1
Approach		441	7.0	0.497	9.8	LOS A	4.8	35.8	0.95	0.94	1.08	54.9
North: Pacific Highway NB Ramps												
7	L2	85	7.0	0.287	5.9	LOS A	1.4	10.7	0.77	0.81	0.77	54.0
8	T1	1	7.0	0.287	6.1	LOS A	1.4	10.7	0.77	0.81	0.77	54.6
9	R2	123	7.0	0.287	13.0	LOS B	1.4	10.7	0.77	0.81	0.77	62.4
Approach		209	7.0	0.287	10.1	LOS B	1.4	10.7	0.77	0.81	0.77	58.3
West: Manning River Drive												
10	L2	219	7.0	0.480	2.5	LOS A	4.1	30.3	0.40	0.28	0.40	57.6
11	T1	714	7.0	0.480	2.7	LOS A	4.1	30.3	0.40	0.28	0.40	58.6
12	R2	779	7.0	0.540	10.0	LOS A	4.8	35.4	0.49	0.57	0.49	61.6
Approach		1712	7.0	0.540	6.0	LOS A	4.8	35.4	0.44	0.41	0.44	60.0
All Vehicles		3068	7.0	0.540	6.3	LOS A	4.8	35.8	0.51	0.50	0.53	59.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	954	7.0	0.419	4.3	LOS A	5.4	40.4	0.19	0.34	0.19	58.1
2	T1	1	7.0	0.419	14.3	LOS B	5.4	40.4	1.00	0.84	1.00	50.8
3	R2	54	7.0	0.419	21.2	LOS C	5.4	40.4	1.00	0.84	1.00	58.6
Approach		1008	7.0	0.419	5.2	LOS A	5.4	40.4	0.24	0.37	0.24	58.1
East: Old Bar Road												
4	L2	99	7.0	0.982	39.4	LOS D	42.6	316.1	1.00	2.06	3.51	38.1
5	T1	909	7.0	0.982	39.7	LOS D	42.6	316.1	1.00	2.06	3.51	35.9
6	R2	121	7.0	0.982	46.6	LOS D	42.6	316.1	1.00	2.06	3.51	42.7
Approach		1129	7.0	0.982	40.4	LOS D	42.6	316.1	1.00	2.06	3.51	36.9
North: Pacific Highway NB Ramps												
7	L2	55	7.0	0.288	4.0	LOS A	1.4	10.2	0.58	0.67	0.58	53.7
8	T1	1	7.0	0.288	4.2	LOS A	1.4	10.2	0.58	0.67	0.58	54.4
9	R2	240	7.0	0.288	11.1	LOS B	1.4	10.2	0.58	0.67	0.58	61.7
Approach		296	7.0	0.288	9.7	LOS A	1.4	10.2	0.58	0.67	0.58	59.8
West: Manning River Drive												
10	L2	187	7.0	0.277	2.7	LOS A	1.9	14.2	0.43	0.31	0.43	57.6
11	T1	199	7.0	0.277	2.9	LOS A	1.9	14.2	0.43	0.31	0.43	58.6
12	R2	438	7.0	0.231	9.5	LOS A	1.7	12.3	0.38	0.54	0.38	62.4
Approach		824	7.0	0.277	6.4	LOS A	1.9	14.2	0.40	0.43	0.40	60.5
All Vehicles		3258	7.0	0.982	18.1	LOS B	42.6	316.1	0.57	1.00	1.44	49.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	619	7.0	0.218	2.6	LOS A	1.8	13.7	0.25	0.32	0.25	58.5
2	T1	1	7.0	0.218	3.9	LOS A	1.8	13.7	0.71	0.51	0.71	56.0
3	R2	104	7.0	0.218	10.8	LOS B	1.8	13.7	0.71	0.51	0.71	65.4
Approach		724	7.0	0.218	3.7	LOS A	1.8	13.7	0.32	0.35	0.32	59.6
East: Old Bar Road												
4	L2	61	7.0	0.566	11.8	LOS B	6.4	47.4	1.00	1.05	1.28	52.1
5	T1	364	7.0	0.566	12.1	LOS B	6.4	47.4	1.00	1.05	1.28	51.6
6	R2	42	7.0	0.566	19.0	LOS B	6.4	47.4	1.00	1.05	1.28	61.3
Approach		467	7.0	0.566	12.7	LOS B	6.4	47.4	1.00	1.05	1.28	52.5
North: Pacific Highway NB Ramps												
7	L2	85	7.0	0.326	6.4	LOS A	1.7	12.7	0.80	0.86	0.83	53.7
8	T1	1	7.0	0.326	6.6	LOS A	1.7	12.7	0.80	0.86	0.83	54.3
9	R2	141	7.0	0.326	13.5	LOS B	1.7	12.7	0.80	0.86	0.83	61.9
Approach		227	7.0	0.326	10.8	LOS B	1.7	12.7	0.80	0.86	0.83	58.2
West: Manning River Drive												
10	L2	260	7.0	0.524	2.5	LOS A	4.7	35.1	0.43	0.28	0.43	57.5
11	T1	758	7.0	0.524	2.7	LOS A	4.7	35.1	0.43	0.28	0.43	58.5
12	R2	820	7.0	0.568	10.0	LOS B	5.3	39.0	0.52	0.58	0.52	61.5
Approach		1838	7.0	0.568	6.0	LOS A	5.3	39.0	0.47	0.41	0.47	59.8
All Vehicles		3257	7.0	0.568	6.8	LOS A	6.4	47.4	0.53	0.52	0.57	58.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	1134	7.0	0.495	4.6	LOS A	6.2	46.0	0.20	0.35	0.22	57.7
2	T1	1	7.0	0.495	15.6	LOS B	6.2	46.0	1.00	0.89	1.09	50.0
3	R2	62	7.0	0.495	22.5	LOS C	6.2	46.0	1.00	0.89	1.09	57.5
Approach		1197	7.0	0.495	5.6	LOS A	6.2	46.0	0.24	0.38	0.26	57.7
East: Old Bar Road												
4	L2	115	7.0	1.323	307.9	LOS F	229.7	1704.2	1.00	7.59	16.13	10.5
5	T1	1093	7.0	1.323	308.1	LOS F	229.7	1704.2	1.00	7.59	16.13	9.1
6	R2	141	7.0	1.323	315.0	LOS F	229.7	1704.2	1.00	7.59	16.13	10.8
Approach		1348	7.0	1.323	308.8	LOS F	229.7	1704.2	1.00	7.59	16.13	9.4
North: Pacific Highway NB Ramps												
7	L2	63	7.0	0.384	4.6	LOS A	2.0	14.8	0.66	0.73	0.68	53.3
8	T1	1	7.0	0.384	4.8	LOS A	2.0	14.8	0.66	0.73	0.68	54.0
9	R2	306	7.0	0.384	11.7	LOS B	2.0	14.8	0.66	0.73	0.68	61.0
Approach		371	7.0	0.384	10.5	LOS B	2.0	14.8	0.66	0.73	0.68	59.4
West: Manning River Drive												
10	L2	231	7.0	0.344	2.7	LOS A	2.5	18.5	0.44	0.31	0.44	57.5
11	T1	251	7.0	0.344	3.0	LOS A	2.5	18.5	0.44	0.31	0.44	58.5
12	R2	522	7.0	0.274	9.5	LOS A	2.0	14.8	0.38	0.54	0.38	62.4
Approach		1003	7.0	0.344	6.3	LOS A	2.5	18.5	0.41	0.43	0.41	60.4
All Vehicles		3919	7.0	1.323	110.6	LOS F	229.7	1704.2	0.58	2.91	5.80	21.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Pacific Highway SB Ramps												
1	L2	729	7.0	0.268	2.7	LOS A	2.5	18.3	0.27	0.34	0.27	58.4
2	T1	1	7.0	0.268	4.6	LOS A	2.5	18.3	0.82	0.58	0.82	55.5
3	R2	121	7.0	0.268	11.5	LOS B	2.5	18.3	0.82	0.58	0.82	64.6
Approach		852	7.0	0.268	4.0	LOS A	2.5	18.3	0.35	0.37	0.35	59.4
East: Old Bar Road												
4	L2	72	7.0	0.971	88.0	LOS F	35.1	260.5	1.00	2.26	4.02	25.8
5	T1	437	7.0	0.971	88.2	LOS F	35.1	260.5	1.00	2.26	4.02	23.4
6	R2	48	7.0	0.971	95.1	LOS F	35.1	260.5	1.00	2.26	4.02	27.9
Approach		557	7.0	0.971	88.8	LOS F	35.1	260.5	1.00	2.26	4.02	24.1
North: Pacific Highway NB Ramps												
7	L2	99	7.0	0.513	11.3	LOS B	3.4	25.4	0.92	1.04	1.18	50.7
8	T1	1	7.0	0.513	11.5	LOS B	3.4	25.4	0.92	1.04	1.18	51.3
9	R2	175	7.0	0.513	18.4	LOS B	3.4	25.4	0.92	1.04	1.18	57.3
Approach		275	7.0	0.513	15.8	LOS B	3.4	25.4	0.92	1.04	1.18	54.5
West: Manning River Drive												
10	L2	349	7.0	0.678	2.8	LOS A	7.9	58.8	0.54	0.32	0.54	56.6
11	T1	944	7.0	0.678	3.0	LOS A	7.9	58.8	0.54	0.32	0.54	57.6
12	R2	999	7.0	0.707	10.5	LOS B	8.1	60.0	0.68	0.61	0.68	60.4
Approach		2293	7.0	0.707	6.3	LOS A	8.1	60.0	0.60	0.44	0.60	58.8
All Vehicles		3976	7.0	0.971	18.0	LOS B	35.1	260.5	0.62	0.72	1.07	48.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-REZ-UP-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total	HV				Vehicles	Distance				
		veh/h	%	v/c	sec		veh	m				km/h
South: Pacific Highway Ramp (South)												
1	L2	954	7.0	0.410	4.5	LOS A	5.2	38.7	0.21	0.35	0.21	58.2
2	T1	1	7.0	0.410	14.4	LOS B	5.2	38.7	1.00	0.84	1.00	50.8
3	R2	54	7.0	0.410	21.2	LOS C	5.2	38.7	1.00	0.84	1.00	58.6
Approach		1008	7.0	0.410	5.4	LOS A	5.2	38.7	0.25	0.38	0.25	58.2
East: Old Bar Road (West)												
4	L2	99	7.0	0.070	4.1	LOS A	0.5	3.5	0.63	0.47	0.63	57.1
5	T1	909	7.0	0.666	7.4	LOS A	8.6	64.0	0.85	0.84	1.06	55.4
6	R2	121	7.0	0.666	14.3	LOS B	8.6	64.0	0.85	0.84	1.06	64.8
Approach		1129	7.0	0.666	7.8	LOS A	8.6	64.0	0.83	0.81	1.02	56.4
North: Pacific Highway Ramp (North)												
7	L2	55	7.0	0.288	4.0	LOS A	1.4	10.1	0.58	0.67	0.58	53.7
8	T1	1	7.0	0.288	4.2	LOS A	1.4	10.1	0.58	0.67	0.58	54.4
9	R2	240	7.0	0.288	11.1	LOS B	1.4	10.1	0.58	0.67	0.58	62.4
Approach		296	7.0	0.288	9.7	LOS A	1.4	10.1	0.58	0.67	0.58	60.5
West: Manning River Drive (East)												
10	L2	187	7.0	0.276	2.7	LOS A	1.9	13.8	0.42	0.31	0.42	58.0
11	T1	199	7.0	0.276	2.9	LOS A	1.9	13.8	0.42	0.31	0.42	58.9
12	R2	438	7.0	0.230	9.5	LOS A	1.6	11.8	0.37	0.54	0.37	62.1
Approach		824	7.0	0.276	6.4	LOS A	1.9	13.8	0.39	0.43	0.39	60.5
All Vehicles		3258	7.0	0.666	6.9	LOS A	8.6	64.0	0.52	0.57	0.58	58.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Project: H:\Projects-SLR\620-BNE\620-BNE\620.12373 Taree, Glenthorne Service Station\00 Data\2020 05 13 - Desktop Model & SIDRAs\SIDRA 8 Files\INT3-20200727-Manning River DR-PAC HWY.sip8

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-REZ-UP-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	619	7.0	0.228	2.7	LOS A	2.1	15.3	0.26	0.33	0.26	58.7
2	T1	1	7.0	0.228	4.4	LOS A	2.1	15.3	0.81	0.56	0.81	55.5
3	R2	104	7.0	0.228	11.3	LOS B	2.1	15.3	0.81	0.56	0.81	64.7
Approach		724	7.0	0.228	3.9	LOS A	2.1	15.3	0.34	0.36	0.34	59.5
East: Old Bar Road												
4	L2	61	7.0	0.054	6.1	LOS A	0.5	3.6	0.89	0.62	0.89	55.6
5	T1	459	7.0	0.443	7.4	LOS A	4.6	34.1	1.00	0.77	1.00	54.7
6	R2	42	7.0	0.443	14.3	LOS B	4.6	34.1	1.00	0.77	1.00	63.9
Approach		562	7.0	0.443	7.8	LOS A	4.6	34.1	0.99	0.76	0.99	55.4
North: Pacific Highway NB Ramps												
7	L2	85	7.0	0.329	6.4	LOS A	1.7	12.8	0.80	0.87	0.83	53.7
8	T1	1	7.0	0.329	6.7	LOS A	1.7	12.8	0.80	0.87	0.83	54.3
9	R2	141	7.0	0.329	13.6	LOS B	1.7	12.8	0.80	0.87	0.83	62.6
Approach		227	7.0	0.329	10.9	LOS B	1.7	12.8	0.80	0.87	0.83	58.9
West: Manning River Drive												
10	L2	260	7.0	0.526	2.5	LOS A	4.8	36.0	0.43	0.28	0.43	57.8
11	T1	758	7.0	0.526	2.7	LOS A	4.8	36.0	0.43	0.28	0.43	58.6
12	R2	820	7.0	0.570	10.0	LOS B	5.4	39.8	0.52	0.58	0.52	61.2
Approach		1838	7.0	0.570	6.0	LOS A	5.4	39.8	0.47	0.41	0.47	59.8
All Vehicles		3352	7.0	0.570	6.2	LOS A	5.4	39.8	0.55	0.49	0.56	58.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-UP-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	1134	7.0	0.567	5.5	LOS A	5.7	42.5	0.08	0.30	0.13	57.4
2	T1	1	7.0	0.567	44.7	LOS D	5.7	42.5	1.00	1.19	1.51	36.6
3	R2	62	7.0	0.567	51.6	LOS E	5.7	42.5	1.00	1.19	1.51	40.3
Approach		1197	7.0	0.567	8.0	LOS A	5.7	42.5	0.13	0.35	0.20	56.0
East: Old Bar Road												
4	L2	115	7.0	0.087	5.0	LOS A	0.7	5.0	0.75	0.58	0.75	56.4
5	T1	1093	7.0	0.894	22.7	LOS C	28.2	209.3	1.00	1.51	2.33	46.1
6	R2	141	7.0	0.894	29.6	LOS C	28.2	209.3	1.00	1.51	2.33	52.4
Approach		1348	7.0	0.894	21.9	LOS C	28.2	209.3	0.98	1.43	2.20	47.4
North: Pacific Highway NB Ramps												
7	L2	63	7.0	0.387	4.6	LOS A	2.1	15.2	0.67	0.74	0.69	53.3
8	T1	1	7.0	0.387	4.9	LOS A	2.1	15.2	0.67	0.74	0.69	53.9
9	R2	306	7.0	0.387	11.7	LOS B	2.1	15.2	0.67	0.74	0.69	61.8
Approach		371	7.0	0.387	10.5	LOS B	2.1	15.2	0.67	0.74	0.69	60.1
West: Manning River Drive												
10	L2	231	7.0	0.355	2.9	LOS A	2.6	19.4	0.49	0.33	0.49	57.6
11	T1	251	7.0	0.355	3.2	LOS A	2.6	19.4	0.49	0.33	0.49	58.4
12	R2	522	7.0	0.280	9.6	LOS A	2.1	15.6	0.42	0.56	0.42	61.8
Approach		1003	7.0	0.355	6.5	LOS A	2.6	19.4	0.46	0.45	0.46	60.1
All Vehicles		3919	7.0	0.894	12.6	LOS B	28.2	209.3	0.56	0.78	1.00	54.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-UP-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	729	7.0	0.260	2.8	LOS A	2.2	16.3	0.26	0.34	0.26	58.7
2	T1	1	7.0	0.260	4.6	LOS A	2.2	16.3	0.76	0.58	0.76	55.8
3	R2	121	7.0	0.260	11.5	LOS B	2.2	16.3	0.76	0.58	0.76	65.1
Approach		852	7.0	0.260	4.0	LOS A	2.2	16.3	0.33	0.38	0.33	59.5
East: Old Bar Road												
4	L2	72	7.0	0.049	3.4	LOS A	0.3	2.2	0.53	0.39	0.53	57.6
5	T1	437	7.0	0.291	3.8	LOS A	2.1	15.6	0.60	0.42	0.60	57.0
6	R2	48	7.0	0.291	10.7	LOS B	2.1	15.6	0.60	0.42	0.60	67.1
Approach		557	7.0	0.291	4.3	LOS A	2.1	15.6	0.59	0.41	0.59	57.9
North: Pacific Highway NB Ramps												
7	L2	99	7.0	0.422	9.0	LOS A	2.8	20.7	0.87	0.98	1.00	52.1
8	T1	1	7.0	0.422	9.2	LOS A	2.8	20.7	0.87	0.98	1.00	52.7
9	R2	175	7.0	0.422	16.1	LOS B	2.8	20.7	0.87	0.98	1.00	60.5
Approach		275	7.0	0.422	13.5	LOS B	2.8	20.7	0.87	0.98	1.00	57.2
West: Manning River Drive												
10	L2	349	7.0	0.676	2.8	LOS A	7.8	57.8	0.53	0.32	0.53	57.2
11	T1	944	7.0	0.676	3.0	LOS A	7.8	57.8	0.53	0.32	0.53	58.0
12	R2	349	7.0	0.226	9.7	LOS A	1.5	10.9	0.38	0.56	0.38	62.1
Approach		1643	7.0	0.676	4.4	LOS A	7.8	57.8	0.50	0.37	0.50	58.8
All Vehicles		3326	7.0	0.676	5.0	LOS A	7.8	57.8	0.50	0.43	0.51	58.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-ULT-AM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway Ramp (South)												
1	L2	1134	7.0	0.512	3.0	LOS A	3.1	22.9	0.17	0.34	0.18	59.5
2	T1	1	7.0	0.379	8.2	LOS A	3.1	22.9	0.99	0.95	1.02	54.8
3	R2	62	7.0	0.379	15.1	LOS B	3.1	22.9	0.99	0.95	1.02	63.8
Approach		1197	7.0	0.512	3.6	LOS A	3.1	22.9	0.21	0.38	0.22	59.7
East: Old Bar Road (West)												
4	L2	115	7.0	0.516	8.7	LOS A	4.8	35.5	0.89	0.91	1.04	54.9
5	T1	1093	7.0	0.627	8.9	LOS A	8.4	62.0	0.92	0.92	1.14	54.9
6	R2	141	7.0	0.627	15.8	LOS B	8.4	62.0	0.94	0.93	1.19	63.6
Approach		1348	7.0	0.627	9.6	LOS A	8.4	62.0	0.92	0.92	1.14	55.7
North: Pacific Highway Ramp (North)												
7	L2	63	7.0	0.387	4.6	LOS A	2.0	15.2	0.67	0.74	0.69	53.3
8	T1	1	7.0	0.387	4.8	LOS A	2.0	15.2	0.67	0.74	0.69	53.9
9	R2	306	7.0	0.387	11.7	LOS B	2.0	15.2	0.67	0.74	0.69	61.8
Approach		371	7.0	0.387	10.5	LOS B	2.0	15.2	0.67	0.74	0.69	60.1
West: Manning River Drive (East)												
10	L2	231	7.0	0.354	2.9	LOS A	2.6	19.2	0.49	0.33	0.49	57.6
11	T1	251	7.0	0.354	3.2	LOS A	2.6	19.2	0.49	0.33	0.49	58.4
12	R2	522	7.0	0.279	9.6	LOS A	2.1	15.3	0.42	0.56	0.42	61.8
Approach		1003	7.0	0.354	6.5	LOS A	2.6	19.2	0.45	0.45	0.45	60.1
All Vehicles		3919	7.0	0.627	7.1	LOS A	8.4	62.0	0.56	0.62	0.64	58.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-ULT-PM+]

Manning River Drive / Old Bar Road / Pacific Highway Ramps
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Pacific Highway SB Ramps												
1	L2	729	7.0	0.312	2.3	LOS A	1.4	10.1	0.14	0.29	0.14	59.5
2	T1	1	7.0	0.231	3.7	LOS A	1.4	10.1	0.63	0.55	0.63	55.9
3	R2	121	7.0	0.231	10.6	LOS B	1.4	10.1	0.63	0.55	0.63	65.1
Approach		852	7.0	0.312	3.5	LOS A	1.4	10.1	0.21	0.33	0.21	60.2
East: Old Bar Road												
4	L2	72	7.0	0.374	12.5	LOS B	3.3	24.3	1.00	0.93	1.00	52.0
5	T1	437	7.0	0.454	11.9	LOS B	5.3	39.5	1.00	0.87	1.00	52.9
6	R2	48	7.0	0.454	18.4	LOS B	5.3	39.5	1.00	0.85	1.00	61.5
Approach		557	7.0	0.454	12.5	LOS B	5.3	39.5	1.00	0.88	1.00	53.4
North: Pacific Highway NB Ramps												
7	L2	99	7.0	0.505	11.1	LOS B	3.3	24.8	0.91	1.04	1.17	50.8
8	T1	1	7.0	0.505	11.4	LOS B	3.3	24.8	0.91	1.04	1.17	51.4
9	R2	175	7.0	0.505	18.3	LOS B	3.3	24.8	0.91	1.04	1.17	58.7
Approach		275	7.0	0.505	15.7	LOS B	3.3	24.8	0.91	1.04	1.17	55.5
West: Manning River Drive												
10	L2	349	7.0	0.673	2.8	LOS A	7.5	55.9	0.52	0.32	0.52	57.3
11	T1	944	7.0	0.673	3.0	LOS A	7.5	55.9	0.52	0.32	0.52	58.1
12	R2	999	7.0	0.703	10.5	LOS B	7.7	57.5	0.65	0.61	0.65	60.5
Approach		2293	7.0	0.703	6.3	LOS A	7.7	57.5	0.58	0.44	0.58	59.1
All Vehicles		3976	7.0	0.703	7.2	LOS A	7.7	57.5	0.58	0.52	0.60	58.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX F

SIDRA Assessment Outputs
The Bucketts Way / Manning River Drive

MOVEMENT SUMMARY

Site: INT1 [2018 EX-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Waang Djarii Way (South)												
1	L2	1	7.0	0.029	7.7	LOS A	0.1	0.8	0.65	0.78	0.65	48.7
2	T1	8	7.0	0.029	8.0	LOS A	0.1	0.8	0.65	0.78	0.65	50.1
3	R2	6	7.0	0.029	13.0	LOS B	0.1	0.8	0.65	0.78	0.65	47.0
3u	U	1	7.0	0.029	15.3	LOS B	0.1	0.8	0.65	0.78	0.65	47.7
Approach		17	7.0	0.029	10.3	LOS B	0.1	0.8	0.65	0.78	0.65	48.8
East: Manning River Drive (East)												
4	L2	14	7.0	0.520	4.6	LOS A	3.4	25.0	0.36	0.60	0.36	45.9
5	T1	88	7.0	0.520	4.6	LOS A	3.4	25.0	0.36	0.60	0.36	51.6
6	R2	1207	7.0	0.520	9.7	LOS A	3.4	25.0	0.37	0.61	0.37	51.0
6u	U	1	7.0	0.520	12.0	LOS B	3.3	24.8	0.37	0.62	0.37	49.4
Approach		1311	7.0	0.520	9.3	LOS A	3.4	25.0	0.37	0.61	0.37	51.0
North: Manning River Drive (North)												
7	L2	434	7.0	0.232	4.5	LOS A	1.3	9.6	0.34	0.51	0.34	52.6
8	T1	32	7.0	0.232	4.6	LOS A	1.3	9.4	0.35	0.54	0.35	52.3
9	R2	65	7.0	0.232	9.6	LOS A	1.3	9.4	0.35	0.54	0.35	54.7
9u	U	15	7.0	0.232	11.9	LOS B	1.3	9.4	0.35	0.54	0.35	55.9
Approach		545	7.0	0.232	5.3	LOS A	1.3	9.6	0.34	0.52	0.34	53.0
West: The Bucketts Way (West)												
10	L2	186	7.0	0.767	53.8	LOS E	11.6	86.3	1.00	1.50	2.32	31.4
11	T1	121	7.0	0.767	54.0	LOS E	11.6	86.3	1.00	1.50	2.32	29.4
12	R2	4	7.0	0.767	59.1	LOS E	11.6	86.3	1.00	1.50	2.32	27.8
12u	U	1	7.0	0.767	61.4	LOS E	11.6	86.3	1.00	1.50	2.32	32.8
Approach		313	7.0	0.767	54.0	LOS E	11.6	86.3	1.00	1.50	2.32	30.6
All Vehicles		2185	7.0	0.767	14.7	LOS B	11.6	86.3	0.45	0.72	0.64	46.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2018 EX-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.049	6.7	LOS A	0.2	1.4	0.58	0.71	0.58	50.1
2	T1	24	7.0	0.049	6.9	LOS A	0.2	1.4	0.58	0.71	0.58	51.7
3	R2	7	7.0	0.049	12.0	LOS B	0.2	1.4	0.58	0.71	0.58	48.7
3u	U	1	7.0	0.049	14.2	LOS B	0.2	1.4	0.58	0.71	0.58	49.7
Approach		35	7.0	0.049	8.2	LOS A	0.2	1.4	0.58	0.71	0.58	51.0
East: Manning River Drive (e)												
4	L2	14	7.0	0.331	4.8	LOS A	1.7	12.7	0.37	0.61	0.37	46.5
5	T1	103	7.0	0.331	4.8	LOS A	1.7	12.7	0.37	0.61	0.37	52.1
6	R2	654	7.0	0.331	9.9	LOS A	1.7	12.7	0.37	0.63	0.37	51.1
6u	U	2	7.0	0.331	12.2	LOS B	1.7	12.5	0.38	0.65	0.38	49.4
Approach		773	7.0	0.331	9.1	LOS A	1.7	12.7	0.37	0.63	0.37	51.2
North: Manning River Drive (n)												
7	L2	1086	7.0	0.483	4.4	LOS A	3.3	24.9	0.30	0.49	0.30	52.8
8	T1	22	7.0	0.483	4.4	LOS A	3.3	24.5	0.31	0.51	0.31	52.8
9	R2	141	7.0	0.483	9.5	LOS A	3.3	24.5	0.31	0.51	0.31	55.0
9u	U	17	7.0	0.483	11.7	LOS B	3.3	24.5	0.31	0.51	0.31	56.3
Approach		1266	7.0	0.483	5.1	LOS A	3.3	24.9	0.30	0.49	0.30	53.1
West: The Bucketts Way												
10	L2	92	7.0	0.200	8.2	LOS A	1.2	9.1	0.73	0.75	0.73	52.1
11	T1	63	7.0	0.200	8.5	LOS A	1.2	9.1	0.73	0.75	0.73	52.6
12	R2	1	7.0	0.200	13.6	LOS B	1.2	9.1	0.73	0.75	0.73	51.3
12u	U	1	7.0	0.200	15.8	LOS B	1.2	9.1	0.73	0.75	0.73	55.0
Approach		157	7.0	0.200	8.4	LOS A	1.2	9.1	0.73	0.75	0.73	52.3
All Vehicles		2231	7.0	0.483	6.8	LOS A	3.3	24.9	0.36	0.56	0.36	52.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.033	8.2	LOS A	0.1	1.0	0.68	0.80	0.68	48.5
2	T1	9	7.0	0.033	8.4	LOS A	0.1	1.0	0.68	0.80	0.68	49.9
3	R2	6	7.0	0.033	13.5	LOS B	0.1	1.0	0.68	0.80	0.68	46.7
3u	U	1	7.0	0.033	15.8	LOS B	0.1	1.0	0.68	0.80	0.68	47.4
Approach		18	7.0	0.033	10.6	LOS B	0.1	1.0	0.68	0.80	0.68	48.7
East: Manning River Drive (e)												
4	L2	15	7.0	0.574	4.7	LOS A	4.0	29.7	0.40	0.61	0.40	45.7
5	T1	94	7.0	0.574	4.7	LOS A	4.0	29.7	0.40	0.61	0.40	51.4
6	R2	1327	7.0	0.574	9.8	LOS A	4.0	29.7	0.41	0.62	0.41	50.8
6u	U	1	7.0	0.574	12.2	LOS B	4.0	29.3	0.42	0.63	0.42	49.2
Approach		1437	7.0	0.574	9.5	LOS A	4.0	29.7	0.41	0.62	0.41	50.8
North: Manning River Drive (n)												
7	L2	472	7.0	0.251	4.5	LOS A	1.4	10.5	0.34	0.51	0.34	52.6
8	T1	34	7.0	0.251	4.5	LOS A	1.4	10.3	0.35	0.54	0.35	52.3
9	R2	72	7.0	0.251	9.6	LOS A	1.4	10.3	0.35	0.54	0.35	54.7
9u	U	16	7.0	0.251	11.9	LOS B	1.4	10.3	0.35	0.54	0.35	55.9
Approach		593	7.0	0.251	5.3	LOS A	1.4	10.5	0.34	0.52	0.34	53.0
West: The Bucketts Way												
10	L2	206	7.0	1.099	218.8	LOS F	43.7	324.4	1.00	2.78	5.75	12.8
11	T1	128	7.0	1.099	219.0	LOS F	43.7	324.4	1.00	2.78	5.75	11.2
12	R2	4	7.0	1.099	224.1	LOS F	43.7	324.4	1.00	2.78	5.75	10.4
12u	U	1	7.0	1.099	226.3	LOS F	43.7	324.4	1.00	2.78	5.75	13.2
Approach		340	7.0	1.099	218.9	LOS F	43.7	324.4	1.00	2.78	5.75	12.2
All Vehicles		2387	7.0	1.099	38.3	LOS D	43.7	324.4	0.48	0.90	1.15	34.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.054	6.9	LOS A	0.2	1.6	0.60	0.73	0.60	50.0
2	T1	26	7.0	0.054	7.1	LOS A	0.2	1.6	0.60	0.73	0.60	51.6
3	R2	7	7.0	0.054	12.2	LOS B	0.2	1.6	0.60	0.73	0.60	48.6
3u	U	1	7.0	0.054	14.4	LOS B	0.2	1.6	0.60	0.73	0.60	49.6
Approach		37	7.0	0.054	8.3	LOS A	0.2	1.6	0.60	0.73	0.60	50.9
East: Manning River Drive (e)												
4	L2	15	7.0	0.360	4.9	LOS A	1.9	14.3	0.40	0.62	0.40	46.3
5	T1	109	7.0	0.360	4.9	LOS A	1.9	14.3	0.40	0.62	0.40	52.0
6	R2	702	7.0	0.360	10.0	LOS B	1.9	14.3	0.40	0.64	0.40	51.0
6u	U	2	7.0	0.360	12.3	LOS B	1.9	14.1	0.41	0.66	0.41	49.2
Approach		828	7.0	0.360	9.3	LOS A	1.9	14.3	0.40	0.64	0.40	51.1
North: Manning River Drive (n)												
7	L2	1187	7.0	0.530	4.4	LOS A	4.0	29.3	0.33	0.49	0.33	52.7
8	T1	24	7.0	0.530	4.5	LOS A	3.9	28.9	0.34	0.52	0.34	52.6
9	R2	156	7.0	0.530	9.6	LOS A	3.9	28.9	0.34	0.52	0.34	54.9
9u	U	18	7.0	0.530	11.8	LOS B	3.9	28.9	0.34	0.52	0.34	56.1
Approach		1385	7.0	0.530	5.1	LOS A	4.0	29.3	0.34	0.49	0.34	53.0
West: The Bucketts Way												
10	L2	99	7.0	0.226	8.9	LOS A	1.4	10.6	0.77	0.78	0.77	51.7
11	T1	67	7.0	0.226	9.1	LOS A	1.4	10.6	0.77	0.78	0.77	52.1
12	R2	1	7.0	0.226	14.2	LOS B	1.4	10.6	0.77	0.78	0.77	50.8
12u	U	1	7.0	0.226	16.4	LOS B	1.4	10.6	0.77	0.78	0.77	54.5
Approach		168	7.0	0.226	9.0	LOS A	1.4	10.6	0.77	0.78	0.77	51.8
All Vehicles		2419	7.0	0.530	6.9	LOS A	4.0	29.3	0.39	0.57	0.39	52.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV-REZ-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.037	8.7	LOS A	0.2	1.1	0.71	0.83	0.71	47.9
2	T1	9	7.0	0.037	8.9	LOS A	0.2	1.1	0.71	0.83	0.71	49.3
3	R2	7	7.0	0.037	14.0	LOS B	0.2	1.1	0.71	0.83	0.71	46.1
3u	U	1	7.0	0.037	16.3	LOS B	0.2	1.1	0.71	0.83	0.71	46.6
Approach		19	7.0	0.037	11.3	LOS B	0.2	1.1	0.71	0.83	0.71	47.9
East: Manning River Drive (e)												
4	L2	16	7.0	0.623	4.8	LOS A	4.6	34.2	0.42	0.61	0.42	45.6
5	T1	108	7.0	0.623	4.7	LOS A	4.6	34.2	0.42	0.61	0.42	51.3
6	R2	1444	7.0	0.623	9.9	LOS A	4.6	34.2	0.43	0.62	0.43	50.7
6u	U	1	7.0	0.623	12.2	LOS B	4.6	33.9	0.44	0.63	0.44	49.1
Approach		1569	7.0	0.623	9.5	LOS A	4.6	34.2	0.43	0.62	0.43	50.7
North: Manning River Drive (n)												
7	L2	518	7.0	0.259	4.4	LOS A	1.5	11.0	0.29	0.49	0.29	52.8
8	T1	34	7.0	0.259	4.4	LOS A	1.4	10.7	0.30	0.52	0.30	52.7
9	R2	72	7.0	0.259	9.5	LOS A	1.4	10.7	0.30	0.52	0.30	55.0
9u	U	16	7.0	0.259	11.7	LOS B	1.4	10.7	0.30	0.52	0.30	56.2
Approach		639	7.0	0.259	5.1	LOS A	1.5	11.0	0.29	0.49	0.29	53.2
West: The Bucketts Way												
10	L2	206	7.0	1.652	661.4	LOS F	100.5	745.7	1.00	4.23	10.64	4.9
11	T1	135	7.0	1.652	661.6	LOS F	100.5	745.7	1.00	4.23	10.64	4.2
12	R2	4	7.0	1.652	666.7	LOS F	100.5	745.7	1.00	4.23	10.64	3.8
12u	U	1	7.0	1.652	668.9	LOS F	100.5	745.7	1.00	4.23	10.64	5.0
Approach		346	7.0	1.652	661.6	LOS F	100.5	745.7	1.00	4.23	10.64	4.6
All Vehicles		2574	7.0	1.652	96.2	LOS F	100.5	745.7	0.47	1.07	1.77	20.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV-REZ-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.059	7.3	LOS A	0.2	1.8	0.63	0.76	0.63	49.7
2	T1	26	7.0	0.059	7.5	LOS A	0.2	1.8	0.63	0.76	0.63	51.2
3	R2	8	7.0	0.059	12.6	LOS B	0.2	1.8	0.63	0.76	0.63	48.2
3u	U	1	7.0	0.059	14.8	LOS B	0.2	1.8	0.63	0.76	0.63	49.1
Approach		38	7.0	0.059	8.8	LOS A	0.2	1.8	0.63	0.76	0.63	50.5
East: Manning River Drive (e)												
4	L2	16	7.0	0.416	5.0	LOS A	2.4	17.7	0.42	0.62	0.42	46.2
5	T1	124	7.0	0.416	4.9	LOS A	2.4	17.7	0.42	0.62	0.42	51.8
6	R2	820	7.0	0.416	10.1	LOS B	2.4	17.7	0.43	0.65	0.43	50.9
6u	U	2	7.0	0.416	12.4	LOS B	2.3	17.4	0.43	0.66	0.43	49.1
Approach		962	7.0	0.416	9.3	LOS A	2.4	17.7	0.43	0.64	0.43	51.0
North: Manning River Drive (n)												
7	L2	1234	7.0	0.553	4.5	LOS A	4.3	31.9	0.36	0.50	0.36	52.5
8	T1	24	7.0	0.553	4.5	LOS A	4.2	31.4	0.37	0.52	0.37	52.5
9	R2	156	7.0	0.553	9.6	LOS A	4.2	31.4	0.37	0.52	0.37	54.9
9u	U	18	7.0	0.553	11.9	LOS B	4.2	31.4	0.37	0.52	0.37	56.0
Approach		1432	7.0	0.553	5.1	LOS A	4.3	31.9	0.37	0.50	0.37	52.9
West: The Bucketts Way												
10	L2	99	7.0	0.262	10.4	LOS B	1.8	13.1	0.84	0.84	0.84	50.6
11	T1	73	7.0	0.262	10.7	LOS B	1.8	13.1	0.84	0.84	0.84	50.7
12	R2	1	7.0	0.262	15.8	LOS B	1.8	13.1	0.84	0.84	0.84	49.3
12u	U	1	7.0	0.262	18.0	LOS B	1.8	13.1	0.84	0.84	0.84	53.3
Approach		174	7.0	0.262	10.6	LOS B	1.8	13.1	0.84	0.84	0.84	50.6
All Vehicles		2605	7.0	0.553	7.1	LOS A	4.3	31.9	0.42	0.58	0.42	52.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.046	9.0	LOS A	0.2	1.4	0.73	0.84	0.73	47.9
2	T1	13	7.0	0.046	9.3	LOS A	0.2	1.4	0.73	0.84	0.73	49.3
3	R2	7	7.0	0.046	14.4	LOS B	0.2	1.4	0.73	0.84	0.73	46.1
3u	U	1	7.0	0.046	16.6	LOS B	0.2	1.4	0.73	0.84	0.73	46.6
Approach		22	7.0	0.046	11.3	LOS B	0.2	1.4	0.73	0.84	0.73	48.1
East: Manning River Drive (e)												
4	L2	16	7.0	0.649	4.9	LOS A	4.9	36.4	0.45	0.62	0.45	45.4
5	T1	101	7.0	0.649	4.9	LOS A	4.9	36.4	0.45	0.62	0.45	51.2
6	R2	1503	7.0	0.649	10.0	LOS B	4.9	36.4	0.46	0.63	0.46	50.6
6u	U	1	7.0	0.649	12.4	LOS B	4.9	36.1	0.47	0.64	0.47	48.9
Approach		1621	7.0	0.649	9.7	LOS A	4.9	36.4	0.46	0.63	0.46	50.6
North: Manning River Drive (n)												
7	L2	526	7.0	0.257	4.3	LOS A	1.5	10.9	0.24	0.48	0.24	53.0
8	T1	37	7.0	0.257	4.3	LOS A	1.4	10.7	0.25	0.51	0.25	52.8
9	R2	80	7.0	0.257	9.3	LOS A	1.4	10.7	0.25	0.51	0.25	55.1
9u	U	17	7.0	0.257	11.6	LOS B	1.4	10.7	0.25	0.51	0.25	56.3
Approach		660	7.0	0.257	5.1	LOS A	1.5	10.9	0.24	0.48	0.24	53.4
West: The Bucketts Way												
10	L2	236	7.0	2.489	1390.8	LOS F	156.8	1163.2	1.00	4.85	13.72	2.4
11	T1	138	7.0	2.489	1391.0	LOS F	156.8	1163.2	1.00	4.85	13.72	2.1
12	R2	5	7.0	2.489	1396.1	LOS F	156.8	1163.2	1.00	4.85	13.72	1.9
12u	U	1	7.0	2.489	1398.4	LOS F	156.8	1163.2	1.00	4.85	13.72	2.5
Approach		380	7.0	2.489	1391.0	LOS F	156.8	1163.2	1.00	4.85	13.72	2.3
All Vehicles		2683	7.0	2.489	204.2	LOS F	156.8	1163.2	0.48	1.19	2.28	11.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.062	7.3	LOS A	0.3	1.9	0.63	0.76	0.63	49.8
2	T1	28	7.0	0.062	7.5	LOS A	0.3	1.9	0.63	0.76	0.63	51.3
3	R2	8	7.0	0.062	12.6	LOS B	0.3	1.9	0.63	0.76	0.63	48.3
3u	U	1	7.0	0.062	14.8	LOS B	0.3	1.9	0.63	0.76	0.63	49.2
Approach		40	7.0	0.062	8.7	LOS A	0.3	1.9	0.63	0.76	0.63	50.6
East: Manning River Drive (e)												
4	L2	16	7.0	0.406	5.1	LOS A	2.3	17.2	0.45	0.64	0.45	46.0
5	T1	118	7.0	0.406	5.1	LOS A	2.3	17.2	0.45	0.64	0.45	51.7
6	R2	775	7.0	0.406	10.2	LOS B	2.3	17.2	0.46	0.66	0.46	50.8
6u	U	2	7.0	0.406	12.6	LOS B	2.3	16.9	0.46	0.68	0.46	49.0
Approach		911	7.0	0.406	9.5	LOS A	2.3	17.2	0.46	0.66	0.46	50.9
North: Manning River Drive (n)												
7	L2	1355	7.0	0.608	4.5	LOS A	5.1	38.1	0.39	0.50	0.39	52.4
8	T1	27	7.0	0.608	4.6	LOS A	5.1	37.5	0.40	0.53	0.40	52.3
9	R2	182	7.0	0.608	9.7	LOS A	5.1	37.5	0.40	0.53	0.40	54.7
9u	U	19	7.0	0.608	11.9	LOS B	5.1	37.5	0.40	0.53	0.40	55.9
Approach		1583	7.0	0.608	5.2	LOS A	5.1	38.1	0.39	0.50	0.39	52.8
West: The Bucketts Way												
10	L2	109	7.0	0.268	9.9	LOS A	1.8	13.2	0.82	0.83	0.82	51.0
11	T1	72	7.0	0.268	10.1	LOS B	1.8	13.2	0.82	0.83	0.82	51.1
12	R2	1	7.0	0.268	15.2	LOS B	1.8	13.2	0.82	0.83	0.82	49.8
12u	U	1	7.0	0.268	17.4	LOS B	1.8	13.2	0.82	0.83	0.82	53.7
Approach		183	7.0	0.268	10.1	LOS B	1.8	13.2	0.82	0.83	0.82	51.0
All Vehicles		2717	7.0	0.608	7.0	LOS A	5.1	38.1	0.45	0.58	0.45	52.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV-REZ-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.055	9.8	LOS A	0.2	1.8	0.76	0.88	0.76	47.1
2	T1	13	7.0	0.055	10.0	LOS B	0.2	1.8	0.76	0.88	0.76	48.4
3	R2	9	7.0	0.055	15.1	LOS B	0.2	1.8	0.76	0.88	0.76	45.1
3u	U	1	7.0	0.055	17.4	LOS B	0.2	1.8	0.76	0.88	0.76	45.5
Approach		24	7.0	0.055	12.3	LOS B	0.2	1.8	0.76	0.88	0.76	47.1
East: Manning River Drive (e)												
4	L2	18	7.0	0.708	5.0	LOS A	5.9	44.1	0.49	0.62	0.49	45.3
5	T1	119	7.0	0.708	5.0	LOS A	5.9	44.1	0.49	0.62	0.49	51.0
6	R2	1636	7.0	0.708	10.2	LOS B	5.9	44.1	0.51	0.63	0.51	50.4
6u	U	1	7.0	0.708	12.5	LOS B	5.9	43.8	0.52	0.64	0.52	48.7
Approach		1774	7.0	0.708	9.8	LOS A	5.9	44.1	0.50	0.63	0.50	50.4
North: Manning River Drive (n)												
7	L2	631	7.0	0.298	4.3	LOS A	1.8	13.1	0.26	0.48	0.26	53.0
8	T1	37	7.0	0.298	4.3	LOS A	1.7	12.8	0.26	0.51	0.26	52.9
9	R2	80	7.0	0.298	9.4	LOS A	1.7	12.8	0.26	0.51	0.26	55.2
9u	U	17	7.0	0.298	11.6	LOS B	1.7	12.8	0.26	0.51	0.26	56.4
Approach		764	7.0	0.298	5.0	LOS A	1.8	13.1	0.26	0.48	0.26	53.3
West: The Bucketts Way												
10	L2	236	7.0	2.660	1514.9	LOS F	162.6	1206.8	1.00	6.50	25.77	2.3
11	T1	157	7.0	2.660	1515.1	LOS F	162.6	1206.8	1.00	6.50	25.77	1.9
12	R2	5	7.0	2.660	1548.4	LOS F	162.6	1206.8	1.00	6.50	25.77	1.8
12u	U	1	7.0	2.660	1550.6	LOS F	162.6	1206.8	1.00	6.50	25.77	2.3
Approach		399	7.0	2.660	1515.5	LOS F	162.6	1206.8	1.00	6.50	25.77	2.1
All Vehicles		2961	7.0	2.660	211.4	LOS F	162.6	1206.8	0.51	1.38	3.85	11.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV-REZ-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.072	7.9	LOS A	0.3	2.2	0.68	0.82	0.68	49.3
2	T1	28	7.0	0.072	8.2	LOS A	0.3	2.2	0.68	0.82	0.68	50.8
3	R2	9	7.0	0.072	13.2	LOS B	0.3	2.2	0.68	0.82	0.68	47.8
3u	U	1	7.0	0.072	15.5	LOS B	0.3	2.2	0.68	0.82	0.68	48.6
Approach		41	7.0	0.072	9.5	LOS A	0.3	2.2	0.68	0.82	0.68	50.1
East: Manning River Drive (e)												
4	L2	19	7.0	0.497	5.2	LOS A	3.2	23.4	0.50	0.64	0.50	45.8
5	T1	145	7.0	0.497	5.2	LOS A	3.2	23.4	0.50	0.64	0.50	51.5
6	R2	951	7.0	0.497	10.4	LOS B	3.2	23.4	0.51	0.67	0.51	50.6
6u	U	2	7.0	0.497	12.7	LOS B	3.1	23.0	0.51	0.69	0.51	48.7
Approach		1117	7.0	0.497	9.6	LOS A	3.2	23.4	0.51	0.67	0.51	50.7
North: Manning River Drive (n)												
7	L2	1417	7.0	0.642	4.6	LOS A	5.8	43.0	0.44	0.51	0.44	52.2
8	T1	27	7.0	0.642	4.7	LOS A	5.7	42.2	0.46	0.54	0.46	52.1
9	R2	182	7.0	0.642	9.8	LOS A	5.7	42.2	0.46	0.54	0.46	54.5
9u	U	19	7.0	0.642	12.0	LOS B	5.7	42.2	0.46	0.54	0.46	55.7
Approach		1645	7.0	0.642	5.3	LOS A	5.8	43.0	0.45	0.51	0.45	52.6
West: The Bucketts Way												
10	L2	109	7.0	0.349	13.0	LOS B	2.5	18.7	0.93	0.93	0.93	48.8
11	T1	81	7.0	0.349	13.3	LOS B	2.5	18.7	0.93	0.93	0.93	48.6
12	R2	1	7.0	0.349	18.3	LOS B	2.5	18.7	0.93	0.93	0.93	47.2
12u	U	1	7.0	0.349	20.6	LOS C	2.5	18.7	0.93	0.93	0.93	51.3
Approach		193	7.0	0.349	13.2	LOS B	2.5	18.7	0.93	0.93	0.93	48.7
All Vehicles		2996	7.0	0.642	7.5	LOS A	5.8	43.0	0.50	0.60	0.50	51.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	Demand Flows HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.061	10.9	LOS B	0.3	2.1	0.81	0.91	0.81	46.4
2	T1	13	7.0	0.061	11.2	LOS B	0.3	2.1	0.81	0.91	0.81	47.6
3	R2	7	7.0	0.061	16.2	LOS B	0.3	2.1	0.81	0.91	0.81	44.3
3u	U	1	7.0	0.061	18.5	LOS B	0.3	2.1	0.81	0.91	0.81	44.5
Approach		22	7.0	0.061	13.2	LOS B	0.3	2.1	0.81	0.91	0.81	46.5
East: Manning River Drive (e)												
4	L2	17	7.0	0.779	6.7	LOS A	8.4	62.6	0.66	0.71	0.72	44.8
5	T1	182	7.0	0.779	6.7	LOS A	8.4	62.6	0.66	0.71	0.72	50.6
6	R2	1632	7.0	0.779	12.1	LOS B	8.6	64.0	0.67	0.73	0.75	49.8
6u	U	1	7.0	0.779	14.6	LOS B	8.6	64.0	0.69	0.75	0.77	47.9
Approach		1832	7.0	0.779	11.5	LOS B	8.6	64.0	0.67	0.73	0.74	49.9
North: Manning River Drive (n)												
7	L2	572	7.0	0.301	4.3	LOS A	1.8	13.5	0.25	0.48	0.25	52.9
8	T1	40	7.0	0.301	4.3	LOS A	1.8	13.1	0.26	0.53	0.26	52.1
9	R2	148	7.0	0.301	9.4	LOS A	1.8	13.1	0.26	0.53	0.26	54.5
9u	U	18	7.0	0.301	11.6	LOS B	1.8	13.1	0.26	0.53	0.26	55.6
Approach		778	7.0	0.301	5.4	LOS A	1.8	13.5	0.25	0.49	0.25	53.3
West: The Bucketts Way												
10	L2	269	7.0	2.961	1785.6	LOS F	191.9	1423.8	1.00	6.76	26.51	1.9
11	T1	168	7.0	2.961	1785.8	LOS F	191.9	1423.8	1.00	6.76	26.51	1.6
12	R2	5	7.0	2.961	1812.6	LOS F	191.9	1423.8	1.00	6.76	26.51	1.5
12u	U	1	7.0	2.961	1814.8	LOS F	191.9	1423.8	1.00	6.76	26.51	2.0
Approach		444	7.0	2.961	1786.1	LOS F	191.9	1423.8	1.00	6.76	26.51	1.8
All Vehicles		3076	7.0	2.961	266.3	LOS F	191.9	1423.8	0.61	1.54	4.34	9.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	3	7.0	0.077	7.8	LOS A	0.3	2.4	0.68	0.81	0.68	49.4
2	T1	31	7.0	0.077	8.1	LOS A	0.3	2.4	0.68	0.81	0.68	50.9
3	R2	9	7.0	0.077	13.1	LOS B	0.3	2.4	0.68	0.81	0.68	47.9
3u	U	1	7.0	0.077	15.4	LOS B	0.3	2.4	0.68	0.81	0.68	48.7
Approach		44	7.0	0.077	9.3	LOS A	0.3	2.4	0.68	0.81	0.68	50.2
East: Manning River Drive (e)												
4	L2	17	7.0	0.474	5.4	LOS A	3.1	22.8	0.56	0.66	0.56	45.7
5	T1	145	7.0	0.474	5.4	LOS A	3.1	22.8	0.56	0.66	0.56	51.4
6	R2	843	7.0	0.474	10.6	LOS B	3.1	22.8	0.56	0.69	0.56	50.4
6u	U	2	7.0	0.474	12.9	LOS B	3.0	22.3	0.57	0.72	0.57	48.5
Approach		1007	7.0	0.474	9.8	LOS A	3.1	22.8	0.56	0.69	0.56	50.5
North: Manning River Drive (n)												
7	L2	1476	7.0	0.736	5.3	LOS A	7.4	55.1	0.65	0.60	0.65	51.3
8	T1	29	7.0	0.736	5.6	LOS A	7.4	55.1	0.66	0.63	0.67	51.1
9	R2	224	7.0	0.736	10.6	LOS B	7.4	55.1	0.66	0.63	0.67	53.7
9u	U	21	7.0	0.736	12.9	LOS B	7.4	55.1	0.66	0.63	0.67	54.8
Approach		1751	7.0	0.736	6.1	LOS A	7.4	55.1	0.65	0.60	0.66	51.7
West: The Bucketts Way												
10	L2	175	7.0	0.525	15.0	LOS B	4.8	35.7	0.95	1.07	1.21	47.5
11	T1	147	7.0	0.525	15.2	LOS B	4.8	35.7	0.95	1.07	1.21	47.1
12	R2	1	7.0	0.525	20.3	LOS C	4.8	35.7	0.95	1.07	1.21	45.6
12u	U	1	7.0	0.525	22.6	LOS C	4.8	35.7	0.95	1.07	1.21	50.0
Approach		324	7.0	0.525	15.1	LOS B	4.8	35.7	0.95	1.07	1.21	47.4
All Vehicles		3126	7.0	0.736	8.3	LOS A	7.4	55.1	0.65	0.68	0.68	50.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV-REZ-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.084	11.8	LOS B	0.4	2.9	0.83	0.92	0.83	45.8
2	T1	16	7.0	0.084	12.0	LOS B	0.4	2.9	0.83	0.92	0.83	47.0
3	R2	9	7.0	0.084	17.1	LOS B	0.4	2.9	0.83	0.92	0.83	43.6
3u	U	1	7.0	0.084	19.3	LOS B	0.4	2.9	0.83	0.92	0.83	43.7
Approach		27	7.0	0.084	14.0	LOS B	0.4	2.9	0.83	0.92	0.83	45.8
East: Manning River Drive (e)												
4	L2	18	7.0	0.820	7.7	LOS A	10.5	77.6	0.72	0.75	0.84	44.0
5	T1	192	7.0	0.820	7.7	LOS A	10.5	77.6	0.72	0.75	0.84	49.9
6	R2	1698	7.0	0.820	13.2	LOS B	10.6	78.9	0.74	0.77	0.87	49.0
6u	U	1	7.0	0.820	15.8	LOS B	10.6	78.9	0.75	0.79	0.89	46.8
Approach		1908	7.0	0.820	12.6	LOS B	10.6	78.9	0.74	0.77	0.86	49.0
North: Manning River Drive (n)												
7	L2	622	7.0	0.326	4.3	LOS A	2.0	14.8	0.26	0.48	0.26	52.8
8	T1	41	7.0	0.326	4.3	LOS A	1.9	14.5	0.27	0.53	0.27	52.1
9	R2	161	7.0	0.326	9.4	LOS A	1.9	14.5	0.27	0.53	0.27	54.5
9u	U	18	7.0	0.326	11.6	LOS B	1.9	14.5	0.27	0.53	0.27	55.6
Approach		842	7.0	0.326	5.4	LOS A	2.0	14.8	0.26	0.50	0.26	53.2
West: The Bucketts Way												
10	L2	296	7.0	3.228	2019.7	LOS F	216.5	1606.8	1.00	6.81	29.85	1.7
11	T1	182	7.0	3.228	2019.9	LOS F	216.5	1606.8	1.00	6.81	29.85	1.5
12	R2	5	7.0	3.228	2107.6	LOS F	216.5	1606.8	1.00	6.81	29.85	1.3
12u	U	1	7.0	3.228	2109.9	LOS F	216.5	1606.8	1.00	6.81	29.85	1.8
Approach		484	7.0	3.228	2020.9	LOS F	216.5	1606.8	1.00	6.81	29.85	1.6
All Vehicles		3262	7.0	3.228	308.9	LOS F	216.5	1606.8	0.65	1.60	5.01	8.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV-REZ-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	3	7.0	0.092	8.6	LOS A	0.4	3.0	0.73	0.86	0.73	49.0
2	T1	33	7.0	0.092	8.8	LOS A	0.4	3.0	0.73	0.86	0.73	50.4
3	R2	9	7.0	0.092	13.9	LOS B	0.4	3.0	0.73	0.86	0.73	47.3
3u	U	1	7.0	0.092	16.1	LOS B	0.4	3.0	0.73	0.86	0.73	48.1
Approach		46	7.0	0.092	10.0	LOS A	0.4	3.0	0.73	0.86	0.73	49.7
East: Manning River Drive (e)												
4	L2	20	7.0	0.559	5.8	LOS A	4.0	29.9	0.63	0.70	0.64	45.4
5	T1	168	7.0	0.559	5.8	LOS A	4.0	29.9	0.63	0.70	0.64	51.2
6	R2	967	7.0	0.559	11.1	LOS B	4.0	29.9	0.64	0.73	0.65	50.2
6u	U	2	7.0	0.559	13.5	LOS B	4.0	29.8	0.64	0.76	0.66	48.2
Approach		1158	7.0	0.559	10.3	LOS B	4.0	29.9	0.64	0.73	0.65	50.2
North: Manning River Drive (n)												
7	L2	1472	7.0	0.749	5.4	LOS A	7.9	58.8	0.67	0.60	0.68	51.2
8	T1	33	7.0	0.749	5.7	LOS A	7.9	58.8	0.69	0.64	0.70	50.9
9	R2	251	7.0	0.749	10.8	LOS B	7.9	58.8	0.69	0.64	0.70	53.5
9u	U	21	7.0	0.749	13.1	LOS B	7.9	58.8	0.69	0.64	0.70	54.6
Approach		1776	7.0	0.749	6.3	LOS A	7.9	58.8	0.67	0.61	0.68	51.6
West: The Bucketts Way												
10	L2	188	7.0	0.661	25.2	LOS C	7.7	56.8	1.00	1.24	1.61	41.9
11	T1	148	7.0	0.661	25.4	LOS C	7.7	56.8	1.00	1.24	1.61	40.7
12	R2	1	7.0	0.661	30.5	LOS C	7.7	56.8	1.00	1.24	1.61	39.1
12u	U	1	7.0	0.661	32.7	LOS C	7.7	56.8	1.00	1.24	1.61	44.0
Approach		339	7.0	0.661	25.3	LOS C	7.7	56.8	1.00	1.24	1.61	41.4
All Vehicles		3319	7.0	0.749	9.7	LOS A	7.9	58.8	0.69	0.72	0.77	49.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2040 BG GR+BG DEV-REZ-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.177	17.9	LOS B	0.9	6.8	0.91	0.96	0.91	41.7
2	T1	20	7.0	0.177	18.2	LOS B	0.9	6.8	0.91	0.96	0.91	42.6
3	R2	12	7.0	0.177	23.2	LOS C	0.9	6.8	0.91	0.96	0.91	38.8
3u	U	1	7.0	0.177	25.5	LOS C	0.9	6.8	0.91	0.96	0.91	38.3
Approach		35	7.0	0.177	20.1	LOS C	0.9	6.8	0.91	0.96	0.91	41.3
East: Manning River Drive (e)												
4	L2	21	7.0	1.032	51.7	LOS E	59.2	439.2	1.00	1.99	3.29	23.5
5	T1	251	7.0	1.032	51.7	LOS E	59.2	439.2	1.00	1.99	3.29	29.4
6	R2	2017	7.0	1.032	58.1	LOS E	59.2	439.2	1.00	1.96	3.32	28.5
6u	U	1	7.0	1.032	61.5	LOS E	55.4	410.9	1.00	1.95	3.35	25.2
Approach		2289	7.0	1.032	57.3	LOS E	59.2	439.2	1.00	1.97	3.32	28.6
North: Manning River Drive (n)												
7	L2	753	7.0	0.400	4.3	LOS A	2.6	19.6	0.28	0.48	0.28	52.7
8	T1	48	7.0	0.400	4.3	LOS A	2.6	19.1	0.29	0.54	0.29	51.8
9	R2	215	7.0	0.400	9.4	LOS A	2.6	19.1	0.29	0.54	0.29	54.3
9u	U	21	7.0	0.400	11.7	LOS B	2.6	19.1	0.29	0.54	0.29	55.4
Approach		1037	7.0	0.400	5.5	LOS A	2.6	19.6	0.28	0.50	0.28	53.1
West: The Bucketts Way												
10	L2	361	7.0	3.951	2668.4	LOS F	286.1	2123.0	1.00	7.10	31.32	1.3
11	T1	224	7.0	3.951	2668.6	LOS F	286.1	2123.0	1.00	7.10	31.32	1.1
12	R2	6	7.0	3.951	2741.1	LOS F	286.1	2123.0	1.00	7.10	31.32	1.0
12u	U	1	7.0	3.951	2743.3	LOS F	286.1	2123.0	1.00	7.10	31.32	1.3
Approach		593	7.0	3.951	2669.4	LOS F	286.1	2123.0	1.00	7.10	31.32	1.2
All Vehicles		3954	7.0	3.951	434.9	LOS F	286.1	2123.0	0.81	2.34	6.70	6.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2040 BG GR+BG DEV-REZ-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	3	7.0	0.140	10.4	LOS B	0.7	5.0	0.82	0.90	0.82	47.5
2	T1	38	7.0	0.140	10.6	LOS B	0.7	5.0	0.82	0.90	0.82	48.8
3	R2	11	7.0	0.140	15.7	LOS B	0.7	5.0	0.82	0.90	0.82	45.5
3u	U	1	7.0	0.140	17.9	LOS B	0.7	5.0	0.82	0.90	0.82	46.0
Approach		53	7.0	0.140	11.8	LOS B	0.7	5.0	0.82	0.90	0.82	48.1
East: Manning River Drive (e)												
4	L2	23	7.0	0.738	8.9	LOS A	8.5	63.4	0.87	0.91	1.05	43.4
5	T1	207	7.0	0.738	8.9	LOS A	8.5	63.4	0.87	0.91	1.05	49.4
6	R2	1144	7.0	0.738	14.4	LOS B	8.5	63.4	0.87	0.93	1.07	48.2
6u	U	3	7.0	0.738	17.0	LOS B	8.3	61.5	0.87	0.95	1.09	45.8
Approach		1378	7.0	0.738	13.5	LOS B	8.5	63.4	0.87	0.93	1.07	48.3
North: Manning River Drive (n)												
7	L2	1799	7.0	0.932	10.9	LOS B	21.0	156.2	0.97	0.80	1.19	47.9
8	T1	40	7.0	0.932	11.9	LOS B	21.0	156.2	1.00	0.84	1.26	46.5
9	R2	324	7.0	0.932	17.0	LOS B	21.0	156.2	1.00	0.84	1.26	49.8
9u	U	24	7.0	0.932	19.2	LOS B	21.0	156.2	1.00	0.84	1.26	50.7
Approach		2187	7.0	0.932	11.9	LOS B	21.0	156.2	0.98	0.81	1.20	48.3
West: The Bucketts Way												
10	L2	258	7.0	1.402	416.5	LOS F	105.3	781.0	1.00	4.34	9.83	7.5
11	T1	220	7.0	1.402	416.8	LOS F	105.3	781.0	1.00	4.34	9.83	6.4
12	R2	1	7.0	1.402	421.9	LOS F	105.3	781.0	1.00	4.34	9.83	5.9
12u	U	1	7.0	1.402	424.1	LOS F	105.3	781.0	1.00	4.34	9.83	7.7
Approach		480	7.0	1.402	416.7	LOS F	105.3	781.0	1.00	4.34	9.83	7.0
All Vehicles		4098	7.0	1.402	59.8	LOS E	105.3	781.0	0.94	1.26	2.16	27.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV-UP-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Waang Djarii Way (South)												
1	L2	1	7.0	0.032	8.2	LOS A	0.1	1.0	0.68	0.80	0.68	50.9
2	T1	9	7.0	0.032	8.4	LOS A	0.1	1.0	0.68	0.80	0.68	52.3
3	R2	6	7.0	0.032	13.5	LOS B	0.1	1.0	0.68	0.80	0.68	52.2
3u	U	1	7.0	0.032	15.8	LOS B	0.1	1.0	0.68	0.80	0.68	53.4
Approach		18	7.0	0.032	10.6	LOS B	0.1	1.0	0.68	0.80	0.68	52.2
East: Manning River Drive (East)												
4	L2	15	7.0	0.568	4.7	LOS A	3.6	26.6	0.36	0.61	0.36	51.3
5	T1	94	7.0	0.568	4.7	LOS A	3.6	26.6	0.36	0.61	0.36	52.8
6	R2	1327	7.0	0.568	9.9	LOS A	3.6	26.6	0.37	0.62	0.37	52.5
6u	U	1	7.0	0.568	12.2	LOS B	3.6	26.5	0.38	0.63	0.38	53.3
Approach		1437	7.0	0.568	9.5	LOS A	3.6	26.6	0.37	0.62	0.37	52.5
North: Manning River Drive (North)												
7	L2	472	7.0	0.163	3.4	LOS A	0.0	0.0	0.00	0.46	0.00	55.9
8	T1	34	7.0	0.163	4.0	LOS A	0.0	0.0	0.00	0.52	0.00	56.4
9	R2	72	7.0	0.163	9.1	LOS A	0.0	0.0	0.00	0.52	0.00	56.4
9u	U	16	7.0	0.163	11.3	LOS B	0.0	0.0	0.00	0.52	0.00	57.7
Approach		593	7.0	0.163	4.4	LOS A	0.0	0.0	0.00	0.47	0.00	56.0
West: The Bucketts Way (West)												
10	L2	206	7.0	0.484	32.2	LOS C	5.3	39.3	1.00	1.10	1.34	39.0
11	T1	128	7.0	0.461	38.1	LOS D	4.0	30.0	1.00	1.13	1.35	37.7
12	R2	4	7.0	0.461	43.1	LOS D	4.0	30.0	1.00	1.13	1.35	37.7
12u	U	1	7.0	0.461	45.4	LOS D	4.0	30.0	1.00	1.13	1.35	38.3
Approach		340	7.0	0.484	34.6	LOS C	5.3	39.3	1.00	1.11	1.35	38.4
All Vehicles		2387	7.0	0.568	11.8	LOS B	5.3	39.3	0.37	0.66	0.42	50.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV-UP-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Waang Djarii Way (South)												
1	L2	2	7.0	0.054	6.9	LOS A	0.2	1.6	0.60	0.73	0.60	52.2
2	T1	26	7.0	0.054	7.1	LOS A	0.2	1.6	0.60	0.73	0.60	53.6
3	R2	7	7.0	0.054	12.2	LOS B	0.2	1.6	0.60	0.73	0.60	53.6
3u	U	1	7.0	0.054	14.4	LOS B	0.2	1.6	0.60	0.73	0.60	54.8
Approach		37	7.0	0.054	8.3	LOS A	0.2	1.6	0.60	0.73	0.60	53.6
East: Manning River Drive (East)												
4	L2	15	7.0	0.359	4.9	LOS A	1.9	14.1	0.39	0.62	0.39	51.7
5	T1	109	7.0	0.359	4.9	LOS A	1.9	14.1	0.39	0.62	0.39	53.2
6	R2	702	7.0	0.359	10.0	LOS B	1.9	14.1	0.40	0.64	0.40	52.6
6u	U	2	7.0	0.359	12.3	LOS B	1.9	13.9	0.40	0.66	0.40	53.2
Approach		828	7.0	0.359	9.3	LOS A	1.9	14.1	0.40	0.64	0.40	52.7
North: Manning River Drive (North)												
7	L2	1187	7.0	0.433	3.6	LOS A	2.8	20.9	0.10	0.45	0.10	55.6
8	T1	24	7.0	0.433	4.3	LOS A	2.8	20.9	0.29	0.51	0.29	55.5
9	R2	156	7.0	0.433	9.4	LOS A	2.8	20.9	0.29	0.51	0.29	55.5
9u	U	18	7.0	0.433	11.7	LOS B	2.8	20.9	0.29	0.51	0.29	56.7
Approach		1385	7.0	0.433	4.3	LOS A	2.8	20.9	0.12	0.46	0.12	55.6
West: The Bucketts Way (West)												
10	L2	99	7.0	0.103	7.7	LOS A	0.7	5.0	0.73	0.69	0.73	52.7
11	T1	67	7.0	0.097	8.8	LOS A	0.6	4.2	0.72	0.70	0.72	53.4
12	R2	1	7.0	0.097	13.9	LOS B	0.6	4.2	0.72	0.70	0.72	53.4
12u	U	1	7.0	0.097	16.1	LOS B	0.6	4.2	0.72	0.70	0.72	54.6
Approach		168	7.0	0.103	8.2	LOS A	0.7	5.0	0.73	0.69	0.73	53.0
All Vehicles		2419	7.0	0.433	6.4	LOS A	2.8	20.9	0.27	0.54	0.27	54.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV+REZ-UP AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.038	8.7	LOS A	0.2	1.2	0.71	0.83	0.71	50.4
2	T1	9	7.0	0.038	8.9	LOS A	0.2	1.2	0.71	0.83	0.71	51.8
3	R2	7	7.0	0.038	14.0	LOS B	0.2	1.2	0.71	0.83	0.71	51.8
3u	U	1	7.0	0.038	16.3	LOS B	0.2	1.2	0.71	0.83	0.71	52.9
Approach		19	7.0	0.038	11.3	LOS B	0.2	1.2	0.71	0.83	0.71	51.8
East: Manning River Drive (e)												
4	L2	16	7.0	0.625	4.8	LOS A	4.7	34.9	0.43	0.61	0.43	51.1
5	T1	108	7.0	0.625	4.8	LOS A	4.7	34.9	0.43	0.61	0.43	52.6
6	R2	1444	7.0	0.625	9.9	LOS A	4.7	34.9	0.44	0.62	0.44	52.3
6u	U	1	7.0	0.625	12.2	LOS B	4.7	34.5	0.45	0.63	0.45	53.1
Approach		1569	7.0	0.625	9.5	LOS A	4.7	34.9	0.44	0.62	0.44	52.3
North: Manning River Drive (n)												
7	L2	518	7.0	0.211	3.6	LOS A	1.2	8.5	0.09	0.46	0.09	55.7
8	T1	34	7.0	0.211	4.5	LOS A	1.2	8.5	0.35	0.54	0.35	54.9
9	R2	72	7.0	0.211	9.6	LOS A	1.2	8.5	0.35	0.54	0.35	54.9
9u	U	16	7.0	0.211	11.9	LOS B	1.2	8.5	0.35	0.54	0.35	56.1
Approach		639	7.0	0.211	4.5	LOS A	1.2	8.5	0.14	0.47	0.14	55.6
West: The Bucketts Way												
10	L2	206	7.0	0.697	68.5	LOS E	8.2	60.8	1.00	1.41	2.15	28.1
11	T1	135	7.0	0.746	93.1	LOS F	7.1	52.9	1.00	1.40	2.23	24.3
12	R2	4	7.0	0.746	98.2	LOS F	7.1	52.9	1.00	1.40	2.23	24.3
12u	U	1	7.0	0.746	100.5	LOS F	7.1	52.9	1.00	1.40	2.23	24.5
Approach		346	7.0	0.746	78.5	LOS F	8.2	60.8	1.00	1.41	2.18	26.4
All Vehicles		2574	7.0	0.746	17.6	LOS B	8.2	60.8	0.44	0.69	0.60	46.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2021 BG GR+BG DEV+REZ-UP PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.059	7.3	LOS A	0.2	1.8	0.63	0.76	0.63	51.9
2	T1	26	7.0	0.059	7.5	LOS A	0.2	1.8	0.63	0.76	0.63	53.4
3	R2	8	7.0	0.059	12.6	LOS B	0.2	1.8	0.63	0.76	0.63	53.3
3u	U	1	7.0	0.059	14.8	LOS B	0.2	1.8	0.63	0.76	0.63	54.5
Approach		38	7.0	0.059	8.8	LOS A	0.2	1.8	0.63	0.76	0.63	53.3
East: Manning River Drive (e)												
4	L2	16	7.0	0.415	5.0	LOS A	2.3	17.3	0.42	0.62	0.42	51.6
5	T1	124	7.0	0.415	4.9	LOS A	2.3	17.3	0.42	0.62	0.42	53.1
6	R2	820	7.0	0.415	10.1	LOS B	2.3	17.3	0.42	0.65	0.42	52.5
6u	U	2	7.0	0.415	12.4	LOS B	2.3	17.1	0.43	0.66	0.43	53.1
Approach		962	7.0	0.415	9.3	LOS A	2.3	17.3	0.42	0.64	0.42	52.6
North: Manning River Drive (n)												
7	L2	1234	7.0	0.449	3.6	LOS A	3.0	22.4	0.10	0.45	0.10	55.6
8	T1	24	7.0	0.449	4.4	LOS A	3.0	22.4	0.31	0.51	0.31	55.4
9	R2	156	7.0	0.449	9.5	LOS A	3.0	22.4	0.31	0.51	0.31	55.4
9u	U	18	7.0	0.449	11.7	LOS B	3.0	22.4	0.31	0.51	0.31	56.7
Approach		1432	7.0	0.449	4.3	LOS A	3.0	22.4	0.13	0.46	0.13	55.6
West: The Bucketts Way												
10	L2	99	7.0	0.114	9.0	LOS A	0.8	6.0	0.80	0.73	0.80	51.7
11	T1	73	7.0	0.117	10.3	LOS B	0.7	5.5	0.79	0.76	0.79	52.3
12	R2	1	7.0	0.117	15.4	LOS B	0.7	5.5	0.79	0.76	0.79	52.3
12u	U	1	7.0	0.117	17.6	LOS B	0.7	5.5	0.79	0.76	0.79	53.4
Approach		174	7.0	0.117	9.6	LOS A	0.8	6.0	0.80	0.74	0.80	52.0
All Vehicles		2605	7.0	0.449	6.6	LOS A	3.0	22.4	0.29	0.55	0.29	54.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV-UP-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.045	9.1	LOS A	0.2	1.4	0.72	0.84	0.72	50.4
2	T1	13	7.0	0.045	9.3	LOS A	0.2	1.4	0.72	0.84	0.72	51.8
3	R2	7	7.0	0.045	14.4	LOS B	0.2	1.4	0.72	0.84	0.72	51.8
3u	U	1	7.0	0.045	16.6	LOS B	0.2	1.4	0.72	0.84	0.72	52.9
Approach		22	7.0	0.045	11.3	LOS B	0.2	1.4	0.72	0.84	0.72	51.8
East: Manning River Drive (e)												
4	L2	16	7.0	0.646	4.9	LOS A	4.6	33.9	0.42	0.62	0.42	51.1
5	T1	101	7.0	0.646	4.9	LOS A	4.6	33.9	0.42	0.62	0.42	52.6
6	R2	1503	7.0	0.646	10.1	LOS B	4.6	33.9	0.44	0.63	0.44	52.3
6u	U	1	7.0	0.646	12.4	LOS B	4.6	33.8	0.45	0.64	0.45	53.1
Approach		1621	7.0	0.646	9.7	LOS A	4.6	33.9	0.44	0.63	0.44	52.3
North: Manning River Drive (n)												
7	L2	526	7.0	0.181	3.4	LOS A	0.0	0.0	0.00	0.46	0.00	55.9
8	T1	37	7.0	0.181	4.0	LOS A	0.0	0.0	0.00	0.52	0.00	56.4
9	R2	80	7.0	0.181	9.1	LOS A	0.0	0.0	0.00	0.52	0.00	56.4
9u	U	17	7.0	0.181	11.3	LOS B	0.0	0.0	0.00	0.52	0.00	57.7
Approach		660	7.0	0.181	4.3	LOS A	0.0	0.0	0.00	0.47	0.00	56.0
West: The Bucketts Way												
10	L2	236	7.0	1.017	174.7	LOS F	20.5	152.0	1.00	2.16	4.58	15.4
11	T1	138	7.0	0.995	190.7	LOS F	13.2	97.8	1.00	1.79	3.66	14.9
12	R2	5	7.0	0.995	195.8	LOS F	13.2	97.8	1.00	1.79	3.66	14.9
12u	U	1	7.0	0.995	198.1	LOS F	13.2	97.8	1.00	1.79	3.66	15.0
Approach		380	7.0	1.017	180.9	LOS F	20.5	152.0	1.00	2.02	4.23	15.2
All Vehicles		2683	7.0	1.017	32.6	LOS C	20.5	152.0	0.41	0.79	0.87	39.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV-UP-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.062	7.3	LOS A	0.3	1.9	0.63	0.76	0.63	52.0
2	T1	28	7.0	0.062	7.5	LOS A	0.3	1.9	0.63	0.76	0.63	53.4
3	R2	8	7.0	0.062	12.6	LOS B	0.3	1.9	0.63	0.76	0.63	53.4
3u	U	1	7.0	0.062	14.8	LOS B	0.3	1.9	0.63	0.76	0.63	54.6
Approach		40	7.0	0.062	8.7	LOS A	0.3	1.9	0.63	0.76	0.63	53.3
East: Manning River Drive (e)												
4	L2	16	7.0	0.404	5.1	LOS A	2.3	16.8	0.44	0.64	0.44	51.5
5	T1	118	7.0	0.404	5.1	LOS A	2.3	16.8	0.44	0.64	0.44	53.0
6	R2	775	7.0	0.404	10.2	LOS B	2.3	16.8	0.45	0.66	0.45	52.4
6u	U	2	7.0	0.404	12.6	LOS B	2.2	16.5	0.45	0.68	0.45	53.0
Approach		911	7.0	0.404	9.5	LOS A	2.3	16.8	0.45	0.66	0.45	52.5
North: Manning River Drive (n)												
7	L2	1355	7.0	0.496	3.6	LOS A	3.5	26.1	0.11	0.46	0.11	55.6
8	T1	27	7.0	0.496	4.4	LOS A	3.5	26.1	0.33	0.51	0.33	55.3
9	R2	182	7.0	0.496	9.5	LOS A	3.5	26.1	0.33	0.51	0.33	55.3
9u	U	19	7.0	0.496	11.7	LOS B	3.5	26.1	0.33	0.51	0.33	56.6
Approach		1583	7.0	0.496	4.4	LOS A	3.5	26.1	0.14	0.46	0.14	55.5
West: The Bucketts Way												
10	L2	109	7.0	0.123	8.5	LOS A	0.9	6.4	0.78	0.72	0.78	52.1
11	T1	72	7.0	0.112	9.7	LOS A	0.7	5.1	0.77	0.75	0.77	52.7
12	R2	1	7.0	0.112	14.8	LOS B	0.7	5.1	0.77	0.75	0.77	52.7
12u	U	1	7.0	0.112	17.1	LOS B	0.7	5.1	0.77	0.75	0.77	53.9
Approach		183	7.0	0.123	9.1	LOS A	0.9	6.4	0.78	0.73	0.78	52.3
All Vehicles		2717	7.0	0.496	6.5	LOS A	3.5	26.1	0.29	0.55	0.29	54.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV+REZ-UP-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.056	9.8	LOS A	0.2	1.8	0.76	0.89	0.76	49.8
2	T1	13	7.0	0.056	10.0	LOS B	0.2	1.8	0.76	0.89	0.76	51.1
3	R2	9	7.0	0.056	15.1	LOS B	0.2	1.8	0.76	0.89	0.76	51.1
3u	U	1	7.0	0.056	17.4	LOS B	0.2	1.8	0.76	0.89	0.76	52.1
Approach		24	7.0	0.056	12.3	LOS B	0.2	1.8	0.76	0.89	0.76	51.1
East: Manning River Drive (e)												
4	L2	18	7.0	0.713	5.0	LOS A	6.2	46.0	0.52	0.62	0.52	50.9
5	T1	119	7.0	0.713	5.0	LOS A	6.2	46.0	0.52	0.62	0.52	52.3
6	R2	1636	7.0	0.713	10.2	LOS B	6.2	46.0	0.53	0.63	0.53	52.0
6u	U	1	7.0	0.713	12.5	LOS B	6.1	45.5	0.54	0.64	0.54	52.7
Approach		1774	7.0	0.713	9.8	LOS A	6.2	46.0	0.53	0.63	0.53	52.0
North: Manning River Drive (n)												
7	L2	631	7.0	0.253	3.6	LOS A	1.4	10.6	0.10	0.46	0.10	55.6
8	T1	37	7.0	0.253	4.6	LOS A	1.4	10.6	0.38	0.55	0.38	54.9
9	R2	80	7.0	0.253	9.7	LOS A	1.4	10.6	0.38	0.55	0.38	54.9
9u	U	17	7.0	0.253	11.9	LOS B	1.4	10.6	0.38	0.55	0.38	56.2
Approach		764	7.0	0.253	4.5	LOS A	1.4	10.6	0.15	0.48	0.15	55.5
West: The Bucketts Way												
10	L2	236	7.0	1.572	559.7	LOS F	58.7	435.7	1.00	4.30	15.19	5.8
11	T1	157	7.0	1.088	157.3	LOS F	13.8	102.3	1.00	1.98	5.47	16.7
12	R2	5	7.0	1.088	267.7	LOS F	13.8	102.3	1.00	1.98	5.47	16.7
12u	U	1	7.0	1.088	269.9	LOS F	13.8	102.3	1.00	1.98	5.47	16.8
Approach		399	7.0	1.572	396.9	LOS F	58.7	435.7	1.00	3.35	11.22	8.0
All Vehicles		2961	7.0	1.572	60.6	LOS E	58.7	435.7	0.50	0.96	1.87	30.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2025 BG GR+BG DEV+REZ-UP-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.072	7.9	LOS A	0.3	2.2	0.68	0.81	0.68	51.6
2	T1	28	7.0	0.072	8.2	LOS A	0.3	2.2	0.68	0.81	0.68	53.0
3	R2	9	7.0	0.072	13.2	LOS B	0.3	2.2	0.68	0.81	0.68	53.0
3u	U	1	7.0	0.072	15.5	LOS B	0.3	2.2	0.68	0.81	0.68	54.2
Approach		41	7.0	0.072	9.5	LOS A	0.3	2.2	0.68	0.81	0.68	53.0
East: Manning River Drive (e)												
4	L2	19	7.0	0.494	5.2	LOS A	3.1	22.7	0.49	0.64	0.49	51.4
5	T1	145	7.0	0.494	5.2	LOS A	3.1	22.7	0.49	0.64	0.49	52.9
6	R2	951	7.0	0.494	10.4	LOS B	3.1	22.7	0.49	0.67	0.49	52.3
6u	U	2	7.0	0.494	12.7	LOS B	3.0	22.3	0.50	0.69	0.50	52.9
Approach		1117	7.0	0.494	9.6	LOS A	3.1	22.7	0.49	0.66	0.49	52.3
North: Manning River Drive (n)												
7	L2	1417	7.0	0.518	3.6	LOS A	3.9	28.6	0.12	0.46	0.12	55.5
8	T1	27	7.0	0.518	4.5	LOS A	3.9	28.6	0.36	0.52	0.36	55.2
9	R2	182	7.0	0.518	9.5	LOS A	3.9	28.6	0.36	0.52	0.36	55.2
9u	U	19	7.0	0.518	11.8	LOS B	3.9	28.6	0.36	0.52	0.36	56.5
Approach		1645	7.0	0.518	4.4	LOS A	3.9	28.6	0.15	0.47	0.15	55.5
West: The Bucketts Way												
10	L2	109	7.0	0.150	10.9	LOS B	1.2	8.6	0.90	0.79	0.90	50.3
11	T1	81	7.0	0.158	12.8	LOS B	1.1	7.8	0.87	0.84	0.87	50.6
12	R2	1	7.0	0.158	17.9	LOS B	1.1	7.8	0.87	0.84	0.87	50.6
12u	U	1	7.0	0.158	20.1	LOS C	1.1	7.8	0.87	0.84	0.87	51.6
Approach		193	7.0	0.158	11.8	LOS B	1.2	8.6	0.89	0.81	0.89	50.4
All Vehicles		2996	7.0	0.518	6.9	LOS A	3.9	28.6	0.33	0.57	0.33	53.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV-UP-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.062	10.9	LOS B	0.3	2.1	0.81	0.91	0.81	46.4
2	T1	13	7.0	0.062	11.2	LOS B	0.3	2.1	0.81	0.91	0.81	47.6
3	R2	7	7.0	0.062	16.3	LOS B	0.3	2.1	0.81	0.91	0.81	44.3
3u	U	1	7.0	0.062	18.5	LOS B	0.3	2.1	0.81	0.91	0.81	44.5
Approach		22	7.0	0.062	13.2	LOS B	0.3	2.1	0.81	0.91	0.81	46.5
East: Manning River Drive (e)												
4	L2	17	7.0	0.786	6.9	LOS A	8.9	66.3	0.69	0.72	0.76	44.7
5	T1	182	7.0	0.786	6.8	LOS A	8.9	66.3	0.69	0.72	0.76	50.5
6	R2	1632	7.0	0.786	12.3	LOS B	9.1	67.5	0.70	0.74	0.78	49.7
6u	U	1	7.0	0.786	14.8	LOS B	9.1	67.5	0.71	0.76	0.81	47.7
Approach		1832	7.0	0.786	11.7	LOS B	9.1	67.5	0.70	0.74	0.78	49.7
North: Manning River Drive (n)												
7	L2	572	7.0	0.257	3.5	LOS A	1.5	10.8	0.07	0.46	0.07	54.7
8	T1	40	7.0	0.257	4.6	LOS A	1.5	10.8	0.38	0.58	0.38	51.4
9	R2	148	7.0	0.257	9.7	LOS A	1.5	10.8	0.38	0.58	0.38	53.9
9u	U	18	7.0	0.257	11.9	LOS B	1.5	10.8	0.38	0.58	0.38	55.0
Approach		778	7.0	0.257	5.0	LOS A	1.5	10.8	0.15	0.49	0.15	54.4
West: The Bucketts Way												
10	L2	269	7.0	1.796	757.4	LOS F	80.5	597.4	1.00	4.88	17.38	4.3
11	T1	168	7.0	1.165	213.8	LOS F	20.6	153.1	1.00	2.35	7.08	11.4
12	R2	5	7.0	1.165	299.1	LOS F	20.6	153.1	1.00	2.35	7.08	10.5
12u	U	1	7.0	1.165	301.3	LOS F	20.6	153.1	1.00	2.35	7.08	13.4
Approach		444	7.0	1.796	544.8	LOS F	80.5	597.4	1.00	3.89	13.33	5.5
All Vehicles		3076	7.0	1.796	87.0	LOS F	80.5	597.4	0.60	1.13	2.43	22.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV-UP-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	3	7.0	0.076	7.8	LOS A	0.3	2.4	0.68	0.81	0.68	49.4
2	T1	31	7.0	0.076	8.1	LOS A	0.3	2.4	0.68	0.81	0.68	50.9
3	R2	9	7.0	0.076	13.1	LOS B	0.3	2.4	0.68	0.81	0.68	47.9
3u	U	1	7.0	0.076	15.4	LOS B	0.3	2.4	0.68	0.81	0.68	48.8
Approach		44	7.0	0.076	9.3	LOS A	0.3	2.4	0.68	0.81	0.68	50.2
East: Manning River Drive (e)												
4	L2	17	7.0	0.469	5.4	LOS A	2.9	21.7	0.53	0.66	0.53	45.8
5	T1	145	7.0	0.469	5.4	LOS A	2.9	21.7	0.53	0.66	0.53	51.5
6	R2	843	7.0	0.469	10.6	LOS B	2.9	21.7	0.54	0.69	0.54	50.5
6u	U	2	7.0	0.469	12.9	LOS B	2.8	21.1	0.55	0.71	0.55	48.6
Approach		1007	7.0	0.469	9.8	LOS A	2.9	21.7	0.54	0.69	0.54	50.6
North: Manning River Drive (n)												
7	L2	1476	7.0	0.569	3.8	LOS A	4.4	32.5	0.15	0.47	0.15	54.3
8	T1	29	7.0	0.569	4.9	LOS A	4.4	32.5	0.50	0.58	0.50	52.0
9	R2	224	7.0	0.569	10.0	LOS A	4.4	32.5	0.50	0.58	0.50	54.4
9u	U	21	7.0	0.569	12.2	LOS B	4.4	32.5	0.50	0.58	0.50	55.6
Approach		1751	7.0	0.569	4.7	LOS A	4.4	32.5	0.20	0.49	0.20	54.3
West: The Bucketts Way												
10	L2	175	7.0	0.215	9.7	LOS A	1.6	12.1	0.86	0.80	0.86	51.0
11	T1	147	7.0	0.251	11.3	LOS B	1.7	12.5	0.86	0.86	0.86	50.2
12	R2	1	7.0	0.251	16.4	LOS B	1.7	12.5	0.86	0.86	0.86	48.8
12u	U	1	7.0	0.251	18.6	LOS B	1.7	12.5	0.86	0.86	0.86	52.8
Approach		324	7.0	0.251	10.5	LOS B	1.7	12.5	0.86	0.82	0.86	50.7
All Vehicles		3126	7.0	0.569	7.0	LOS A	4.4	32.5	0.39	0.59	0.39	52.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV+REZ-UP-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.086	11.8	LOS B	0.4	3.0	0.84	0.92	0.84	48.7
2	T1	16	7.0	0.086	12.0	LOS B	0.4	3.0	0.84	0.92	0.84	49.9
3	R2	9	7.0	0.086	17.1	LOS B	0.4	3.0	0.84	0.92	0.84	49.9
3u	U	1	7.0	0.086	19.3	LOS B	0.4	3.0	0.84	0.92	0.84	50.9
Approach		27	7.0	0.086	14.0	LOS B	0.4	3.0	0.84	0.92	0.84	49.9
East: Manning River Drive (e)												
4	L2	18	7.0	0.828	7.9	LOS A	11.1	82.2	0.76	0.76	0.88	49.9
5	T1	192	7.0	0.828	7.9	LOS A	11.1	82.2	0.76	0.76	0.88	51.3
6	R2	1698	7.0	0.828	13.4	LOS B	11.2	83.2	0.77	0.79	0.91	50.7
6u	U	1	7.0	0.828	16.1	LOS B	11.2	83.2	0.78	0.81	0.94	51.2
Approach		1908	7.0	0.828	12.8	LOS B	11.2	83.2	0.77	0.78	0.91	50.7
North: Manning River Drive (n)												
7	L2	622	7.0	0.278	3.6	LOS A	1.6	11.9	0.07	0.46	0.07	55.7
8	T1	41	7.0	0.278	4.6	LOS A	1.6	11.9	0.39	0.58	0.39	54.0
9	R2	161	7.0	0.278	9.7	LOS A	1.6	11.9	0.39	0.58	0.39	54.0
9u	U	18	7.0	0.278	11.9	LOS B	1.6	11.9	0.39	0.58	0.39	55.2
Approach		842	7.0	0.278	5.0	LOS A	1.6	11.9	0.15	0.49	0.15	55.3
West: The Bucketts Way												
10	L2	296	7.0	1.972	898.9	LOS F	95.5	708.3	1.00	6.01	25.08	3.8
11	T1	182	7.0	1.256	279.0	LOS F	30.1	223.2	1.00	2.23	7.17	10.4
12	R2	5	7.0	1.256	649.4	LOS F	30.1	223.2	1.00	2.23	7.17	10.4
12u	U	1	7.0	1.256	651.6	LOS F	30.1	223.2	1.00	2.23	7.17	10.5
Approach		484	7.0	1.972	662.5	LOS F	95.5	708.3	1.00	4.54	18.11	5.0
All Vehicles		3262	7.0	1.972	107.3	LOS F	95.5	708.3	0.64	1.27	3.26	22.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2030 BG GR+BG DEV+REZ-UP-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	3	7.0	0.090	8.6	LOS A	0.4	3.0	0.72	0.85	0.72	51.3
2	T1	33	7.0	0.090	8.8	LOS A	0.4	3.0	0.72	0.85	0.72	52.7
3	R2	9	7.0	0.090	13.9	LOS B	0.4	3.0	0.72	0.85	0.72	52.7
3u	U	1	7.0	0.090	16.1	LOS B	0.4	3.0	0.72	0.85	0.72	53.8
Approach		46	7.0	0.090	10.0	LOS A	0.4	3.0	0.72	0.85	0.72	52.6
East: Manning River Drive (e)												
4	L2	20	7.0	0.550	5.8	LOS A	3.8	28.0	0.60	0.69	0.61	51.1
5	T1	168	7.0	0.550	5.8	LOS A	3.8	28.0	0.60	0.69	0.61	52.6
6	R2	967	7.0	0.550	11.1	LOS B	3.8	28.0	0.61	0.73	0.62	51.9
6u	U	2	7.0	0.550	13.5	LOS B	3.8	28.0	0.62	0.75	0.63	52.5
Approach		1158	7.0	0.550	10.2	LOS B	3.8	28.0	0.61	0.72	0.62	52.0
North: Manning River Drive (n)												
7	L2	1472	7.0	0.578	3.8	LOS A	4.6	33.9	0.14	0.47	0.14	55.4
8	T1	33	7.0	0.578	4.9	LOS A	4.6	33.9	0.52	0.59	0.52	54.4
9	R2	251	7.0	0.578	10.0	LOS A	4.6	33.9	0.52	0.59	0.52	54.4
9u	U	21	7.0	0.578	12.2	LOS B	4.6	33.9	0.52	0.59	0.52	55.6
Approach		1776	7.0	0.578	4.8	LOS A	4.6	33.9	0.21	0.49	0.21	55.2
West: The Bucketts Way												
10	L2	188	7.0	0.274	11.8	LOS B	2.3	16.8	0.96	0.87	0.96	49.8
11	T1	148	7.0	0.307	13.9	LOS B	2.2	16.2	0.93	0.93	0.93	49.9
12	R2	1	7.0	0.307	19.0	LOS B	2.2	16.2	0.93	0.93	0.93	49.9
12u	U	1	7.0	0.307	21.2	LOS C	2.2	16.2	0.93	0.93	0.93	50.9
Approach		339	7.0	0.307	12.8	LOS B	2.3	16.8	0.95	0.90	0.95	49.8
All Vehicles		3319	7.0	0.578	7.5	LOS A	4.6	33.9	0.43	0.62	0.43	53.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2040 BG GR+BG DEV+REZ-UP-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.174	17.6	LOS B	0.9	6.6	0.91	0.96	0.91	45.3
2	T1	20	7.0	0.174	17.8	LOS B	0.9	6.6	0.91	0.96	0.91	46.4
3	R2	12	7.0	0.174	22.9	LOS C	0.9	6.6	0.91	0.96	0.91	46.4
3u	U	1	7.0	0.174	25.1	LOS C	0.9	6.6	0.91	0.96	0.91	47.3
Approach		35	7.0	0.174	19.7	LOS B	0.9	6.6	0.91	0.96	0.91	46.4
East: Manning River Drive (e)												
4	L2	21	7.0	1.043	59.6	LOS E	64.9	481.9	1.00	2.17	3.64	29.8
5	T1	251	7.0	1.043	59.6	LOS E	64.9	481.9	1.00	2.17	3.64	30.2
6	R2	2017	7.0	1.043	65.9	LOS E	64.9	481.9	1.00	2.14	3.66	29.8
6u	U	1	7.0	1.043	69.3	LOS E	60.4	448.4	1.00	2.11	3.68	29.9
Approach		2289	7.0	1.043	65.2	LOS E	64.9	481.9	1.00	2.14	3.66	29.9
North: Manning River Drive (n)												
7	L2	753	7.0	0.341	3.6	LOS A	2.1	15.5	0.07	0.46	0.07	55.7
8	T1	48	7.0	0.341	4.7	LOS A	2.1	15.5	0.41	0.59	0.41	53.8
9	R2	215	7.0	0.341	9.8	LOS A	2.1	15.5	0.41	0.59	0.41	53.8
9u	U	21	7.0	0.341	12.0	LOS B	2.1	15.5	0.41	0.59	0.41	55.0
Approach		1037	7.0	0.341	5.1	LOS A	2.1	15.5	0.16	0.49	0.16	55.2
West: The Bucketts Way												
10	L2	361	7.0	2.407	1286.6	LOS F	137.0	1016.3	1.00	6.92	29.44	2.7
11	T1	224	7.0	1.544	522.5	LOS F	57.2	424.7	1.00	3.12	11.63	6.2
12	R2	6	7.0	1.544	827.7	LOS F	57.2	424.7	1.00	3.12	11.63	6.2
12u	U	1	7.0	1.544	830.0	LOS F	57.2	424.7	1.00	3.12	11.63	6.2
Approach		593	7.0	2.407	991.8	LOS F	137.0	1016.3	1.00	5.44	22.48	3.5
All Vehicles		3954	7.0	2.407	187.9	LOS F	137.0	1016.3	0.78	2.19	5.54	15.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: SITE1 [2040 BG GR+BG DEV+REZ-UP-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	3	7.0	0.136	10.4	LOS B	0.7	4.8	0.81	0.90	0.81	50.1
2	T1	38	7.0	0.136	10.6	LOS B	0.7	4.8	0.81	0.90	0.81	51.4
3	R2	11	7.0	0.136	15.7	LOS B	0.7	4.8	0.81	0.90	0.81	51.4
3u	U	1	7.0	0.136	17.9	LOS B	0.7	4.8	0.81	0.90	0.81	52.5
Approach		53	7.0	0.136	11.8	LOS B	0.7	4.8	0.81	0.90	0.81	51.4
East: Manning River Drive (e)												
4	L2	23	7.0	0.717	8.6	LOS A	7.7	57.3	0.81	0.89	0.98	49.8
5	T1	207	7.0	0.717	8.6	LOS A	7.7	57.3	0.81	0.89	0.98	51.2
6	R2	1144	7.0	0.717	14.1	LOS B	7.7	57.3	0.82	0.91	1.00	50.4
6u	U	3	7.0	0.717	16.6	LOS B	7.5	55.8	0.82	0.93	1.02	50.8
Approach		1378	7.0	0.717	13.2	LOS B	7.7	57.3	0.82	0.91	1.00	50.5
North: Manning River Drive (n)												
7	L2	1799	7.0	0.732	4.2	LOS A	7.9	58.7	0.19	0.50	0.20	55.2
8	T1	40	7.0	0.732	6.5	LOS A	7.9	58.7	0.73	0.71	0.79	53.5
9	R2	324	7.0	0.732	11.6	LOS B	7.9	58.7	0.73	0.71	0.79	53.5
9u	U	24	7.0	0.732	13.8	LOS B	7.9	58.7	0.73	0.71	0.79	54.7
Approach		2187	7.0	0.732	5.4	LOS A	7.9	58.7	0.28	0.54	0.31	54.9
West: The Bucketts Way												
10	L2	258	7.0	0.549	25.8	LOS C	6.3	47.0	1.00	1.12	1.38	41.8
11	T1	220	7.0	0.688	43.9	LOS D	7.8	58.1	1.00	1.29	1.78	35.7
12	R2	1	7.0	0.688	49.0	LOS D	7.8	58.1	1.00	1.29	1.78	35.7
12u	U	1	7.0	0.688	51.2	LOS E	7.8	58.1	1.00	1.29	1.78	36.2
Approach		480	7.0	0.688	34.2	LOS C	7.8	58.1	1.00	1.20	1.56	38.7
All Vehicles		4098	7.0	0.732	11.5	LOS B	7.9	58.7	0.55	0.74	0.69	50.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [2025 BG GR+BG DEV+REZ-ULT-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.163	40.0	LOS D	0.8	5.9	0.96	0.69	0.96	36.7
2	T1	13	7.0	0.163	34.3	LOS C	0.8	5.9	0.96	0.69	0.96	37.5
3	R2	9	7.0	0.163	40.0	LOS D	0.8	5.9	0.96	0.69	0.96	37.1
Approach		23	7.0	0.163	36.9	LOS D	0.8	5.9	0.96	0.69	0.96	37.3
East: Manning River Drive (e)												
4	L2	18	7.0	0.147	16.3	LOS B	2.6	19.1	0.58	0.51	0.58	49.2
5	T1	119	7.0	0.147	10.7	LOS B	2.6	19.1	0.58	0.51	0.58	50.6
6	R2	1636	7.0	0.650	20.0	LOS C	15.0	111.3	0.79	0.81	0.79	44.8
Approach		1773	7.0	0.650	19.4	LOS B	15.0	111.3	0.77	0.79	0.77	45.2
North: Manning River Drive (n)												
7	L2	631	7.0	0.354	17.8	LOS B	6.7	49.8	0.66	0.75	0.66	45.9
8	T1	37	7.0	0.222	34.3	LOS C	1.3	9.3	0.97	0.70	0.97	38.5
9	R2	80	7.0	0.506	41.4	LOS D	2.8	21.0	1.00	0.76	1.00	35.4
Approach		747	7.0	0.506	21.1	LOS C	6.7	49.8	0.71	0.75	0.71	44.1
West: The Bucketts Way												
10	L2	236	7.0	0.321	11.5	LOS B	3.6	26.6	0.56	0.72	0.56	49.7
11	T1	157	7.0	0.490	29.5	LOS C	5.2	38.8	0.95	0.77	0.95	40.6
12	R2	5	7.0	0.490	35.0	LOS D	5.2	38.8	0.95	0.77	0.95	39.5
Approach		398	7.0	0.490	18.9	LOS B	5.2	38.8	0.72	0.74	0.72	45.5
All Vehicles		2941	7.0	0.650	19.9	LOS B	15.0	111.3	0.75	0.77	0.75	44.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	12.6	LOS B	0.1	0.1	0.60	0.60
P3	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		158	23.8	LOS C			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101v [2025 BG GR+BG DEV+REZ-ULT-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 70 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.245	40.1	LOS D	1.4	10.1	0.97	0.71	0.97	37.0
2	T1	28	7.0	0.245	34.4	LOS C	1.4	10.1	0.97	0.71	0.97	37.8
3	R2	9	7.0	0.245	40.1	LOS D	1.4	10.1	0.97	0.71	0.97	37.4
Approach		40	7.0	0.245	36.1	LOS D	1.4	10.1	0.97	0.71	0.97	37.7
East: Manning River Drive (e)												
4	L2	19	7.0	0.332	28.9	LOS C	4.7	34.6	0.86	0.71	0.86	42.2
5	T1	145	7.0	0.332	23.3	LOS C	4.7	34.6	0.86	0.71	0.86	43.3
6	R2	951	7.0	0.704	32.4	LOS C	10.9	81.1	0.95	0.86	1.00	38.9
Approach		1115	7.0	0.704	31.2	LOS C	10.9	81.1	0.94	0.83	0.98	39.5
North: Manning River Drive (n)												
7	L2	1417	7.0	0.796	25.2	LOS C	22.4	166.1	0.90	0.90	0.99	42.0
8	T1	27	7.0	0.099	29.0	LOS C	0.8	6.2	0.90	0.65	0.90	40.8
9	R2	182	7.0	0.695	39.4	LOS D	6.5	47.9	1.00	0.87	1.13	36.1
Approach		1626	7.0	0.796	26.8	LOS C	22.4	166.1	0.91	0.90	1.00	41.2
West: The Bucketts Way												
10	L2	109	7.0	0.098	8.8	LOS A	1.1	8.0	0.39	0.65	0.39	51.6
11	T1	81	7.0	0.248	28.0	LOS C	2.5	18.7	0.90	0.70	0.90	41.3
12	R2	1	7.0	0.248	33.6	LOS C	2.5	18.7	0.90	0.70	0.90	40.2
Approach		192	7.0	0.248	17.0	LOS B	2.5	18.7	0.61	0.67	0.61	46.6
All Vehicles		2973	7.0	0.796	27.9	LOS C	22.4	166.1	0.90	0.86	0.97	40.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	24.1	LOS C	0.1	0.1	0.83	0.83
P3	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		158	27.6	LOS C			0.89	0.89

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101v [2030 BG GR+BG DEV+REZ-ULT-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 70 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	1	7.0	0.124	36.1	LOS D	0.8	6.2	0.92	0.68	0.92	38.3
2	T1	16	7.0	0.124	30.5	LOS C	0.8	6.2	0.92	0.68	0.92	39.2
3	R2	9	7.0	0.124	36.2	LOS D	0.8	6.2	0.92	0.68	0.92	38.7
Approach		26	7.0	0.124	32.8	LOS C	0.8	6.2	0.92	0.68	0.92	38.9
East: Manning River Drive (e)												
4	L2	18	7.0	0.246	18.8	LOS B	4.5	33.3	0.66	0.57	0.66	47.8
5	T1	192	7.0	0.246	13.2	LOS B	4.5	33.3	0.66	0.57	0.66	49.2
6	R2	1698	7.0	0.752	24.0	LOS C	18.5	136.9	0.87	0.86	0.91	42.7
Approach		1907	7.0	0.752	22.9	LOS C	18.5	136.9	0.85	0.83	0.88	43.3
North: Manning River Drive (n)												
7	L2	622	7.0	0.383	19.9	LOS B	7.2	53.3	0.71	0.77	0.71	44.7
8	T1	41	7.0	0.165	30.5	LOS C	1.3	9.7	0.92	0.68	0.92	40.1
9	R2	161	7.0	0.756	42.1	LOS D	6.0	44.4	1.00	0.91	1.25	35.2
Approach		824	7.0	0.756	24.7	LOS C	7.2	53.3	0.78	0.79	0.83	42.2
West: The Bucketts Way												
10	L2	296	7.0	0.387	12.7	LOS B	5.0	37.2	0.62	0.74	0.62	48.9
11	T1	182	7.0	0.566	29.9	LOS C	6.1	45.5	0.97	0.79	0.97	40.4
12	R2	5	7.0	0.566	35.5	LOS D	6.1	45.5	0.97	0.79	0.97	39.3
Approach		483	7.0	0.566	19.5	LOS B	6.1	45.5	0.75	0.76	0.75	45.2
All Vehicles		3241	7.0	0.756	22.9	LOS C	18.5	136.9	0.82	0.81	0.85	43.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	14.5	LOS B	0.1	0.1	0.64	0.64
P3	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		158	24.4	LOS C			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101v [2030 BG GR+BG DEV+REZ-ULT-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 70 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	3	7.0	0.277	40.2	LOS D	1.6	11.5	0.97	0.72	0.97	37.0
2	T1	33	7.0	0.277	34.6	LOS C	1.6	11.5	0.97	0.72	0.97	37.8
3	R2	9	7.0	0.277	40.3	LOS D	1.6	11.5	0.97	0.72	0.97	37.4
Approach		45	7.0	0.277	36.2	LOS D	1.6	11.5	0.97	0.72	0.97	37.6
East: Manning River Drive (e)												
4	L2	20	7.0	0.429	31.2	LOS C	5.7	42.1	0.90	0.74	0.90	41.2
5	T1	168	7.0	0.429	25.6	LOS C	5.7	42.1	0.90	0.74	0.90	42.1
6	R2	967	7.0	0.806	37.2	LOS D	12.4	92.0	0.99	0.93	1.17	37.1
Approach		1156	7.0	0.806	35.4	LOS D	12.4	92.0	0.98	0.90	1.12	37.8
North: Manning River Drive (n)												
7	L2	1472	7.0	0.826	27.5	LOS C	24.9	184.6	0.93	0.93	1.05	40.9
8	T1	33	7.0	0.098	27.0	LOS C	1.0	7.2	0.87	0.64	0.87	41.7
9	R2	251	7.0	0.797	40.8	LOS D	9.3	69.1	1.00	0.94	1.25	35.6
Approach		1755	7.0	0.826	29.4	LOS C	24.9	184.6	0.94	0.93	1.08	40.1
West: The Bucketts Way												
10	L2	188	7.0	0.165	9.3	LOS A	2.1	15.3	0.42	0.66	0.42	51.2
11	T1	148	7.0	0.451	29.2	LOS C	4.8	35.5	0.94	0.76	0.94	40.7
12	R2	1	7.0	0.451	34.8	LOS C	4.8	35.5	0.94	0.76	0.94	39.7
Approach		338	7.0	0.451	18.1	LOS B	4.8	35.5	0.65	0.70	0.65	46.0
All Vehicles		3294	7.0	0.826	30.4	LOS C	24.9	184.6	0.92	0.89	1.05	39.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	25.8	LOS C	0.1	0.1	0.86	0.86
P3	North Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
P4	West Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		158	28.1	LOS C			0.90	0.90

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101v [2040 BG GR+BG DEV+REZ-ULT-AM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Unnamed Road (to Purfleet)												
1	L2	2	7.0	0.114	46.6	LOS D	1.5	11.4	0.87	0.68	0.87	34.5
2	T1	20	7.0	0.114	41.0	LOS D	1.5	11.4	0.87	0.68	0.87	35.2
3	R2	12	7.0	0.114	46.7	LOS D	1.5	11.4	0.87	0.68	0.87	34.8
Approach		34	7.0	0.114	43.3	LOS D	1.5	11.4	0.87	0.68	0.87	35.0
East: Manning River Drive (e)												
4	L2	21	7.0	0.282	22.6	LOS C	8.4	62.0	0.62	0.55	0.62	45.6
5	T1	251	7.0	0.282	17.0	LOS B	8.4	62.0	0.62	0.55	0.62	46.8
6	R2	2017	7.0	0.822	31.4	LOS C	35.9	266.2	0.87	0.87	0.90	39.4
Approach		2288	7.0	0.822	29.8	LOS C	35.9	266.2	0.84	0.84	0.87	40.1
North: Manning River Drive (n)												
7	L2	753	7.0	0.411	24.1	LOS C	12.6	93.3	0.67	0.77	0.67	42.5
8	T1	48	7.0	0.138	41.0	LOS D	2.2	16.3	0.87	0.66	0.87	36.0
9	R2	215	7.0	0.826	61.0	LOS E	12.5	93.0	1.00	0.94	1.24	29.8
Approach		1016	7.0	0.826	32.7	LOS C	12.6	93.3	0.75	0.80	0.80	38.7
West: The Bucketts Way												
10	L2	361	7.0	0.508	20.8	LOS C	11.9	88.6	0.72	0.79	0.72	44.1
11	T1	224	7.0	0.773	52.1	LOS D	12.7	94.4	1.00	0.91	1.13	32.5
12	R2	6	7.0	0.773	57.7	LOS E	12.7	94.4	1.00	0.91	1.13	31.8
Approach		592	7.0	0.773	33.1	LOS C	12.7	94.4	0.83	0.83	0.88	38.7
All Vehicles		3929	7.0	0.826	31.1	LOS C	35.9	266.2	0.82	0.82	0.85	39.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	17.0	LOS B	0.1	0.1	0.56	0.56
P3	North Full Crossing	53	49.3	LOS E	0.2	0.2	0.95	0.95
P4	West Full Crossing	53	42.0	LOS E	0.1	0.1	0.87	0.87
All Pedestrians		158	36.1	LOS D			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: INT1 [2040 BG GR+BG DEV+REZ-ULT-PM+]

Manning River Drive / The Bucketts Way
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 90 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Waang Djarii Way (South)												
1	L2	3	7.0	0.348	50.7	LOS D	2.3	16.9	0.98	0.73	0.98	33.5
2	T1	38	7.0	0.348	45.0	LOS D	2.3	16.9	0.98	0.73	0.98	34.2
3	R2	11	7.0	0.348	50.7	LOS D	2.3	16.9	0.98	0.73	0.98	33.8
Approach		52	7.0	0.348	46.5	LOS D	2.3	16.9	0.98	0.73	0.98	34.1
East: Manning River Drive (East)												
4	L2	23	7.0	0.432	34.7	LOS C	8.4	62.3	0.87	0.73	0.87	39.7
5	T1	207	7.0	0.432	29.0	LOS C	8.4	62.3	0.87	0.73	0.87	40.6
6	R2	1144	7.0	0.818	42.2	LOS D	19.0	141.3	0.98	0.92	1.10	35.3
Approach		1375	7.0	0.818	40.1	LOS D	19.0	141.3	0.96	0.88	1.06	36.1
North: Manning River Drive (North)												
7	L2	1799	7.0	0.892	36.1	LOS D	43.2	320.6	0.95	0.98	1.11	37.4
8	T1	40	7.0	0.098	31.0	LOS C	1.4	10.6	0.84	0.63	0.84	39.9
9	R2	324	7.0	0.838	49.5	LOS D	15.5	115.2	1.00	0.96	1.23	32.8
Approach		2163	7.0	0.892	38.0	LOS D	43.2	320.6	0.95	0.97	1.13	36.7
West: The Bucketts Way (West)												
10	L2	258	7.0	0.233	11.1	LOS B	4.2	30.8	0.45	0.68	0.45	50.0
11	T1	220	7.0	0.686	40.1	LOS D	9.6	71.4	0.99	0.85	1.05	36.4
12	R2	1	7.0	0.686	45.7	LOS D	9.6	71.4	0.99	0.85	1.05	35.5
Approach		479	7.0	0.686	24.5	LOS C	9.6	71.4	0.70	0.76	0.73	42.6
All Vehicles		4068	7.0	0.892	37.2	LOS D	43.2	320.6	0.93	0.91	1.06	37.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	28.1	LOS C	0.1	0.1	0.79	0.79
P3	North Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
P4	West Full Crossing	53	39.3	LOS D	0.1	0.1	0.94	0.94
All Pedestrians		158	35.5	LOS D			0.89	0.89

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

APPENDIX G

SIDRA Assessment Outputs
Biripi Way / Manning River Drive

MOVEMENT SUMMARY

Site: INT4 [2018 EX-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Manning River Drive (s)												
1	L2	1	7.0	0.466	4.4	LOS A	2.7	20.3	0.14	0.39	0.14	52.0
2	T1	1344	7.0	0.502	4.4	LOS A	3.1	23.0	0.14	0.40	0.14	56.1
3	R2	20	7.0	0.502	9.0	LOS A	3.1	23.0	0.13	0.40	0.13	41.9
3u	U	3	7.0	0.502	11.1	LOS B	3.1	23.0	0.13	0.40	0.13	56.9
Approach		1368	7.0	0.502	4.4	LOS A	3.1	23.0	0.14	0.40	0.14	55.9
East: Holden Dealership Access												
4	L2	1	7.0	0.012	4.3	LOS A	0.0	0.3	0.44	0.67	0.44	47.2
5	T1	1	7.0	0.012	4.8	LOS A	0.0	0.3	0.44	0.67	0.44	42.1
6	R2	7	7.0	0.012	9.0	LOS A	0.0	0.3	0.44	0.67	0.44	49.4
6u	U	1	7.0	0.012	11.2	LOS B	0.0	0.3	0.44	0.67	0.44	17.4
Approach		11	7.0	0.012	8.4	LOS A	0.0	0.3	0.44	0.67	0.44	46.2
North: Manning River Drive (n)												
7	L2	16	7.0	0.205	4.3	LOS A	0.9	6.4	0.10	0.40	0.10	39.9
8	T1	532	7.0	0.205	4.3	LOS A	0.9	6.4	0.11	0.41	0.11	56.2
9	R2	1	7.0	0.205	9.0	LOS A	0.9	6.4	0.11	0.42	0.11	54.0
9u	U	13	7.0	0.205	11.1	LOS B	0.9	6.4	0.11	0.42	0.11	57.1
Approach		561	7.0	0.205	4.5	LOS A	0.9	6.4	0.11	0.41	0.11	55.8
West: Biripi Way												
10	L2	2	7.0	0.004	7.5	LOS A	0.0	0.1	0.62	0.61	0.62	50.1
11	T1	1	7.0	0.004	7.5	LOS A	0.0	0.1	0.62	0.61	0.62	40.0
12	R2	1	7.0	0.004	13.2	LOS B	0.0	0.1	0.63	0.71	0.63	46.2
12u	U	1	7.0	0.004	15.4	LOS B	0.0	0.1	0.63	0.71	0.63	42.2
Approach		5	7.0	0.004	10.2	LOS B	0.0	0.1	0.62	0.65	0.62	46.6
All Vehicles		1945	7.0	0.502	4.5	LOS A	3.1	23.0	0.13	0.40	0.13	55.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2018 EX-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	1	7.0	0.278	4.4	LOS A	1.3	9.8	0.14	0.40	0.14	52.0
2	T1	773	7.0	0.300	4.4	LOS A	1.5	10.9	0.14	0.40	0.14	56.1
3	R2	9	7.0	0.300	9.0	LOS A	1.5	10.9	0.14	0.41	0.14	41.9
3u	U	1	7.0	0.300	11.1	LOS B	1.5	10.9	0.14	0.41	0.14	56.9
Approach		784	7.0	0.300	4.4	LOS A	1.5	10.9	0.14	0.40	0.14	55.9
East: Holden Dealership Access												
4	L2	6	7.0	0.031	6.4	LOS A	0.1	0.8	0.60	0.78	0.60	45.8
5	T1	1	7.0	0.031	6.9	LOS A	0.1	0.8	0.60	0.78	0.60	40.0
6	R2	12	7.0	0.031	11.2	LOS B	0.1	0.8	0.60	0.78	0.60	47.9
6u	U	1	7.0	0.031	13.3	LOS B	0.1	0.8	0.60	0.78	0.60	16.1
Approach		20	7.0	0.031	9.6	LOS A	0.1	0.8	0.60	0.78	0.60	45.7
North: Manning River Drive (n)												
7	L2	7	7.0	0.443	4.3	LOS A	2.4	18.1	0.09	0.39	0.09	40.0
8	T1	1253	7.0	0.443	4.3	LOS A	2.5	18.2	0.09	0.40	0.09	56.3
9	R2	1	7.0	0.443	9.0	LOS A	2.5	18.2	0.10	0.41	0.10	54.2
9u	U	20	7.0	0.443	11.1	LOS B	2.5	18.2	0.10	0.41	0.10	57.2
Approach		1281	7.0	0.443	4.4	LOS A	2.5	18.2	0.09	0.40	0.09	56.2
West: Biripi Way												
10	L2	1	7.0	0.002	6.1	LOS A	0.0	0.1	0.49	0.52	0.49	51.0
11	T1	1	7.0	0.002	6.1	LOS A	0.0	0.1	0.49	0.52	0.49	41.5
12	R2	1	7.0	0.003	11.1	LOS B	0.0	0.1	0.51	0.66	0.51	47.9
12u	U	1	7.0	0.003	13.2	LOS B	0.0	0.1	0.51	0.66	0.51	44.3
Approach		4	7.0	0.003	9.1	LOS A	0.0	0.1	0.50	0.59	0.50	47.1
All Vehicles		2089	7.0	0.443	4.5	LOS A	2.5	18.2	0.12	0.41	0.12	56.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	57	7.0	0.543	4.7	LOS A	3.5	25.7	0.26	0.43	0.26	51.3
2	T1	1425	7.0	0.585	4.6	LOS A	4.0	29.5	0.26	0.43	0.26	55.4
3	R2	20	7.0	0.585	9.2	LOS A	4.0	29.5	0.26	0.43	0.26	41.3
3u	U	3	7.0	0.585	11.4	LOS B	4.0	29.5	0.26	0.43	0.26	56.3
Approach		1505	7.0	0.585	4.7	LOS A	4.0	29.5	0.26	0.43	0.26	55.2
East: Holden Dealership Access												
4	L2	1	7.0	0.013	4.5	LOS A	0.0	0.3	0.47	0.68	0.47	47.0
5	T1	1	7.0	0.013	5.0	LOS A	0.0	0.3	0.47	0.68	0.47	41.8
6	R2	7	7.0	0.013	9.3	LOS A	0.0	0.3	0.47	0.68	0.47	49.1
6u	U	1	7.0	0.013	11.4	LOS B	0.0	0.3	0.47	0.68	0.47	17.3
Approach		11	7.0	0.013	8.6	LOS A	0.0	0.3	0.47	0.68	0.47	46.0
North: Manning River Drive (n)												
7	L2	16	7.0	0.236	4.4	LOS A	1.1	8.0	0.14	0.40	0.14	39.7
8	T1	563	7.0	0.236	4.4	LOS A	1.1	8.0	0.15	0.43	0.15	55.8
9	R2	39	7.0	0.236	9.0	LOS A	1.1	8.0	0.15	0.46	0.15	53.2
9u	U	14	7.0	0.236	11.2	LOS B	1.1	8.0	0.15	0.46	0.15	56.4
Approach		632	7.0	0.236	4.8	LOS A	1.1	8.0	0.15	0.43	0.15	55.3
West: Biripi Way												
10	L2	12	7.0	0.023	9.2	LOS A	0.1	0.7	0.67	0.75	0.67	48.7
11	T1	1	7.0	0.023	9.2	LOS A	0.1	0.7	0.67	0.75	0.67	37.6
12	R2	15	7.0	0.022	12.7	LOS B	0.1	0.7	0.67	0.78	0.67	47.3
12u	U	1	7.0	0.022	14.8	LOS B	0.1	0.7	0.67	0.78	0.67	43.4
Approach		28	7.0	0.023	11.2	LOS B	0.1	0.7	0.67	0.77	0.67	47.6
All Vehicles		2176	7.0	0.585	4.8	LOS A	4.0	29.5	0.24	0.43	0.24	55.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total	HV				Vehicles	Distance				
		veh/h	%	v/c	sec		veh	m				km/h
South: Manning River Drive (s)												
1	L2	11	7.0	0.301	4.4	LOS A	1.5	10.8	0.16	0.40	0.16	51.9
2	T1	819	7.0	0.325	4.4	LOS A	1.6	12.0	0.16	0.41	0.16	56.0
3	R2	9	7.0	0.325	9.0	LOS A	1.6	12.0	0.16	0.41	0.16	41.8
3u	U	1	7.0	0.325	11.2	LOS B	1.6	12.0	0.16	0.41	0.16	56.8
Approach		840	7.0	0.325	4.5	LOS A	1.6	12.0	0.16	0.41	0.16	55.8
East: Holden Dealership Access												
4	L2	6	7.0	0.034	6.7	LOS A	0.1	1.0	0.64	0.81	0.64	45.5
5	T1	1	7.0	0.034	7.2	LOS A	0.1	1.0	0.64	0.81	0.64	39.6
6	R2	12	7.0	0.034	11.5	LOS B	0.1	1.0	0.64	0.81	0.64	47.6
6u	U	1	7.0	0.034	13.6	LOS B	0.1	1.0	0.64	0.81	0.64	15.9
Approach		20	7.0	0.034	9.9	LOS A	0.1	1.0	0.64	0.81	0.64	45.4
North: Manning River Drive (n)												
7	L2	7	7.0	0.509	4.5	LOS A	3.4	25.0	0.24	0.41	0.24	39.3
8	T1	1327	7.0	0.509	4.5	LOS A	3.4	25.0	0.25	0.42	0.25	55.5
9	R2	7	7.0	0.509	9.2	LOS A	3.3	24.8	0.25	0.43	0.25	53.2
9u	U	21	7.0	0.509	11.3	LOS B	3.3	24.8	0.25	0.43	0.25	56.4
Approach		1363	7.0	0.509	4.7	LOS A	3.4	25.0	0.25	0.42	0.25	55.4
West: Biripi Way												
10	L2	28	7.0	0.039	7.0	LOS A	0.1	1.1	0.54	0.68	0.54	50.7
11	T1	1	7.0	0.039	7.0	LOS A	0.1	1.1	0.54	0.68	0.54	40.8
12	R2	42	7.0	0.047	11.0	LOS B	0.2	1.3	0.52	0.75	0.52	48.6
12u	U	1	7.0	0.047	13.2	LOS B	0.2	1.3	0.52	0.75	0.52	45.1
Approach		73	7.0	0.047	9.4	LOS A	0.2	1.3	0.53	0.72	0.53	49.3
All Vehicles		2296	7.0	0.509	4.8	LOS A	3.4	25.0	0.23	0.43	0.23	55.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	57	7.0	0.584	4.7	LOS A	4.0	29.4	0.28	0.43	0.28	51.2
2	T1	1542	7.0	0.629	4.7	LOS A	4.6	34.1	0.28	0.43	0.28	55.4
3	R2	20	7.0	0.629	9.3	LOS A	4.6	34.1	0.28	0.43	0.28	41.2
3u	U	3	7.0	0.629	11.4	LOS B	4.6	34.1	0.28	0.43	0.28	56.2
Approach		1622	7.0	0.629	4.7	LOS A	4.6	34.1	0.28	0.43	0.28	55.1
East: Holden Dealership Access												
4	L2	1	7.0	0.013	4.7	LOS A	0.0	0.3	0.48	0.69	0.48	46.9
5	T1	1	7.0	0.013	5.1	LOS A	0.0	0.3	0.48	0.69	0.48	41.6
6	R2	7	7.0	0.013	9.4	LOS A	0.0	0.3	0.48	0.69	0.48	49.0
6u	U	1	7.0	0.013	11.5	LOS B	0.0	0.3	0.48	0.69	0.48	17.2
Approach		11	7.0	0.013	8.7	LOS A	0.0	0.3	0.48	0.69	0.48	45.8
North: Manning River Drive (n)												
7	L2	16	7.0	0.253	4.4	LOS A	1.2	8.8	0.15	0.40	0.15	39.7
8	T1	609	7.0	0.253	4.4	LOS A	1.2	8.8	0.15	0.42	0.15	55.8
9	R2	39	7.0	0.253	9.0	LOS A	1.2	8.7	0.15	0.45	0.15	53.3
9u	U	14	7.0	0.253	11.2	LOS B	1.2	8.7	0.15	0.45	0.15	56.5
Approach		678	7.0	0.253	4.8	LOS A	1.2	8.8	0.15	0.43	0.15	55.4
West: Biripi Way												
10	L2	12	7.0	0.025	9.9	LOS A	0.1	0.8	0.70	0.77	0.70	48.1
11	T1	1	7.0	0.025	9.9	LOS A	0.1	0.8	0.70	0.77	0.70	36.7
12	R2	15	7.0	0.023	13.1	LOS B	0.1	0.8	0.70	0.79	0.70	46.9
12u	U	1	7.0	0.023	15.3	LOS B	0.1	0.8	0.70	0.79	0.70	42.9
Approach		28	7.0	0.025	11.8	LOS B	0.1	0.8	0.70	0.78	0.70	47.1
All Vehicles		2339	7.0	0.629	4.8	LOS A	4.6	34.1	0.25	0.43	0.25	55.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2021 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	11	7.0	0.342	4.4	LOS A	1.7	12.8	0.17	0.41	0.17	51.8
2	T1	937	7.0	0.368	4.4	LOS A	1.9	14.3	0.17	0.41	0.17	55.9
3	R2	9	7.0	0.368	9.1	LOS A	1.9	14.3	0.17	0.41	0.17	41.8
3u	U	1	7.0	0.368	11.2	LOS B	1.9	14.3	0.17	0.41	0.17	56.8
Approach		958	7.0	0.368	4.5	LOS A	1.9	14.3	0.17	0.41	0.17	55.8
East: Holden Dealership Access												
4	L2	6	7.0	0.035	6.9	LOS A	0.1	1.0	0.65	0.82	0.65	45.3
5	T1	1	7.0	0.035	7.4	LOS A	0.1	1.0	0.65	0.82	0.65	39.4
6	R2	12	7.0	0.035	11.6	LOS B	0.1	1.0	0.65	0.82	0.65	47.4
6u	U	1	7.0	0.035	13.8	LOS B	0.1	1.0	0.65	0.82	0.65	15.9
Approach		20	7.0	0.035	10.0	LOS B	0.1	1.0	0.65	0.82	0.65	45.2
North: Manning River Drive (n)												
7	L2	7	7.0	0.526	4.5	LOS A	3.6	26.7	0.25	0.41	0.25	39.2
8	T1	1375	7.0	0.526	4.5	LOS A	3.6	26.7	0.26	0.42	0.26	55.4
9	R2	7	7.0	0.526	9.2	LOS A	3.6	26.5	0.26	0.43	0.26	53.1
9u	U	21	7.0	0.526	11.4	LOS B	3.6	26.5	0.26	0.43	0.26	56.4
Approach		1411	7.0	0.526	4.7	LOS A	3.6	26.7	0.26	0.42	0.26	55.4
West: Biripi Way												
10	L2	28	7.0	0.041	7.4	LOS A	0.2	1.1	0.56	0.71	0.56	50.3
11	T1	1	7.0	0.041	7.4	LOS A	0.2	1.1	0.56	0.71	0.56	40.2
12	R2	42	7.0	0.048	11.3	LOS B	0.2	1.4	0.55	0.76	0.55	48.5
12u	U	1	7.0	0.048	13.4	LOS B	0.2	1.4	0.55	0.76	0.55	45.0
Approach		73	7.0	0.048	9.7	LOS A	0.2	1.4	0.55	0.74	0.55	49.1
All Vehicles		2461	7.0	0.526	4.8	LOS A	3.6	26.7	0.23	0.43	0.23	55.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2025 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	152	7.0	0.711	5.4	LOS A	5.9	43.8	0.51	0.52	0.51	49.9
2	T1	1664	7.0	0.766	5.4	LOS A	7.1	52.9	0.52	0.52	0.52	54.2
3	R2	20	7.0	0.766	10.0	LOS A	7.1	52.9	0.53	0.51	0.53	40.0
3u	U	3	7.0	0.766	12.1	LOS B	7.1	52.9	0.53	0.51	0.53	54.9
Approach		1839	7.0	0.766	5.4	LOS A	7.1	52.9	0.52	0.52	0.52	53.8
East: Holden Dealership Access												
4	L2	1	7.0	0.014	5.2	LOS A	0.1	0.4	0.53	0.72	0.53	46.4
5	T1	1	7.0	0.014	5.6	LOS A	0.1	0.4	0.53	0.72	0.53	40.9
6	R2	7	7.0	0.014	9.9	LOS A	0.1	0.4	0.53	0.72	0.53	48.5
6u	U	1	7.0	0.014	12.0	LOS B	0.1	0.4	0.53	0.72	0.53	17.0
Approach		11	7.0	0.014	9.2	LOS A	0.1	0.4	0.53	0.72	0.53	45.3
North: Manning River Drive (n)												
7	L2	16	7.0	0.326	4.5	LOS A	1.7	13.0	0.22	0.42	0.22	39.4
8	T1	711	7.0	0.326	4.5	LOS A	1.7	13.0	0.22	0.45	0.22	55.3
9	R2	103	7.0	0.326	9.2	LOS A	1.7	12.8	0.23	0.49	0.23	52.3
9u	U	15	7.0	0.326	11.3	LOS B	1.7	12.8	0.23	0.49	0.23	55.7
Approach		844	7.0	0.326	5.2	LOS A	1.7	13.0	0.22	0.45	0.22	54.7
West: Biripi Way												
10	L2	27	7.0	0.073	11.4	LOS B	0.3	2.4	0.78	0.89	0.78	46.8
11	T1	1	7.0	0.073	11.4	LOS B	0.3	2.4	0.78	0.89	0.78	34.7
12	R2	39	7.0	0.074	14.3	LOS B	0.4	2.8	0.80	0.89	0.80	46.0
12u	U	1	7.0	0.074	16.5	LOS B	0.4	2.8	0.80	0.89	0.80	41.8
Approach		68	7.0	0.074	13.2	LOS B	0.4	2.8	0.79	0.89	0.79	46.2
All Vehicles		2762	7.0	0.766	5.6	LOS A	7.1	52.9	0.44	0.51	0.44	53.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2025 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	95% Back of Queue Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Manning River Drive (s)												
1	L2	35	7.0	0.403	4.6	LOS A	2.3	17.2	0.24	0.42	0.24	51.4
2	T1	1057	7.0	0.435	4.5	LOS A	2.6	19.5	0.24	0.42	0.24	55.6
3	R2	9	7.0	0.435	9.2	LOS A	2.6	19.5	0.23	0.42	0.23	41.4
3u	U	1	7.0	0.435	11.3	LOS B	2.6	19.5	0.23	0.42	0.23	56.5
Approach		1102	7.0	0.435	4.6	LOS A	2.6	19.5	0.24	0.42	0.24	55.4
East: Holden Dealership Access												
4	L2	6	7.0	0.044	8.0	LOS A	0.2	1.4	0.73	0.87	0.73	44.2
5	T1	1	7.0	0.044	8.5	LOS A	0.2	1.4	0.73	0.87	0.73	37.9
6	R2	12	7.0	0.044	12.8	LOS B	0.2	1.4	0.73	0.87	0.73	46.3
6u	U	1	7.0	0.044	14.9	LOS B	0.2	1.4	0.73	0.87	0.73	15.3
Approach		20	7.0	0.044	11.2	LOS B	0.2	1.4	0.73	0.87	0.73	44.1
North: Manning River Drive (n)												
7	L2	7	7.0	0.643	5.2	LOS A	5.1	37.5	0.50	0.50	0.50	38.2
8	T1	1489	7.0	0.643	5.2	LOS A	5.1	37.5	0.51	0.52	0.51	54.2
9	R2	23	7.0	0.643	10.0	LOS A	5.0	37.0	0.52	0.53	0.52	51.5
9u	U	23	7.0	0.643	12.1	LOS B	5.0	37.0	0.52	0.53	0.52	55.1
Approach		1543	7.0	0.643	5.4	LOS A	5.1	37.5	0.51	0.52	0.51	54.1
West: Biripi Way												
10	L2	94	7.0	0.144	8.1	LOS A	0.6	4.2	0.63	0.81	0.63	49.6
11	T1	1	7.0	0.144	8.1	LOS A	0.6	4.2	0.63	0.81	0.63	39.0
12	R2	138	7.0	0.167	11.9	LOS B	0.7	5.2	0.62	0.86	0.62	48.0
12u	U	1	7.0	0.167	14.0	LOS B	0.7	5.2	0.62	0.86	0.62	44.4
Approach		234	7.0	0.167	10.4	LOS B	0.7	5.2	0.62	0.84	0.62	48.6
All Vehicles		2899	7.0	0.643	5.5	LOS A	5.1	37.5	0.42	0.51	0.42	54.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	163	7.0	0.726	5.5	LOS A	6.2	46.0	0.53	0.53	0.53	49.8
2	T1	1681	7.0	0.783	5.5	LOS A	7.6	56.0	0.55	0.53	0.55	54.1
3	R2	20	7.0	0.783	10.1	LOS B	7.6	56.0	0.56	0.52	0.56	39.8
3u	U	4	7.0	0.783	12.2	LOS B	7.6	56.0	0.56	0.52	0.56	54.7
Approach		1868	7.0	0.783	5.5	LOS A	7.6	56.0	0.55	0.53	0.55	53.7
East: Holden Dealership Access												
4	L2	1	7.0	0.015	5.2	LOS A	0.1	0.4	0.54	0.72	0.54	46.3
5	T1	1	7.0	0.015	5.7	LOS A	0.1	0.4	0.54	0.72	0.54	40.8
6	R2	7	7.0	0.015	9.9	LOS A	0.1	0.4	0.54	0.72	0.54	48.4
6u	U	1	7.0	0.015	12.1	LOS B	0.1	0.4	0.54	0.72	0.54	17.0
Approach		11	7.0	0.015	9.3	LOS A	0.1	0.4	0.54	0.72	0.54	45.3
North: Manning River Drive (n)												
7	L2	16	7.0	0.333	4.5	LOS A	1.8	13.4	0.24	0.42	0.24	39.3
8	T1	717	7.0	0.333	4.5	LOS A	1.8	13.4	0.24	0.45	0.24	55.2
9	R2	108	7.0	0.333	9.2	LOS A	1.8	13.3	0.24	0.50	0.24	52.2
9u	U	16	7.0	0.333	11.3	LOS B	1.8	13.3	0.24	0.50	0.24	55.6
Approach		857	7.0	0.333	5.2	LOS A	1.8	13.4	0.24	0.46	0.24	54.7
West: Biripi Way												
10	L2	29	7.0	0.081	11.7	LOS B	0.4	2.7	0.79	0.89	0.79	46.5
11	T1	1	7.0	0.081	11.7	LOS B	0.4	2.7	0.79	0.89	0.79	34.4
12	R2	44	7.0	0.087	14.5	LOS B	0.4	3.3	0.81	0.91	0.81	45.9
12u	U	1	7.0	0.087	16.7	LOS B	0.4	3.3	0.81	0.91	0.81	41.6
Approach		76	7.0	0.087	13.4	LOS B	0.4	3.3	0.80	0.90	0.80	46.0
All Vehicles		2812	7.0	0.783	5.7	LOS A	7.6	56.0	0.46	0.52	0.46	53.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	39	7.0	0.393	4.6	LOS A	2.3	16.9	0.25	0.42	0.25	51.4
2	T1	1014	7.0	0.423	4.5	LOS A	2.6	19.2	0.25	0.42	0.25	55.5
3	R2	9	7.0	0.423	9.2	LOS A	2.6	19.2	0.25	0.42	0.25	41.4
3u	U	1	7.0	0.423	11.3	LOS B	2.6	19.2	0.25	0.42	0.25	56.4
Approach		1063	7.0	0.423	4.6	LOS A	2.6	19.2	0.25	0.42	0.25	55.3
East: Holden Dealership Access												
4	L2	6	7.0	0.049	8.7	LOS A	0.2	1.6	0.76	0.89	0.76	43.6
5	T1	1	7.0	0.049	9.2	LOS A	0.2	1.6	0.76	0.89	0.76	37.0
6	R2	12	7.0	0.049	13.5	LOS B	0.2	1.6	0.76	0.89	0.76	45.6
6u	U	1	7.0	0.049	15.6	LOS B	0.2	1.6	0.76	0.89	0.76	15.0
Approach		20	7.0	0.049	11.9	LOS B	0.2	1.6	0.76	0.89	0.76	43.4
North: Manning River Drive (n)												
7	L2	7	7.0	0.696	5.5	LOS A	5.9	43.4	0.58	0.53	0.58	37.8
8	T1	1567	7.0	0.696	5.7	LOS A	6.0	44.4	0.59	0.56	0.60	53.8
9	R2	25	7.0	0.696	10.5	LOS B	6.0	44.4	0.60	0.59	0.62	51.1
9u	U	25	7.0	0.696	12.7	LOS B	6.0	44.4	0.60	0.59	0.62	54.6
Approach		1625	7.0	0.696	5.8	LOS A	6.0	44.4	0.59	0.56	0.60	53.7
West: Biripi Way												
10	L2	103	7.0	0.159	8.1	LOS A	0.6	4.7	0.63	0.81	0.63	49.7
11	T1	1	7.0	0.159	8.1	LOS A	0.6	4.7	0.63	0.81	0.63	39.0
12	R2	167	7.0	0.200	11.9	LOS B	0.9	6.4	0.62	0.87	0.62	48.1
12u	U	1	7.0	0.200	14.0	LOS B	0.9	6.4	0.62	0.87	0.62	44.4
Approach		273	7.0	0.200	10.4	LOS B	0.9	6.4	0.62	0.84	0.62	48.6
All Vehicles		2981	7.0	0.696	5.9	LOS A	6.0	44.4	0.47	0.54	0.48	53.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	163	7.0	0.828	9.2	LOS A	11.1	82.6	0.77	0.77	0.93	48.0
2	T1	1747	7.0	0.893	10.0	LOS A	15.8	117.5	0.82	0.80	1.02	52.1
3	R2	48	7.0	0.893	15.2	LOS B	15.8	117.5	0.85	0.82	1.08	37.6
3u	U	4	7.0	0.893	17.3	LOS B	15.8	117.5	0.85	0.82	1.08	52.3
Approach		1963	7.0	0.893	10.1	LOS B	15.8	117.5	0.81	0.80	1.01	51.5
East: Holden Dealership Access												
4	L2	15	7.0	0.166	6.0	LOS A	0.7	5.0	0.61	0.86	0.61	45.5
5	T1	1	7.0	0.166	6.4	LOS A	0.7	5.0	0.61	0.86	0.61	39.6
6	R2	97	7.0	0.166	10.7	LOS B	0.7	5.0	0.61	0.86	0.61	47.5
6u	U	1	7.0	0.166	12.8	LOS B	0.7	5.0	0.61	0.86	0.61	16.4
Approach		114	7.0	0.166	10.0	LOS B	0.7	5.0	0.61	0.86	0.61	47.0
North: Manning River Drive (n)												
7	L2	161	7.0	0.420	4.7	LOS A	2.4	17.7	0.30	0.46	0.30	39.0
8	T1	768	7.0	0.420	4.7	LOS A	2.4	17.7	0.30	0.48	0.30	54.9
9	R2	108	7.0	0.420	9.4	LOS A	2.4	17.6	0.31	0.51	0.31	52.1
9u	U	16	7.0	0.420	11.5	LOS B	2.4	17.6	0.31	0.51	0.31	55.5
Approach		1054	7.0	0.420	5.3	LOS A	2.4	17.7	0.30	0.48	0.30	52.6
West: Biripi Way												
10	L2	29	7.0	0.115	14.2	LOS B	0.6	4.2	0.86	0.93	0.86	44.6
11	T1	1	7.0	0.115	14.2	LOS B	0.6	4.2	0.86	0.93	0.86	31.7
12	R2	44	7.0	0.120	16.4	LOS B	0.7	5.0	0.90	0.96	0.90	44.4
12u	U	1	7.0	0.120	18.6	LOS B	0.7	5.0	0.90	0.96	0.90	39.9
Approach		76	7.0	0.120	15.6	LOS B	0.7	5.0	0.88	0.95	0.88	44.3
All Vehicles		3206	7.0	0.893	8.6	LOS A	15.8	117.5	0.64	0.70	0.76	51.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Manning River Drive (s)												
1	L2	39	7.0	0.523	5.6	LOS A	3.5	25.9	0.54	0.55	0.54	49.7
2	T1	1138	7.0	0.564	5.5	LOS A	4.1	30.1	0.54	0.54	0.54	54.1
3	R2	24	7.0	0.564	10.1	LOS B	4.1	30.1	0.55	0.54	0.55	39.9
3u	U	1	7.0	0.564	12.3	LOS B	4.1	30.1	0.55	0.54	0.55	54.8
Approach		1202	7.0	0.564	5.6	LOS A	4.1	30.1	0.54	0.54	0.54	53.7
East: Holden Dealership Access												
4	L2	33	7.0	0.509	13.4	LOS B	2.9	21.2	0.87	1.03	1.12	39.1
5	T1	1	7.0	0.509	13.9	LOS B	2.9	21.2	0.87	1.03	1.12	31.6
6	R2	160	7.0	0.509	18.2	LOS B	2.9	21.2	0.87	1.03	1.12	40.9
6u	U	1	7.0	0.509	20.3	LOS C	2.9	21.2	0.87	1.03	1.12	13.3
Approach		195	7.0	0.509	17.3	LOS B	2.9	21.2	0.87	1.03	1.12	40.5
North: Manning River Drive (n)												
7	L2	98	7.0	0.744	6.2	LOS A	7.4	54.6	0.65	0.62	0.68	37.6
8	T1	1562	7.0	0.744	6.4	LOS A	7.5	55.4	0.66	0.64	0.70	53.5
9	R2	25	7.0	0.744	11.3	LOS B	7.5	55.4	0.67	0.65	0.72	50.7
9u	U	25	7.0	0.744	13.4	LOS B	7.5	55.4	0.67	0.65	0.72	54.3
Approach		1711	7.0	0.744	6.5	LOS A	7.5	55.4	0.66	0.64	0.70	52.7
West: Biripi Way												
10	L2	103	7.0	0.210	9.7	LOS A	0.9	7.0	0.74	0.87	0.74	48.2
11	T1	1	7.0	0.210	9.7	LOS A	0.9	7.0	0.74	0.87	0.74	36.8
12	R2	167	7.0	0.255	13.1	LOS B	1.3	9.5	0.76	0.92	0.76	47.0
12u	U	1	7.0	0.255	15.3	LOS B	1.3	9.5	0.76	0.92	0.76	43.1
Approach		273	7.0	0.255	11.8	LOS B	1.3	9.5	0.75	0.90	0.75	47.4
All Vehicles		3380	7.0	0.744	7.3	LOS A	7.5	55.4	0.64	0.65	0.67	52.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	251	7.0	1.035	57.5	LOS E	56.2	417.1	1.00	2.10	3.48	25.4
2	T1	2032	7.0	1.116	94.8	LOS F	110.8	822.5	1.00	2.95	5.07	23.5
3	R2	54	7.0	1.116	124.0	LOS F	110.8	822.5	1.00	3.50	6.12	12.4
3u	U	4	7.0	1.116	126.1	LOS F	110.8	822.5	1.00	3.50	6.12	20.1
Approach		2340	7.0	1.116	91.5	LOS F	110.8	822.5	1.00	2.87	4.93	23.3
East: Holden Dealership Access												
4	L2	16	7.0	0.203	6.9	LOS A	0.9	6.4	0.69	0.89	0.69	44.5
5	T1	1	7.0	0.203	7.4	LOS A	0.9	6.4	0.69	0.89	0.69	38.4
6	R2	101	7.0	0.203	11.7	LOS B	0.9	6.4	0.69	0.89	0.69	46.6
6u	U	1	7.0	0.203	13.8	LOS B	0.9	6.4	0.69	0.89	0.69	15.9
Approach		119	7.0	0.203	11.0	LOS B	0.9	6.4	0.69	0.89	0.69	46.0
North: Manning River Drive (n)												
7	L2	179	7.0	0.531	4.9	LOS A	3.5	26.1	0.40	0.49	0.40	38.6
8	T1	923	7.0	0.531	5.0	LOS A	3.5	26.1	0.41	0.52	0.41	54.4
9	R2	167	7.0	0.531	9.7	LOS A	3.5	25.8	0.42	0.55	0.42	51.4
9u	U	18	7.0	0.531	11.8	LOS B	3.5	25.8	0.42	0.55	0.42	54.9
Approach		1287	7.0	0.531	5.7	LOS A	3.5	26.1	0.41	0.52	0.41	52.2
West: Biripi Way												
10	L2	49	7.0	0.257	18.2	LOS B	1.3	9.8	0.91	0.95	0.91	41.8
11	T1	1	7.0	0.257	18.2	LOS B	1.3	9.8	0.91	0.95	0.91	28.2
12	R2	79	7.0	0.279	20.0	LOS B	1.7	12.6	0.96	0.99	0.96	42.0
12u	U	1	7.0	0.279	22.1	LOS C	1.7	12.6	0.96	0.99	0.96	37.0
Approach		131	7.0	0.279	19.3	LOS B	1.7	12.6	0.94	0.97	0.94	41.8
All Vehicles		3877	7.0	1.116	58.1	LOS E	110.8	822.5	0.79	1.96	3.17	29.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Manning River Drive (s)												
1	L2	71	7.0	0.657	6.9	LOS A	5.7	42.4	0.67	0.69	0.73	49.0
2	T1	1358	7.0	0.708	6.9	LOS A	7.0	52.1	0.69	0.69	0.75	53.4
3	R2	25	7.0	0.708	11.6	LOS B	7.0	52.1	0.70	0.69	0.77	39.2
3u	U	1	7.0	0.708	13.7	LOS B	7.0	52.1	0.70	0.69	0.77	54.0
Approach		1455	7.0	0.708	7.0	LOS A	7.0	52.1	0.69	0.69	0.75	53.0
East: Holden Dealership Access												
4	L2	37	7.0	1.017	109.3	LOS F	15.0	111.0	1.00	1.80	3.58	13.9
5	T1	1	7.0	1.017	109.8	LOS F	15.0	111.0	1.00	1.80	3.58	8.7
6	R2	180	7.0	1.017	114.1	LOS F	15.0	111.0	1.00	1.80	3.58	14.5
6u	U	1	7.0	1.017	116.2	LOS F	15.0	111.0	1.00	1.80	3.58	3.9
Approach		219	7.0	1.017	113.3	LOS F	15.0	111.0	1.00	1.80	3.58	14.3
North: Manning River Drive (n)												
7	L2	102	7.0	0.995	30.9	LOS C	35.6	264.0	1.00	1.58	2.47	26.7
8	T1	1829	7.0	0.995	32.0	LOS C	35.6	264.0	1.00	1.60	2.50	39.6
9	R2	47	7.0	0.995	37.9	LOS D	34.2	253.7	1.00	1.62	2.55	34.6
9u	U	28	7.0	0.995	40.0	LOS D	34.2	253.7	1.00	1.62	2.55	39.8
Approach		2007	7.0	0.995	32.2	LOS C	35.6	264.0	1.00	1.60	2.50	38.9
West: Biripi Way												
10	L2	187	7.0	0.489	14.9	LOS B	2.8	20.6	0.86	1.00	1.09	44.1
11	T1	1	7.0	0.489	14.9	LOS B	2.8	20.6	0.86	1.00	1.09	31.1
12	R2	304	7.0	0.578	18.6	LOS B	4.1	30.1	0.91	1.08	1.23	42.9
12u	U	1	7.0	0.578	20.8	LOS C	4.1	30.1	0.91	1.08	1.23	38.0
Approach		494	7.0	0.578	17.2	LOS B	4.1	30.1	0.89	1.05	1.17	43.3
All Vehicles		4175	7.0	1.017	25.9	LOS C	35.6	264.0	0.88	1.23	1.79	41.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: INT4 [2030 BG GR+BG DEV-REZ-UP-AM+]

Manning River Drive / Biripi Way
Site Category: UNSIG.
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Manning River Drive (s)												
1	L2	163	7.0	0.175	5.8	LOS A	0.7	5.5	0.38	0.57	0.38	53.4
2	T1	1747	7.0	0.725	6.0	LOS A	6.5	47.9	0.58	0.60	0.60	54.0
3	R2	48	7.0	0.725	10.5	LOS B	6.5	47.9	0.58	0.59	0.60	39.1
3u	U	4	7.0	0.725	12.7	LOS B	6.5	47.9	0.58	0.59	0.60	54.8
Approach		1963	7.0	0.725	6.1	LOS A	6.5	47.9	0.56	0.59	0.58	53.6
East: Holden Dealership Access												
4	L2	15	7.0	0.168	5.3	LOS A	0.5	3.9	0.52	0.83	0.52	46.6
5	T1	1	7.0	0.168	5.7	LOS A	0.5	3.9	0.52	0.83	0.52	48.5
6	R2	97	7.0	0.168	10.0	LOS A	0.5	3.9	0.52	0.83	0.52	48.3
6u	U	1	7.0	0.168	12.1	LOS B	0.5	3.9	0.52	0.83	0.52	16.0
Approach		114	7.0	0.168	9.4	LOS A	0.5	3.9	0.52	0.83	0.52	47.8
North: Manning River Drive (n)												
7	L2	161	7.0	0.147	5.0	LOS A	0.6	4.5	0.24	0.50	0.24	49.2
8	T1	768	7.0	0.321	4.6	LOS A	1.6	12.0	0.25	0.46	0.25	55.3
9	R2	108	7.0	0.321	9.3	LOS A	1.6	11.8	0.26	0.51	0.26	54.5
9u	U	16	7.0	0.321	11.4	LOS B	1.6	11.8	0.26	0.51	0.26	55.5
Approach		1054	7.0	0.321	5.2	LOS A	1.6	12.0	0.25	0.47	0.25	54.6
West: Biripi Way												
10	L2	29	7.0	0.086	11.0	LOS B	0.3	2.5	0.77	0.88	0.77	50.1
11	T1	1	7.0	0.086	11.0	LOS B	0.3	2.5	0.77	0.88	0.77	44.3
12	R2	44	7.0	0.100	14.3	LOS B	0.4	3.2	0.75	0.92	0.75	49.3
12u	U	1	7.0	0.100	16.5	LOS B	0.4	3.2	0.75	0.92	0.75	50.2
Approach		76	7.0	0.100	13.0	LOS B	0.4	3.2	0.76	0.90	0.76	49.6
All Vehicles		3206	7.0	0.725	6.1	LOS A	6.5	47.9	0.46	0.57	0.48	53.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2030 BG GR+BG DEV-REZ-UP-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	39	7.0	0.043	5.5	LOS A	0.2	1.3	0.37	0.53	0.37	53.4
2	T1	1138	7.0	0.479	5.2	LOS A	3.2	24.0	0.48	0.51	0.48	54.5
3	R2	24	7.0	0.479	9.8	LOS A	3.2	24.0	0.47	0.50	0.47	39.6
3u	U	1	7.0	0.479	11.9	LOS B	3.2	24.0	0.47	0.50	0.47	55.4
Approach		1202	7.0	0.479	5.3	LOS A	3.2	24.0	0.47	0.51	0.47	54.2
East: Holden Dealership Access												
4	L2	33	7.0	0.475	10.8	LOS B	2.2	16.1	0.82	1.00	1.02	41.7
5	T1	1	7.0	0.475	11.3	LOS B	2.2	16.1	0.82	1.00	1.02	43.2
6	R2	160	7.0	0.475	15.5	LOS B	2.2	16.1	0.82	1.00	1.02	43.1
6u	U	1	7.0	0.475	17.7	LOS B	2.2	16.1	0.82	1.00	1.02	13.7
Approach		195	7.0	0.475	14.7	LOS B	2.2	16.1	0.82	1.00	1.02	42.7
North: Manning River Drive (n)												
7	L2	98	7.0	0.105	5.5	LOS A	0.4	3.2	0.35	0.55	0.35	48.6
8	T1	1562	7.0	0.623	5.3	LOS A	4.7	34.7	0.52	0.52	0.52	54.2
9	R2	25	7.0	0.623	10.1	LOS B	4.5	33.7	0.54	0.54	0.54	53.9
9u	U	25	7.0	0.623	12.2	LOS B	4.5	33.7	0.54	0.54	0.54	54.9
Approach		1711	7.0	0.623	5.4	LOS A	4.7	34.7	0.51	0.52	0.51	54.0
West: Biripi Way												
10	L2	103	7.0	0.194	8.1	LOS A	0.7	5.1	0.64	0.82	0.64	52.1
11	T1	1	7.0	0.194	8.1	LOS A	0.7	5.1	0.64	0.82	0.64	47.2
12	R2	167	7.0	0.255	12.1	LOS B	1.0	7.3	0.65	0.88	0.65	50.8
12u	U	1	7.0	0.255	14.2	LOS B	1.0	7.3	0.65	0.88	0.65	51.8
Approach		273	7.0	0.255	10.6	LOS B	1.0	7.3	0.64	0.85	0.64	51.3
All Vehicles		3380	7.0	0.623	6.3	LOS A	4.7	34.7	0.53	0.57	0.54	53.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-UP-AM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov	Turn	Demand Flows		Deg.	Average	Level of	95% Back of Queue		Prop.	Effective	Aver. No.	Average
ID		Total	HV	Satn	Delay	Service	Vehicles	Distance	Queued	Stop Rate	Cycles	Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Manning River Drive (s)												
1	L2	251	7.0	0.278	6.3	LOS A	1.3	9.7	0.46	0.62	0.46	53.1
2	T1	2032	7.0	0.877	9.8	LOS A	14.8	110.0	0.80	0.83	1.03	52.4
3	R2	54	7.0	0.877	14.7	LOS B	14.8	110.0	0.81	0.83	1.06	37.5
3u	U	4	7.0	0.877	16.8	LOS B	14.8	110.0	0.81	0.83	1.06	53.0
Approach		2340	7.0	0.877	9.6	LOS A	14.8	110.0	0.76	0.80	0.97	52.2
East: Holden Dealership Access												
4	L2	16	7.0	0.201	6.0	LOS A	0.7	5.0	0.59	0.86	0.59	45.9
5	T1	1	7.0	0.201	6.5	LOS A	0.7	5.0	0.59	0.86	0.59	47.7
6	R2	101	7.0	0.201	10.7	LOS B	0.7	5.0	0.59	0.86	0.59	47.5
6u	U	1	7.0	0.201	12.9	LOS B	0.7	5.0	0.59	0.86	0.59	15.7
Approach		119	7.0	0.201	10.1	LOS B	0.7	5.0	0.59	0.86	0.59	47.1
North: Manning River Drive (n)												
7	L2	179	7.0	0.175	5.2	LOS A	0.8	5.6	0.31	0.53	0.31	48.9
8	T1	923	7.0	0.412	4.7	LOS A	2.4	17.4	0.34	0.49	0.34	54.8
9	R2	167	7.0	0.412	9.5	LOS A	2.3	17.0	0.35	0.55	0.35	53.9
9u	U	18	7.0	0.412	11.6	LOS B	2.3	17.0	0.35	0.55	0.35	55.0
Approach		1287	7.0	0.412	5.5	LOS A	2.4	17.4	0.34	0.50	0.34	54.2
West: Biripi Way												
10	L2	49	7.0	0.212	14.2	LOS B	0.9	6.7	0.87	0.93	0.87	47.9
11	T1	1	7.0	0.212	14.2	LOS B	0.9	6.7	0.87	0.93	0.87	41.3
12	R2	79	7.0	0.252	16.9	LOS B	1.2	9.0	0.86	0.95	0.86	47.7
12u	U	1	7.0	0.252	19.1	LOS B	1.2	9.0	0.86	0.95	0.86	48.5
Approach		131	7.0	0.252	15.9	LOS B	1.2	9.0	0.86	0.94	0.86	47.8
All Vehicles		3877	7.0	0.877	8.5	LOS A	14.8	110.0	0.62	0.71	0.74	52.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [2040 BG GR+BG DEV-REZ-UP-PM+]

Manning River Drive / Biripi Way
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (s)												
1	L2	71	7.0	0.080	5.8	LOS A	0.4	2.6	0.42	0.57	0.42	53.3
2	T1	1358	7.0	0.590	5.6	LOS A	4.6	33.8	0.59	0.55	0.59	54.0
3	R2	25	7.0	0.590	10.1	LOS B	4.6	33.8	0.59	0.54	0.59	39.2
3u	U	1	7.0	0.590	12.3	LOS B	4.6	33.8	0.59	0.54	0.59	54.8
Approach		1455	7.0	0.590	5.7	LOS A	4.6	33.8	0.58	0.55	0.58	53.7
East: Holden Dealership Access												
4	L2	37	7.0	0.794	25.2	LOS C	4.8	35.6	0.96	1.18	1.64	32.6
5	T1	1	7.0	0.794	25.7	LOS C	4.8	35.6	0.96	1.18	1.64	33.5
6	R2	180	7.0	0.794	30.0	LOS C	4.8	35.6	0.96	1.18	1.64	33.4
6u	U	1	7.0	0.794	32.1	LOS C	4.8	35.6	0.96	1.18	1.64	10.0
Approach		219	7.0	0.794	29.2	LOS C	4.8	35.6	0.96	1.18	1.64	33.2
North: Manning River Drive (n)												
7	L2	102	7.0	0.120	6.1	LOS A	0.5	4.0	0.47	0.62	0.47	48.0
8	T1	1829	7.0	0.820	9.0	LOS A	10.9	80.8	0.83	0.86	1.04	52.6
9	R2	47	7.0	0.820	14.4	LOS B	10.7	79.7	0.86	0.90	1.10	52.0
9u	U	28	7.0	0.820	16.5	LOS B	10.7	79.7	0.86	0.90	1.10	53.0
Approach		2007	7.0	0.820	9.0	LOS A	10.9	80.8	0.82	0.85	1.01	52.5
West: Biripi Way												
10	L2	187	7.0	0.425	10.7	LOS B	1.9	13.8	0.78	0.93	0.93	50.2
11	T1	1	7.0	0.425	10.7	LOS B	1.9	13.8	0.78	0.93	0.93	44.5
12	R2	304	7.0	0.547	15.1	LOS B	2.9	21.2	0.80	1.00	1.02	48.8
12u	U	1	7.0	0.547	17.3	LOS B	2.9	21.2	0.80	1.00	1.02	49.7
Approach		494	7.0	0.547	13.5	LOS B	2.9	21.2	0.79	0.97	0.99	49.4
All Vehicles		4175	7.0	0.820	9.5	LOS A	10.9	80.8	0.74	0.77	0.89	51.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [2040 BG GR+BG DEV-REZ-ULT-AM]

Manning River Drive / Biripi Way
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: Manning River Drive (S)												
1	L2	251	7.0	0.507	24.7	LOS C	23.1	171.5	0.63	0.67	0.63	43.2
2	T1	2032	7.0	0.890	29.0	LOS C	61.0	452.4	0.78	0.78	0.83	40.5
3	R2	54	7.0	0.275	73.4	LOS E	3.7	27.4	0.96	0.75	0.96	18.7
Approach		2336	7.0	0.890	29.6	LOS C	61.0	452.4	0.77	0.76	0.81	40.2
East: Biripi Way (E)												
4	L2	16	7.0	0.533	67.7	LOS E	8.1	60.3	0.97	0.80	0.97	19.8
5	T1	1	7.0	0.533	63.8	LOS E	8.1	60.3	0.97	0.80	0.97	20.2
6	R2	101	7.0	0.533	67.9	LOS E	8.1	60.3	0.97	0.80	0.97	20.0
Approach		118	7.0	0.533	67.8	LOS E	8.1	60.3	0.97	0.80	0.97	19.9
North: Manning River Drive (N)												
7	L2	179	7.0	0.218	20.1	LOS C	7.9	59.0	0.49	0.64	0.49	24.0
8	T1	923	7.0	0.382	16.1	LOS B	16.4	121.7	0.55	0.50	0.55	47.3
9	R2	167	7.0	0.856	86.1	LOS F	13.3	98.6	1.00	0.93	1.26	24.8
Approach		1269	7.0	0.856	25.9	LOS C	16.4	121.7	0.60	0.58	0.63	39.1
West: Biripi Way (W)												
10	L2	49	7.0	0.159	62.4	LOS E	3.1	23.3	0.89	0.74	0.89	29.2
11	T1	1	7.0	0.159	56.7	LOS E	3.1	23.3	0.89	0.74	0.89	21.2
12	R2	79	7.0	0.318	65.8	LOS E	5.2	38.3	0.92	0.77	0.92	28.8
Approach		129	7.0	0.318	64.4	LOS E	5.2	38.3	0.91	0.76	0.91	28.9
All Vehicles		3853	7.0	0.890	30.7	LOS C	61.0	452.4	0.73	0.70	0.76	38.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow	Average Delay	Level of Service	Average Back of Queue		Prop. Queued	Effective Stop Rate
		ped/h	sec		Pedestrian ped	Distance m		
P1	South Full Crossing	53	69.3	LOS F	0.2	0.2	0.96	0.96
P2	East Full Crossing	53	14.6	LOS B	0.1	0.1	0.44	0.44
P4	West Full Crossing	53	17.3	LOS B	0.1	0.1	0.48	0.48
All Pedestrians		158	33.7	LOS D			0.63	0.63

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101v [2040 BG GR+BG DEV-REZ-ULT-PM]

Manning River Drive / Biripi Way
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 100 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Manning River Drive (S)												
1	L2	71	7.0	0.334	21.6	LOS C	9.1	67.6	0.64	0.60	0.64	45.6
2	T1	1358	7.0	0.587	18.3	LOS B	19.5	144.4	0.74	0.66	0.74	46.1
3	R2	25	7.0	0.230	57.1	LOS E	1.3	9.3	0.98	0.71	0.98	21.9
Approach		1454	7.0	0.587	19.1	LOS B	19.5	144.4	0.74	0.66	0.74	45.6
East: Biripi Way (E)												
4	L2	37	7.0	0.869	59.1	LOS E	12.4	92.2	1.00	1.01	1.37	21.5
5	T1	1	7.0	0.869	55.2	LOS E	12.4	92.2	1.00	1.01	1.37	22.0
6	R2	180	7.0	0.869	59.3	LOS E	12.4	92.2	1.00	1.01	1.37	21.8
Approach		218	7.0	0.869	59.2	LOS E	12.4	92.2	1.00	1.01	1.37	21.7
North: Manning River Drive (N)												
7	L2	102	7.0	0.500	23.1	LOS C	14.4	106.8	0.70	0.66	0.70	24.0
8	T1	1829	7.0	0.879	29.6	LOS C	42.7	316.9	0.86	0.88	0.98	40.3
9	R2	47	7.0	0.431	58.2	LOS E	2.4	17.8	1.00	0.74	1.00	30.5
Approach		1979	7.0	0.879	30.0	LOS C	42.7	316.9	0.85	0.86	0.97	39.2
West: Biripi Way (W)												
10	L2	187	7.0	0.395	38.8	LOS D	7.7	56.8	0.87	0.79	0.87	35.9
11	T1	1	7.0	0.395	33.2	LOS C	7.7	56.8	0.87	0.79	0.87	28.0
12	R2	304	7.0	0.828	51.6	LOS D	15.8	117.4	1.00	0.95	1.21	32.4
Approach		493	7.0	0.828	46.7	LOS D	15.8	117.4	0.95	0.89	1.08	33.6
All Vehicles		4143	7.0	0.879	29.7	LOS C	42.7	316.9	0.83	0.80	0.92	39.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	53	44.3	LOS E	0.1	0.1	0.94	0.94
P2	East Full Crossing	53	15.7	LOS B	0.1	0.1	0.56	0.56
P4	West Full Crossing	53	19.3	LOS B	0.1	0.1	0.62	0.62
All Pedestrians		158	26.4	LOS C			0.71	0.71

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Appendix G – Aboriginal Heritage Impact Assessment

Blue Sky Planning and Environment

Taree South re-zoning

LGA: MidCoast Council

Aboriginal Heritage Impact Assessment

22 August 2018

McCARDLE CULTURAL HERITAGE PTY LTD

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McCARDLE
CULTURAL HERITAGE

Report No: J18044	
Approved by:	Penny McCardle
Position:	Director
Signed:	
Date:	22 August 2018

This report has been prepared in accordance with the scope of services described in the contract or agreement between McCardle Cultural Heritage Pty Ltd (MCH), ACN: 104 590 141, ABN: 89 104 590 141, and Blue-Sky Planning and Environment. The report relies upon data, surveys, measurements and specific times and conditions specified herein. Any findings, conclusions or recommendations only apply to the aforementioned circumstances and no greater reliance should be assumed or drawn by Blue Sky Planning and Environment. Furthermore, the report has been prepared solely for use by Blue Sky Planning and Environment and MCH accepts no responsibility for its use by other parties.

CONTENTS

APPENDICES

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EXECUTIVE SUMMARY

MCH have been engaged by Blue Sky Planning and Environment to undertake an Aboriginal Cultural Heritage Assessment (ACHA) for an amendment to Greater Taree LEP 2010 (GTLEP 2010) which would increase the area of employment-related land in the Manning River Drive Employment Precinct, south of Taree, generally in accordance with Mid Coast Council's Draft Manning Valley Local Strategy. The project area includes 50 Eriksson Lane (Lot 2 DP 827097), 51 Glenthorne Road (Lot 50 DP 863972) and 55 Glenthorne Road, Taree South (Lot 2 DP 573214).

The project area is located on Quaternary sand, silt, mud and gravel and consists of very gentle slopes that form flats towards the northern end of the project area. One 3rd order creek (Stitts Creek) is located through the far northern portion of the project area, one 2nd order creek is located in the southern half of the project area and one 1st order roughly through the centre of the project area. The closest reliable water source is Manning River located approximately 900 metres to the north of the project area. Thus, the project area may be considered reasonable resourced in terms of water availability during wet seasons or after continuous heavy rain when water was available. However, it is the Manning River that would have been the main focus of past Aboriginal land use due to its abundance of reliable subsistence and medicinal resources, whilst the surrounding area would have provided for small groups of people, such as areas along Stitts Creek.

The project area has been cleared and primarily used for pastoral purposes (grazing), involving the wholesale clearance of native vegetation, the introduction of pasture grass, the construction of dams, housing, fencing, numerous tracks and associated infrastructure (water, electricity, telephone). Such land uses can be expected to have had low to moderate impacts on the archaeological record.

A search of the OEH AHIMS register has shown that 26 known Aboriginal sites are currently recorded within five kilometres of the project area and include artefacts, scar trees, Aboriginal Ceremonial and dreaming, shell middens, burials and PADs. Within the project area, the landscape would have provided some subsistence resources during times of heavy rain, which was likely suited to small scale camping by small groups of people over short periods of time as well as hunting and gathering and travel to the more reliable Manning River. It is possible that isolated finds and small density artefacts scatters maybe located along and within 50 metres of Stitts Creek and the 2nd order creek in the south of the project area.

The survey confirmed the past land uses and additional disturbances along the 2nd order creek that included a dam. The effective coverage for project area illustrates that overall effective coverage was low at 13.39% with grass being the limiting factor and erosion across the project area is minimal. No sites were identified during the survey. Given the known extent and content of sites typically situated on elevated land in close proximity to reliable water sources, the very gentle slope overlooking Stitts Creek and flood plain is likely to have been utilised for small to moderate groups of people for camping. Identified as TS/PAD1, this area of archaeological potential is located in the eastern end of the project area and includes the very gentle slope on the western side of Stitts Creek. The eastern side consists of flood plains and would not have been suitable for camping. The PAD extends from the upper flood plain reaches and for approximately 50 metres. This PAD appears to have been subject to minimal disturbances and is an elevated landform overlooking the Creek (3rd order) and as such has potential to contain in situ cultural materials.

The results of the assessment indicate that the identified ST/PAD1 will be impacted on by any future development. As the nature of the PAD remains unknown at this time, the impacts from any future development on the archaeological record remain unknown.

Based on the environmental and archaeological contexts as well as the survey results, the following recommendations are provided:

1) The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974;

2) Should any Aboriginal objects be uncovered during works, all work will cease in that location immediately and the Environmental Line contacted; and

3) If the identified PAD will be impacted upon by any future development an archaeological subsurface investigation will be required in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW.

GLOSSARY

Aboriginal Cultural Heritage Values: traditional values of Aboriginal people, handed down in spiritual beliefs, stories and community practices and may include local plant and animal species, places that are important and ways of showing respect for other people.

Aboriginal Place: are locations that have been recognised by the Minister for Climate Change and the Environment (and gazetted under the *National Parks and Wildlife Act 1974*) as having special cultural significance to the Aboriginal community. An Aboriginal Place may or may not include archaeological materials.

Aboriginal Site: an Aboriginal site is the location of one or more Aboriginal archaeological objects, including flaked stone artefacts, midden shell, grinding grooves, archaeological deposits, scarred trees etc.

Artefact: any object that is physically modified by humans.

Assemblage: a collection of artefacts associated by a particular place or time, assumed generated by a single group of people, and can comprise different artefact types.

Axe: a stone-headed axe usually having two ground surfaces that meet at a bevel.

Backed artefact: a stone tool where the margin of a flake is retouched at a steep angle and that margin is opposite a sharp edge.

Background scatter: a term used to describe low density scatter of isolated finds that are distributed across the landscape without any obvious focal point.

Blade: a flake that is at least twice as long as it is wide.

Bondi point: a small asymmetrical backed artefact with a point at one end and backing retouch.

Core: a chunk of stone from which flakes are removed and will have one or more negative flake scars but no positive flake scars. The core itself can be shaped into a tool or used as a source of flakes to be formed into tools.

Debitage: small pieces of stone debris that break off during the manufacturing of stone tools. These are usually considered waste and are the by-product of production (also referred to as flake piece).

Flake: any piece of stone struck off a core and has a number of characteristics including ring cracks showing where the hammer hit the core and a bulb of percussion. May be used as a tool with no further working, may be retouched or serve as a platform for further reduction.

Flaked piece/waste flake: an unmodified and unused flake, usually the by-product of tool manufacture or core preparation (also referred to as debitage).

Formation processes: human caused (land uses etc) or natural processes (geological, animal, plant growth etc) by which an archaeological site is modified during or after occupation and abandonment. These processes have a large effect on the provenience of artefacts or features.

Grinding stone: an abrasive stone used to abrade another artefact or to process food.

Hammer stone: a stone that has been used to strike a core to remove a flake, often causing pitting or other wear on the stone's surface.

Harm: is defined as an act that may destroy, deface or damage an Aboriginal object or place. In relation to an object, this means the movement or removal of an object from the land in which it has been situated

Holocene: the post-glacial period, beginning about 10,000 B.P.

In situ: archaeological items are said to be "in situ" when they are found in the location where they were last deposited.

Pleistocene: the latest major geological epoch, colloquially known as the "Ice Age" due to the multiple expansion and retreat of glaciers. Ca. 3.000, 000-10,000 years B.P.

Retouched flake: a flake that has been flaked again in a manner that modified the edge for the purpose of resharpening that edge.

Stratified Archaeological Deposits: Aboriginal archaeological objects may be observed in soil deposits and within rock shelters or caves. Where layers can be detected within the soil or sediments, which are attributable to separate depositional events in the past, the deposit is said to be stratified. The integrity of sediments and soils are usually affected by 200 years of European settlement and activities such as land clearing, cultivation and construction of industrial, commercial and residential developments.

Taphonomy: the study of processes which have affected organic materials such as bone after death; it also involves the microscopic analysis of tooth-marks or cut marks to assess the effects of butchery or scavenging activities.

Traditional Aboriginal Owners: Aboriginal people who are listed in the Register of Aboriginal owners pursuant to Division 3 of the *Aboriginal Land Register Act (1983)*. The Registrar must give priority to registering Aboriginal people for lands listed in Schedule 14 of the *National Parks and Wildlife Act 1974* or land subject to a claim under 36A of the *Aboriginal Land Rights Act 1983*.

Traditional Knowledge: Information about the roles, responsibilities and practices set out in the cultural beliefs of the Aboriginal community. Only certain individuals have traditional knowledge and different aspects of traditional knowledge may be known by different people, e.g. information about men's initiation sites and practices, women's sites, special pathways, proper responsibilities of people fishing or gathering food for the community, ways of sharing and looking after others, etc.

Typology: the systematic organization of artefacts into types on the basis of shared attributes.

Use wear: the wear displayed on an artefact as a result of use.

ACRONYMS

ACHMP	Aboriginal Cultural Heritage Management Plan
AHIMS	Aboriginal Heritage Information Management System. Data base of recorded sites across NSW managed by OEH
OEH	Office of Environment and Heritage

OEH AHIMS SITE ACRONYMS

ACD	Aboriginal ceremonial and dreaming
AFT	Artefact (stone, bone, shell, glass, ceramic and metal)
ARG	Aboriginal resource and gathering
ART	Art (pigment or engraving)
BOM	Non-human bone and organic material
BUR	Burial
CFT	Conflict site
CMR	Ceremonial ring (stone or earth)
ETM	Earth mound
FSH	Fish trap
GDG	Grinding groove
HAB	Habitation structure
HTH	Hearth
OCQ	Ochre quarry
PAD	Potential archaeological Deposit. Used to define an area of the landscape that is believed to contain subsurface archaeological deposits.
SHL	Shell
STA	Stone arrangement
STQ	Stone quarry
TRE	Modified tree (carved or scarred)
WTR	Water hole

1 INTRODUCTION

1.1 INTRODUCTION

MCH have been engaged by Blue Sky Planning and Environment to undertake an Aboriginal Cultural Heritage Assessment (ACHA) for an amendment to Greater Taree LEP 2010 (GTLEP 2010) which would increase the area of employment-related land in the Manning River Drive Employment Precinct, south of Taree, generally in accordance with Mid Coast Council's Draft Manning Valley Local Strategy.

The assessment has been undertaken to meet the NSW Office of Environment and Heritage (OEH), Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (DECCW 2010), the OEH Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), the DECCW Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b) and the brief.

1.2 PROPONENT DETAILS

Mulgrave Trust and Jasbe Glenthorne Pty Ltd

1.3 THE PROJECT AREA

The project area is defined by the proponent and includes 50 Eriksson Lane (Lot 2 DP 827097), 51 Glenthorne Road (Lot 50 DP 863972) and 55 Glenthorne Road, Taree South (Lot 2 DP 573214). The location and extent of the project area is illustrated in Figures 1.1 to 1.3.

Figure 1.1 Regional location of the project area

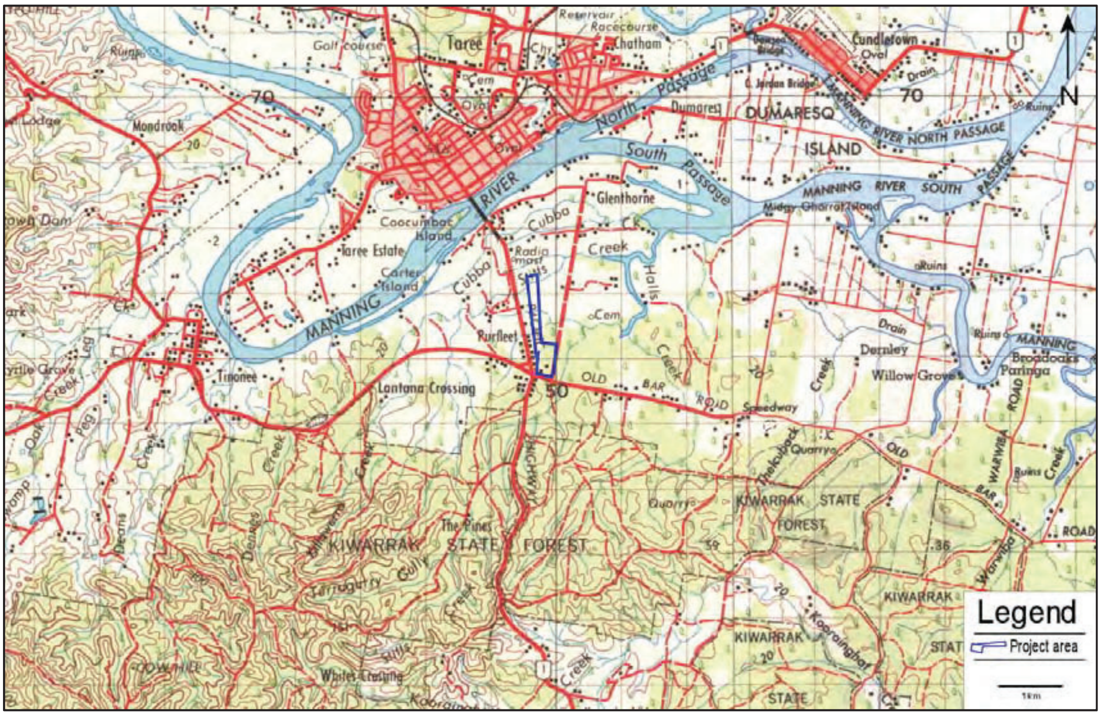


Figure 1.2 Local location of the project area

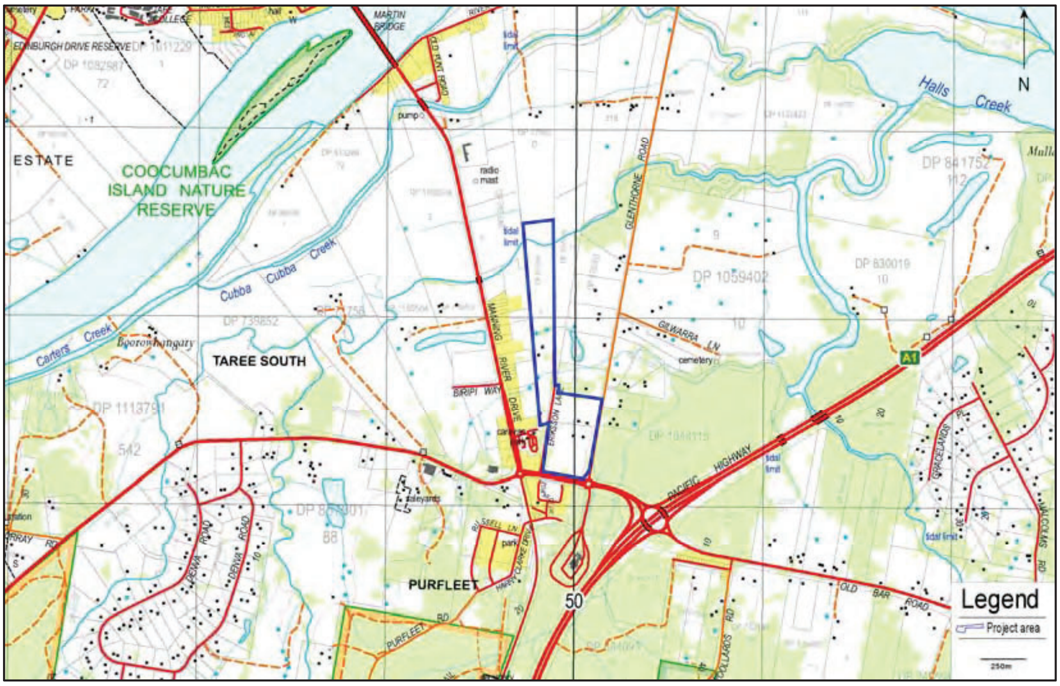


Figure 1.3 Aerial location of the project area

1.4 DESCRIPTION OF THE PROPOSED DEVELOPPMENT

The project is only in the rezoning stage and as such there is no development or impacts at this stage. The proponent confirms that every effort will be made with this development to avoid impacting on any Aboriginal objects.

The objective of the Planning Proposal is to facilitate an amendment to Greater Taree LEP 2010 (GTLEP 2010) which would increase the area of employment-related land in the Manning River

Drive Employment Precinct, south of Taree, generally in accordance with MidCoast Council's Draft Manning Valley Local Strategy.

It is likely that Lot 2 DP 827097 and Lot 2 DP 573214 will be subdivided into industrial lots and would include factories, warehouses, automotive uses, manufacturing etc. It is intended that Lot 50 would be rezoned to a B6 (Enterprise Corridor) zone, and Lot 2 DP 573214 and Lot 2 DP 827097 would be rezoned to IN1 (General Industrial). Eriksson Lane will be included in the adjacent zones. In the latter stages of the development, it is likely that a connecting road would be constructed between Manning River Drive northbound and Lot 2 DP 827097.

We note that detailed design plans have not been prepared at this early stage but where feasible and practical any future development application for the subdivision of the site will have regard to the requirements and provision of the National Parks and Wildlife Act 1974.

1.5 PURPOSE OF THE ARCAHEOLOGICAL ASSESSMENT

The purpose of the assessment is to assess any archaeological constraints to support the rezoning application and to provide opportunities and options to ensure any cultural materials present are protected and managed in an appropriate manner.

1.6 OBJECTIVE OF THE ASSESSMENT

The objective of the assessment is to identify areas of indigenous cultural heritage value, to determine possible impacts on any indigenous cultural heritage identified (including potential subsurface evidence) and to develop management recommendations where appropriate. The assessment employs a regional approach, taking into consideration both the landscape of the project area (landforms, water resources, soils, geology etc) and the regional archaeological patterning identified by past studies.

1.7 PROJECT BRIEF/SCOPE OF WORK

The following tasks were carried out:

- a review of relevant statutory registers and inventories for indigenous cultural heritage including the NSW Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS) for known archaeological sites, the State Heritage Register, the Australian Heritage Database (includes data from the World Heritage List UNESCO, National Heritage List, Commonwealth Heritage List, Register of the National Estate) and the MidCoast Local Environmental Plan;
- a review of local environmental information (topographic, geological, soil, geomorphological and vegetation descriptions) to determine the likelihood of archaeological sites and specific site types, prior and existing land uses and site disturbance that may affect site integrity;
- a review of previous cultural heritage investigations to determine the extent of archaeological investigations in the area and any archaeological patterns;
- the development of a predictive archaeological statement based on the data searches and literature review;
- identification of human and natural impacts in relation to the known and any new archaeological sites archaeological potential of the project area;

- consultation with the Aboriginal stakeholders as per the Aboriginal Cultural Heritage Consultation Requirements for Proponents (2010);
- undertake a site inspection with the participation of the registered Aboriginal stakeholders, and
- the development of mitigation and conservation measures in consultation with the registered Aboriginal stakeholders.

1.8 LEGISLATIVE CONTEXT

The following overview of the legislative framework, is provided solely for information purposes for the client, and should not be interpreted as legal advice. MCH will not be liable for any actions taken by any person, body or group as a result of this general overview and MCH recommends that specific legal advice be obtained from a qualified legal practitioner prior to any action being taken as a result of the general summary below.

Land managers are required to consider the affects of their activities or proposed development on the environment under several pieces of legislation. Although there are a number of Acts and regulations protecting Aboriginal heritage, including places, sites and objects, within NSW, the three main ones include:

- National Parks and Wildlife Act (1974, as amended)
- National Parks and Wildlife Regulation (2009)
- Environmental Planning and Assessment Act (1979)

1.8.1 NATIONAL PARKS AND WILDLIFE ACT (1974, AS AMENDED)

The National Parks and Wildlife Act (1974), Amended 2010, is the primary legislation for the protection of Aboriginal cultural heritage in New South Wales. The NPW Act protects Aboriginal heritage (places, sites and objects) within NSW and the Protection of Aboriginal heritage is outlined in s86 of the Act, as follows:

- "A person must not harm or desecrate an object that the person knows is an Aboriginal object" s86(1)
- "A person must not harm an Aboriginal object" s86(2)
- "A person must not harm or desecrate an Aboriginal place" s86(4)

Penalties apply for harming an Aboriginal object, site or place. The penalty for knowingly harming an Aboriginal object (s86[1]) and/or an Aboriginal place (s86[4]) is up to $550,000 for an individual and/or imprisonment for 2 years; and in the case of a corporation the penalty is up to $1.1 million. The penalty for a strict liability offence (s86[2]) is up to $110,000 for an individual and $220,000 for a corporation.

Harm under the National Parks and Wildlife Act (1974, as amended) is defined as any act that; destroys defaces or damages the object, moves the object from the land on which it has been situated, causes or permits the object to be harmed. However, it is a defence from prosecution if the proponent can demonstrate that;

1) harm was authorised under an Aboriginal Heritage Impact Permit (AHIP) (and the permit was properly followed), or

2) the proponent exercised due diligence in respect to Aboriginal heritage.

The 'due diligence' defence (s87[2]), states that if a person or company has applied due diligence to determine that no Aboriginal object, site or place was likely to be harmed as a result of the activities proposed for the Project Area, then liability from prosecution under the NPW Act 1974 will be removed or mitigated if it later transpires that an Aboriginal object, site or place was harmed. If any Aboriginal objects are identified during the activity, then works should cease in that area and OEH notified (DECCW 2010:13). The due diligence defence does not authorise continuing harm.

The archaeological due diligence assessment and report has been carried out in compliance with the NSW DECCW 2010 Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW.

1.8.2 NATIONAL PARKS AND WILDLIFE REGULATION (2009)

The National Parks and Wildlife Regulation 2009 provides a framework for undertaking activities and exercising due diligence in respect to Aboriginal heritage. The Regulation (2009) recognises various due diligence codes of practice, including the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW which is pertinent to this report, but it also outlines procedures for Aboriginal Heritage Impact Permit (AHIP) applications and Aboriginal Cultural Heritage Consultation Requirements (ACHCRs); amongst other regulatory processes.

1.8.3 ENVIRONMENTAL PLANNING & ASSESSMENT ACT 1979 (EP&A ACT)

EP&A Act establishes the statutory framework for planning and environmental assessment in NSW and the implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils. The EP&A Act contains three parts which impose requirements for planning approval:

- Part 3 of the EP&A Act relates to the preparation and making of Environmental Planning Instruments (EPIs), State Environmental Planning Policies (SEPPs) and Local Environmental Plans (LEPs).
- Part 4 of the EP&A Act establishes the framework for assessing development under an EPI. The consent authority for Part 4 development is generally the local council, however the consent authority may by the Minister, the Planning Assessment Commission or a joint regional planning panel depending upon the nature of the development.
- Part 4, Division 4.1 of the EP&A Act establishes the assessment pathway for State significant development (**SSD**) declared by the State Environmental Planning Policy (State and Regional Development) 2011 (NSW). Once a development is declared as SSD, the Director-General will issue Director-General Requirements (DGRs) outlining what issues must be considered in the EIS.
- Part 5 of the EP&A Act provides for the control of 'activities' that do not require development consent and are undertaken or approved by a determining authority. Development under Part 5 that are likely to significantly affect the environment is required to have an EIS prepared for the proposed activity.
- Part 5.1 of the EP&A Act establishes the assessment pathways for State significant infrastructure (**SSI**). Development applications made for SSI can only be approved by the Minister. Once a development is declared as SSI, the Director-General will issue DGRs outlining what issues must be addressed in the EIS.

The applicable approval process is determined by reference to the relevant environmental planning instruments and other controls, LEPs and State Environmental Planning Policies (SEPPs).

This project falls under Part 4.

1.9 QUALIFICATIONS OF THE INVESTIGATOR

Penny McCardle: Principal Archaeologist & Forensic Anthropologist has 10 years experience in Indigenous archaeological assessments, excavation, research, reporting, analysis and consultation. Six years in skeletal identification, biological profiling and skeletal trauma identification.

- BA (Archaeology and Palaeoanthropology, University of New England 1999
- Hons (Archaeology and Palaeoanthropology): Physical Anthropology), University of New England 2001
- Forensic Anthropology Course, University of New England 2003
- Armed Forces Institute of Pathology Forensic Anthropology Course, Ashburn, VA 2008
- Analysis of Bone trauma and Pseudo-Trauma in Suspected Violent Death Course, Erie College, Pennsylvania, 2009
- Documenting Scenes of War and Human Rights Violations. Institute for International Criminal Investigations, 2018
- Completed PhD, University of Newcastle, 2018

1.10 REPORT STRUCTURE

The report includes Section 1 which outlines the project, Section 2 provides the consultation, Section 3 presents the environmental context, Section 4 presents ethno historic context, Section 5 provides the archaeological background, Section 6 provides the results of the fieldwork, analysis and discussion; Section 7 presents the development impact assessment, Section 8 presents the mitigation strategies and Section 9 presents the management recommendations.

2 CONSULTATION

As per the Aboriginal Cultural Heritage Consultation Requirements for Proponents (April 2010), MCH followed the four stages of consultation as set out below. All correspondences for each stage are provided in Annex A.

In relation to cultural significance, MCH recognises and supports the indigenous system of knowledge. That is, that knowledge is not 'open' in the sense that everyone has access and an equal right to it. Knowledge is not always definitive (in the sense that there is only one right answer) and knowledge is often restricted. As access to this knowledge is power, it must be controlled by people with the appropriate qualifications (usually based on age seniority but may be based on other factors). Thus, it is important to obtain information from the correct people: those that hold the appropriate knowledge of those sites and/or areas relevant to the project. It is noted that only the Aboriginal community can identify and determine the accepted knowledge holder(s) may be not archaeologists or proponents. If knowledge is shared, that information must be used correctly and per the wishes of the knowledge holder. Whilst an archaeologist may view this information as data, a custodian may view this information as highly sensitive, secret/sacred information and may place restrictions on its use. Thus, it is important for MCH to engage in affective and long-term consultation to ensure knowledge is shared and managed in a suitable manner that will allow for the appropriate management of that site/area. MCH also know that archaeologists do not have the capability nor the right to adjudicate on the spirituality of a particular location or site as this is the exclusive right of the traditional owners who have the cultural and hereditary association with the land of their own ancestors. For these reasons, consultation forms an integral component of all projects and this information is sought form the registered stakeholders to be included in the report in the appropriate manner that is stipulated by those with the information.

2.1 STAGE 1: NOTIFICATION & REGISTRATION OF INTEREST

The aim of this stage is to identify, notify and register Aboriginal people and/or groups who hold cultural knowledge that is relevant to the project area, and who can determine the cultural significance of any Aboriginal objects and/or places within the proposed project area. In order to do this, the sources identified by OEH (2010:10) and listed in Table 2.1, to provide the names of people who may hold cultural knowledge that is relevant to determining the significance of Aboriginal objects and/or places were contacted by letter on 11 April 2018. A reply was requested by the 24 April 2018 and it was stipulated that if no response was received, the project and consultation will proceed. Information included in the correspondence to the sources listed in Table 2.1 included the name and contact details of the proponent, an overview of the proposed project including the location and a map showing the location.

Table 2.1 Sources contacted

Organisations contacted	Response
Office of Environment and Heritage	17 groups
FLALC	no response
MIdCoast City Council	9 groups
Registrar Aboriginal Land Rights Act 1983	PLALC
National Native Title Tribunal	no groups
Native Title Services Corporation Limited	no response
Hunter Local Land Services	no response

Following this, MCH compiled a list of people/groups to contact (Refer to Annex A). As per the Aboriginal cultural heritage consultation requirements for proponents (April 2010), archaeologists and proponents must write to all those groups provided asking if they would like to register their interest in the project. Unfortunately some Government departments written to requesting a list of groups to consult with do not differentiate groups from different traditional boundaries and provide an exhaustive list of groups from across the region including those outside their traditional boundaries.

MCH wrote to all parties identified on 24 April 2018, and an advertisement was placed in the Manning River Times on 126 April 2018. The correspondence and advertisement included the required information as per the Aboriginal Cultural Heritage Consultation Requirements for Proponents (April 2010) and requested to nominate the preferred option for the presentation of information about the proposed project: an information packet or a meeting and information packet (Refer to Stage 2). The Rregistered Aboriginal Parties (RAPs) are listed in Table 2.2.

Table 2.2 Registered Aboriginal Parties

RAP	Contact
Tide Ltd	Mick Leon
NA	Lee Davison

2.2 STAGE 2: PRESENTATION OF INFORMATION

The aim of this stage is to provide the RAPs with information regarding the scope of the proposed project and the cultural heritage assessment process.

An information packet was sent to all RAPs and included the required information as per the Aboriginal Cultural Heritage Consultation Requirements for Proponents (April 2010). The pack included the required information as per the Aboriginal Cultural Heritage Consultation Requirements for Proponents (April 2010). A written response to the methods and the preferred method of sharing traditional knowledge was due no later than 11 June 2018.

The information pack also stipulated that consultation was not employment, and requested that in order to assist the proponent in the engagement of field workers, that the groups provide information that will assit in the selection of field staff who may be paid on a contractual basis). This included, but was not limited to, experience in field work and in providing cultural heritage advice (asked to nominate at least two individuals who will be available and fit for work) and their relevant experience; and to provide a CV and insurance details.

The information pack also noted that failure to provide the required information by the date provided will result in a missed opportunity for the RAPs to contribute to their cultural heritage and the project will proceed.

2.3 STAGE 3: GATHERING INFORMATION ABOUT CULTURAL SIGNIFICANCE

The aim of this stage is to facilitate a process whereby the RAPs can contribute to culturally appropriate information gathering and the research methodology, provide information that will enable the cultural significance of any Aboriginal objects and or/places within the proposed project area to be determined and have input into the development of any cultural heritage management options and mitigation measures. In order to do his, included in the information pack sent for Stage

2, was information pertaining to the gathering of cultural knowledge. This included the following information;

- MCH noted that information provided by RAPs may be sensitive and MCH and the proponent will not share that information with all RAPs or others without the express permission of the individual. MCH and the proponent extended an invitation to develop and implement appropriate protocols for sourcing and holding cultural information including any restrictions to place on information, as well as the preferred method of providing information;
- request for traditional/cultural knowledge or information associated with ceremonial, spiritual, mythological beliefs, traditions and known sites from the pre-contact period;
- request for traditional/cultural knowledge or information regarding sites or places with historical associations and/or cultural significance which date from the post-contact period and that are remembered by people today (e.g. plant and animal resource use areas, known camp sites); and
- request for traditional/cultural knowledge or information in relation to any sites or places of contemporary cultural significance (apart from the above) which has acquired significance recently.

During this process, the RAPs did not disclose any specific traditional/cultural knowledge or information of sites or places associated with spiritual, mythological, ceremonies or beliefs from the pre contact period within the project area or surrounding area. The stakeholders did not disclose any information pertaining to sites or places of cultural significance associated with the historic or contemporary periods within the project area or surrounding area. However, it must be noted that traditional/cultural knowledge and/or information regarding sites and/or places of cultural significance may exist that were not divulged to MCH by those consulted.

2.4 SURVEY

All RAPs were invited to participate in the survey on 13 July 2018. Unfortunately, no RAPs attended and the survey proceeded.

2.5 STAGE 4: REVIEW OF DRAFT CULTURAL HERITAGE ASSESSMENT

Copies of the DRAFT report were forwarded to all RAPs for their review and were asked to provide a written or verbal response no later than 16th August 2018. MCH received no responses form the RAPs.

All comments received from the RAPs were considered in the final report, all submissions responded to and the draft report altered to include their comments. All RAPs were provided a copy of the final report. All documentation regarding the consultation process is provided in Appendix A.

3 LANDSCAPE AND ENVIRONMENTAL CONTEXT

3.1 INTRODUCTION

The nature and distribution of Aboriginal cultural materials in a landscape are strongly influenced by environmental factors such as topography, geology, landforms, climate, geomorphology, hydrology and the associated soils and vegetation (Hughes and Sullivan 1984). These factors influence the availability of plants, animals, water, raw materials, the location of suitable camping places, ceremonial grounds, burials, and suitable surfaces for the application of rock art. As site locations may differ between landforms due to differing environmental constraints that result in the physical manifestation of different spatial distributions and forms of archaeological evidence, these environmental factors are used in constructing predictive models of Aboriginal site locations.

Environmental factors also effect the degree to which cultural materials have survived in the face of both natural and human influences and affect the likelihood of sites being detected during ground surface survey. Site detection is dependent on a number of environmental factors including surface visibility (which is determined by the nature and extent of ground cover including grass and leaf litter etc) and the survival of the original land surface and associated cultural materials (by flood alluvium and slope wash materials). It is also dependant on the exposure of the original landscape and associated cultural materials (by water, sheet and gully erosion, ploughing, vehicle tracks etc), (Hughes and Sullivan 1984). Combined, these processes and activities are used in determining the likelihood of both surface and subsurface cultural materials surviving and being detected.

It is therefore necessary to have an understanding of the environmental factors, processes and activities, all of which affect site location, preservation, detection during surface survey and the likelihood of in situ subsurface cultural materials being present. The environmental factors, processes and disturbances of the surrounding environment and specific project area are discussed below.

3.2 TOPOGRAPHY

The topographical context is important to identify potential factors relating to past Aboriginal land use patterns. The project consists of very gentle slopes that form flats towards the northern end of the project area that also includes Stitts Creek, and two lower order drainage lines through the centre of the project area.

3.3 GEOLOGY

The underlying regional geology plays a major role in the structure of the surrounding environment (landforms, topography, geomorphology, vegetation, climate etc), and also influences patterns of past occupation and their manifestation in the archaeological record. This is primarily relevant to past Aboriginal land use in regard to the location of stone resources or raw materials and their procurement for the manufacturing and modification of stone tools. The project area is located on Quaternary sand, silt, mud and gravel (Hastings 1:100,000 geological map sheet).

3.4 SOILS

The nature of the surrounding soil landscape also has implications for Aboriginal land use and site preservation, mainly relating to supporting vegetation and the preservation of organic materials and burials. The deposit of alluvial and aeolian sediments and colluvium movement of fine sediments (including artefacts) results in the movement and burying of archaeological materials. The increased movement in soils by this erosion is likely to impact upon cultural materials through the post-depositional movement of materials, specifically small portable materials such as stone tools, contained within the soil profiles. The project area consists of an A horizon of fine clay loam that overlays a B Horizon of fine clay loam sand (NSW Soil and Land Information Ststem).

3.5 CLIMATE

Climatic conditions would also have played a part in past occupation of an area as well as impacted upon the soils and vegetation and associated cultural materials. The is characterised by temperatures ranging from an average minimum of below 5°C to an average maximum of 28°C. Winter rainfall levels are somewhat variable and generally average 30 millimetres per month. Summer rainfalls are more stable at approximately 55-60 millimetres per month, giving a mean annual rainfall of 740 millimetres. During summer, the increased rainfall rate and reduced ground cover is reflected in a proportionately higher risk of erosion.

3.6 WATERWAYS

One of the major environmental factors influencing human behaviour is water as it is essential for survival and as such people will not travel far from reliable water sources. In those situations where people did travel far from reliable water, this indicates a different behaviour such as travelling to obtain rare or prized resources and/or trade. Proximity to water not only influences the number of sites likely to be found but also artefact densities. The highest number of sites and the highest density are usually found in close proximity to water and usually on an elevated landform. This assertion is undisputedly supported by the regional archaeological investigations carried out in the region where by such patterns are typically within 50 metres of a reliable water source.

The main types of water sources include permanent (rivers and soaks), semi-permanent (large streams, swamps and billabongs), ephemeral (small stream and creeks) and underground (artesian). Stream order assessment is one way of determining the reliability of streams as a water source. Stream order is determined by applying the Strahler method to 1:25 000 topographic maps. Based on the climatic analysis (see Section 2.5), the project area will typically experience comparatively reliable rainfalls under normal conditions and thus it is assumed that any streams above a third order classification will constitute a relatively permanent water source.

The Strahler method dictates that upper tributaries do not exhibit flow permanence and are defined as first order streams. When two first order streams meet they form a second order stream. Where two-second order streams converge, a third order stream is formed and so on. When a stream of lower order joins a stream of higher order, the downstream section of the stream will retain the order of the higher order upstream section (Anon 2003; Wheeling Jesuit University 2002).

One 3rd order creek (Stitts Creek) is located through the far northern portion of the project area, one 2nd order creek is located in the southern half of the project area and one 1st order roughly through the centre of the project area (Refer to Figure 1.2). The closest reliable water source is Manning River located approximately 900 metres to the north of the project area.

Thus, the project area may be considered reasonable resourced in terms of water availability during wet seasons or after continuous heavy rain when water was available. However, it is the Manning River that would have been the main focus of past Aboriginal land use due to its abundance of reliable subsistence and medicinal resources, whilst the surrounding area would have provided for small groups of people, such as areas along Stitts Creek.

3.7 FLORA AND FAUNA

The availability of flora and associated water sources affect fauna resources, all of which are primary factors influencing patterns of past Aboriginal land use and occupation. The assessment of flora has two factors that assist in an assessment including a guide to the range of plant resources used for food and medicine and to manufacture objects including nets, string bags, shields and canoes which would have been available to Indigenous people in the past. The second is what it may imply about current and past land uses and to affect survey conditions such as visibility, access and disturbances.

European settlers extensively cleared the original native vegetation in the 1800's and the present vegetation within the investigation area is primarily covered in grasses with open woodlands towards the south and scattered areas of trees throughout. The drainage throughout the project area would have supported a limited range of faunal populations including kangaroo, wallaby, goanna, snakes and a variety of birds.

3.8 LAND USES AND DISTURBANCES

Based upon archaeological evidence, the occupation of Australia extends back some 40,000 years (Mulvaney and Kamminga 1999). Although the impact of past Aboriginal occupation on the natural landscape is thought to have been relatively minimal, it cannot simply be assumed that 20,000 years of land use have passed without affecting various environmental variables. The practice of 'firestick farming' whereby the cautious setting of fires served to drive game from cover, provide protection and alter vegetation communities significantly influenced seed germination, thus increasing diversity within the floral community.

Following European settlement of the area in the 1820s, the landscape has been subjected to a range of different modifactory activities including extensive logging and clearing, agricultural cultivation (ploughing), pastoral grazing, residential developments and mining (Turner 1985). The associated high degree of landscape disturbance has resulted in the alteration of large tracts of land and the cultural materials contained within these areas. The specific project area has been cleared and primarily used for pastoral purposes (grazing), involving the wholesale clearance of native vegetation, the introduction of pasture grass, the construction of dams, housing, fencing, numerous tracks and associated infrastructure (water, electricity, telephone).

Although pastoralism is a comparatively low impact activity, it does result in disturbances due to vegetation clearance and the trampling and compaction of grazed areas. These factors accelerate the natural processes of sheet and gully erosion, which in turn can cause the horizontal and lateral displacement of artefacts. Furthermore, grazing by hoofed animals can affect the archaeological record due to the displacement and breakage of artefacts resulting from trampling (Yorston et al 1990). Pastoral land uses are also closely linked to alterations in the landscape due to the construction of dams, fence lines and associated structures. As a sub-set of agricultural land use, ploughing typically disturbs the top 10-12 centimetres of topsoil (Koettig 1986) depending on the method and machinery used during the process. Ploughing increases the occurrence of erosion and can also result in the direct horizontal and vertical movement of artefacts, thus causing artificial changes in artefact densities and distributions. In fact, studies undertaken on artefact movement due to ploughing (e.g. Roper 1976; Odell and Cowan 1987) has shown that artefact move between one centimetre up to 18 metres laterally depending on the equipment used and horizontal movement. Ploughing may also interfere with other features and disrupt soil stratigraphy (Lewarch and O'Brien 1981). Ploughing activities are typically evidenced through 'ridges and furrows' however a lengthy cessation in ploughing activities dictates that these features may no longer be apparent on the surface.

Whilst the impacts of vehicular movements on sites have not been well documented, based on general observations it is expected that the creation of dirt tracks for vehicle access would result in the loss of vegetation and therefore will enhance erosion and the associated relocation of cultural materials. Dumping of rubbish would have impacted on site through vehicular access (tracks) and movement of surface artefacts through the actual 'dumping' of rubbish.

Excavation works required for dam construction and the laying of infrastructure (water, telephone) would require the removal of soils thus displacing and destroying any cultural materials that may have been present. As fence construction and the erection of telegraph poles require the removal of sols for the holes, this would also have resulted in the disturbance and possible destruction of any cultural materials. All of which result in loss of vegetation and erosion to some extent.

3.9 NATURAL DISTURBANCES

It must be recognised that the disturbance of cultural materials can also be a result of natural processes. The patterns of deposition and erosion within a locality can influence the formation and/or destruction of archaeological sites. Within an environment where the rate of sediment accumulation is generally very high, artefacts deposited in such an environment will be buried shortly after being abandoned. Frequent and lengthy depositional events will also increase the likelihood of the presence of well-stratified cultural deposits (Waters 2000:538,540).

In a stable landscape with few episodes of deposition and minimal to moderate erosion, soils will form and cultural materials will remain on the surface until they are buried. Repeated and extended periods of stability will result in the compression of the archaeological record with multiple occupational episodes being located on one surface prior to burial (Waters 2000:538-539). Within the duplex soils artefacts typically stay within the A horizon on the interface between the A and B horizons.

If erosion occurs after cultural material is deposited, it will disturb or destroy sections of archaeological sites even if they were initially in a good state of preservation. The more frequent and severe the episodes of erosional events the more likely it is that the archaeological record in that area will be disturbed or destroyed (Waters 2000:539; Waters and Kuehn 1996:484). Regional erosional events may entirely remove older sediments, soils and cultural deposits so that archaeological material or deposits of a certain time interval no longer exist within a region (Waters and Kuehn 1996:484-485).

The role of bioturbation is another significant factor in the formation of the archaeological record. Post-depositional processes can disturb and destroy artefacts and sites as well as preserve cultural materials. Redistribution and mixing of cultural deposits occurs as a result of burrowing and mounding by earthworms, ants and other species of burrowing animals. Artefacts can move downwards through root holes as well as through sorting and settling due to gravity. Translocation can also occur as a result of tree falls (Balek 2002:41-42; Peacock and Fant 2002:92). Depth of artefact burial and movement as a result of bioturbation corresponds to the limit of major biologic activity (Balek 2002:43). Artefacts may also be moved as a result of an oscillating water table causing alternate drying and wetting of sediments, and by percolating rainwater (Villa 1982:279).

Experiments to assess the degree that bioturbation can affect material have been undertaken. In abandoned cultivated fields in South Carolina, Michie (summarised in Balek 2002:42-43) found that over a 100-year period 35% of shell fragments that had been previously used to fertilise the fields were found between 15 and 60 centimetres below the surface, inferred to be as a result of bioturbation and gravity. Earthworms have been known to completely destroy stratification within 450 years (Balek 2002:48). At sites in Africa, conjoined artefacts have been found over a metre apart within the soil profile. The vertical distribution of artefacts from reconstructed cores did not follow the order in which they were struck off (Cahen and Moeyersons 1977:813). These kinds of variations in the depths of conjoined artefacts can occur without any other visible trace of disturbance (Villa 1982:287).

However, bioturbation does not always destroy the stratigraphy of cultural deposits. In upland sites in America, temporally-distinct cultural horizons were found to move downwards through the soil as a layer within minimal mixing of artefacts (Balek 2002:48).

3.10 DISCUSSION

Within the project area, one 3rd order creek (Stitts Creek) is located through the far northern portion of the project area, one 2nd order creek is located in the southern half of the project area and one 1st order in the north half of the project area, thus providing some resources suitable for hunting and gathering and/or short-term camping by small numbers of people during times of heavy rain.

In relation to modern alterations to the landscape, the previous large-scale clearing and used of the project area for farming purposes can be expected to have had moderate impacts upon the archaeological record. European land uses such as clearing, grazing and the construction of dams, housing and fences may have displaced cultural materials, however in less disturbed areas, it is likely that archaeological deposits may remain relatively intact.

Vegetation cover across the project area consists of grasses with open woodlands towards the south and scattered areas of trees throughout. This will affect visibility and thereby reduce the potential for identifying archaeological evidence. Typically, due to vegetation cover, most artefacts identified through surface inspection are identified when they are visible on exposures created by erosion or ground surface disturbances (Kuskie and Kamminga 2000).

4 ETHNO-HISTORIC BACKGROUND

Unfortunately, due to European settlement and associated destruction of past Aboriginal communities, their culture, social structure, activities and beliefs, little information with regards to the early traditional way of life of past Aboriginal societies remains.

4.1 USING ETHNO-HISTORIC DATA

Anthropologists and ethnographers have attempted to piece together a picture of past Aboriginal societies throughout the Hunter Valley. Although providing a glimpse into the past, one must be aware that information obtained on cultural and social practices were commonly biased and generally obtained from informants including white settlers, bureaucrats, officials and explorers. Problems encountered with such sources are well documented (e.g. Barwick 1984; L'Oste-Brown et al 1998). There is little information about who collected information or their skills. There were language barrier and interpretation issues, and the degree of interest and attitudes towards Aboriginal people varied in light of the violent settlement history. Access to view certain ceremonies was limited. Cultural practices (such as initiation ceremonies and burial practices) were commonly only viewed once by an informant who would then interpret what he saw based on his own understanding and then generalise about those practices.

4.2 TAREE ETHNO-HISTORIC ACCOUNTS

The Taree area was within the bounds of the Biripi language group (also spelt Birpai). It ranged from just to the north of Forster-Tuncurry at its southern-most extent, to past Port Macquarie at its northern extent. From the coastline it reached west to the Glenrock area. This traditional language area was bordered to the north by the Dainggatti and Nganyaywana language groups, to the west by the Kamilaroi and Geawegal, and to the south by the Worimi language group. Close to the border of the Biripi traditional language group area, Forster-Tuncurry was defined as being at the northern extent of the Worimi area, which stretched to Port Stephens in the south and Gloucester in the west (Horton, 1996). Having the coast along its eastern border was a boon for both the Worimi and Biripi groups, as it provided rich marine resources for those who lived there. Canoes were used for fishing, with woven nets and lines with shell and bone fish hooks as part of the traditional tool kit (Byrne and Nugent, 2004: 18). Quartz flakes were also used to fashion points for fishing spears (Byrne and Nugent, 2004:35). Fish traps were constructed in the river areas to provide a regular source of food. The bags and nets that were regularly used were made from such resources as spun bark fibre and the hair of small marsupials, spun by a small wooden spindle with a hook at one end (Klaver and Heffernan, 1991).

The Biripi traditional country covered a number of different landforms, each with its own resources. As well as undulating bush areas and open woodland plain, there were also bands of rainforest along the Manning River, which was a major water source and an important cultural element within the Biripi landscape. Major creeks flowing from the Manning River were utilised as pathways and resource gathering areas. Vegetation along the Manning River included cedars, fig trees, tamarind trees, ferns, vines and shrubs. Swamps areas close to the Manning River and along the eastern coastline were also resource rich areas that were regularly utilised. Ethnographic recordings refer to the islands located in the estuary being frequented, with known camps present on Oxley Island (Byrne and Nugent, 2004: 16).

Registered sites across the Biripi area attest to the use of the wider landscape, both inland and coastal, in the Aboriginal past. Site types predominantly include artefact scatters across the wider area and shell middens along the coast. The middens attest to the use of coastal resources such as oysters for food, with the refuse deposited following meals accumulating over long periods of time into the remnant deposits. Artefact scatters attest to both the production and use of stone tools, with uses including hunting and preparing animals for food as well as preparing their skins for clothing. Stone tools were hafted to wood and were also often used to shape other wooden implements, such as clubs, spears, spear throwers and boomerangs. Other tools included tomahawks, nulla nullas and shields (Klaver and Heffernan, 1991; Byrne and Nugent, 2004: 35).

One site previously identified as a traditional camping area at Saltwater, to the south of Old Bar, was noted as a place of continuity for the local Aboriginal community, as it was used over thousands of years, with recordings of contemporary community use as well within the same ancient space (Byrne & Nugent, 2004: 6). Access to traditional Dreaming locations became restricted, as did access to resources, due to encroaching settlement. Other elements within the landscape were imbued with cultural significance on into contemporary times, as local resident Ella Simon described of her experiences growing up in the area in the early 1900s. She noted that she was told that a rock in Wallis Lake was the embodiment of a clever woman, known as ‘Granny Rock’, and that heavy rain would result from touching a forbidden mangrove tree on the beach, an isolated growth near Blackhead (Simon, 1987).

Some information was recorded about the ceremonial life of the Biripi people by early settlers, describing totemic beliefs and practices. This included a description of a cabra ground used for male initiation, an area that consisted of two rings surrounding carved trees. The bark of the trees was described as especially carved for such ceremonies with the ritual musical instrument known as a bull roarer used during the initiation. Corroborees were also known to occur, with fires and dancing described, prior to 1900 (Byrne and Nugent, 2004: 33-34). Male initiation rites in pre-contact times included body scarification and the knocking out of a boy’s front tooth (Byrne & Nugent, 2004: 46). Women were described as wearing cloaks made from animal skins, while men wore waist bands. Other cultural decoration included tattoos, nose piercings with bone adornments, body painting, hair styling and headdresses (Klaver and Heffernan, 1991).

The Dreaming was understood in traditional Biripi culture as the time when Ancestral Beings shaped the landscape. Totems were used by the Biripi as classifications that tied people to the plants and animals of the natural world. Some totems that were used included the crab, shark, eagle, stingray, kangaroo, bass and porpoise. Those people belonging to a particular totem were forbidden to hunt or eat that animal and performed ceremonies related to its protection. Totemic groups also defined lineage and family history, as well as how different totemic groups interacted with each other (Robinson, 2011).

Burial practices varied over time and from location to location, with burial grounds having been described along waterways such as Koala Creek, between the Cross and Bully Mountains, in dunes, and later in historic cemeteries. Oral history described a burial ground in Wingham where Aboriginal warriors and elders were buried in a sitting position (Klaver & Heffernan, 1991). Grave robbing is known to have occurred in the area, perpetrated by early settlers and explorers claiming ethnographic research as their motivation (Byrne and Nugent, 2004).

The first white explorers moved through Biripi country in 1818, with settlement following soon after. Radical changes to Aboriginal life started around 1826 in the Manning Valley, accelerating from the 1830s to the 1860s. Steel fish hooks were an early commodity of trade, adopted readily by Aboriginal people across the area (Byrne and Nugent, 2004: 17). Tobacco, tea, rum and steel hatchets were other items traded between the settlers and the Biripi people (Byrne and Nugent, 2004: 24). As contact increased conflict also resulted, with at least two massacres in the area, the first in 1835 at Belbora, where damper laced with dingo poison was given to Aboriginal people, the second in the same year, when a group of Aboriginal people were driven off a cliff at Mount McKenzie, near the headwaters of the Gloucester River, now part of the Barrington Tops National Park (Byrne & Nugent, 2004: 22).

By the 1880s access to traditional resource areas had been restricted by the settlers and Aboriginal people became increasingly dependent on work from the invading economy, working as labourers for farmers and cedar getters. At the same time segregation became institutionalised and reserves were set up where Aboriginal people were forced to reside, such as the one at Purfleet established in 1900.

The Biripi area holds numerous post-contact sites, including missions, fringe camp areas at the edges of Taree and Wingham and the reserve at Purfleet. These locations are an important reflection of the changed lifestyles in the historical period as Aboriginal people were excluded both from the majority of their former country and from the settler community. Aboriginal community focus was instead contained within new areas that were defined by the invaders rather than being attached to cultural significance (Byrne and Nugent, 2004: 6). Oral history records demonstrate that these camps and settlements were still surrounded by circles used as traditional country, defined in one study as “backyard zones” and regarded as extensions of the camps and settlements (Byrne and Nugent, 2004: 123). Despite the impact that settlers had on traditional culture, it has continued to survive through the Aboriginal people that still live in the area today.

5 ARCHAEOLOGICAL CONTEXT

A review of the archaeological literature of the region, and more specifically the Branxton area and the results of an OEH AHIMS search provide essential contextual information for the current assessment. Thus, it is possible to obtain a broader picture of the wider cultural landscape highlighting the range of site types throughout the region, frequency and distribution patterns and the presence of any sites within the project area. It is then possible to use the archaeological context in combination with the review of environmental conditions to establish an archaeological predictive model for the project area.

5.1 REGIONAL ARCHAEOLOGICAL CONTEXT

No regional based archaeological assessments were available and as such a general broad based regional archaeological context and summary is provided. In summary, despite the recognised limitations of utilising previous studies as the basis for generalisations regarding archaeological patterning, the following broad predictions can be made for the region:

- a wide variety of site types are represented in the project area with open campsites and isolated artefacts by far the most common;
- lithic artefacts are primarily manufactured from mudstone and silcrete with a variety of other raw materials also utilised but in smaller proportions;
- sites in proximity to ephemeral water sources or located in the vicinity of headwaters of upper tributaries (1st order streams) have a sparse distribution and density and contain little more than a background scatter;
- sites located in the vicinity of the upper reaches of minor tributaries (2nd order streams) also have a relatively sparse distribution and density and may represent evidence of localised one-off behaviour;
- sites located in the vicinity of the lower reaches of tributaries (3rd order creeks) have an increased distribution and density and contain evidence that may represent repeated occupation or concentration of activity;
- sites located in the vicinity of major tributaries (4th and 5th order streams/rivers) have the highest distribution and densities. These sites tend to be extensive and complex in landscapes with permanent and reliable water and contain evidence representative of concentrated activity; and
- sites located within close vicinity at the confluence of any order stream may be a focus of activity and may contain a relatively higher artefact distribution and density.

Within the region, a broad range of site types are represented including artefact scatters, isolated artefacts, scar trees, grinding grooves and water holes. Within the areas covered by the regional studies, the range of available landforms has been sampled. In regional terms, site distribution is extremely closely linked to topography, with elevated landforms with access to reliable water exhibiting the highest concentrations of sites.

However, it must be emphasised that the vast majority of the areas assessed by the afore-mentioned regional studies are in a variety of topographic and geological contexts and some vary considerably from the specific project area which is located in an alluvial context. Thus, whilst a number of trends have been identified, the relevance of these patterns for the specific project area is limited.

There are a number of factors which affect site location and that are beyond human control. Shelter sites, grinding grooves and engravings are site types typical of the "sandstone country" however, their presence is limited to areas containing suitable sandstone outcrops and therefore such sites are not expected within an alluvial context such as the project area

5.2 OEH ABORIGINAL HERITAGE INFORMATION MANAGEMENT SYSTEM

MCH note that there are many limitations with an AHIMS search. Firstly, site coordinates are not always correct due to errors and changing of computer systems at OEH over the years that failed to correctly translate old coordinate systems to new systems. Secondly, OEH will only provide up to 110 sites per search, thus limiting the search area surrounding the project area and enabling a more comprehensive analysis and finally, few sites have been updated on the OEH AHIMS register to notify if they have been subject to a s87 or s90 and as such what sites remain in the local area and what sites have been destroyed, to assist in determining the cumulative impacts, is unknown.

In addition to this, other limitations include the number of studies in the local area. Fewer studies suggest that sites have not been recorded, ground surface visibility also hinders site identification and the geomorphology of the majority of NSW soils and high levels of erosion have proven to disturb sites and site contents, and the extent of those disturbances is unknown (i.e. we do not know if a site identified at the base of an eroded slope derived from the upper crest, was washed along the bottom etc: thus, altering our predictive modelling in an unknown way). Thus, the OEH AHIMS search is limited and provides a basis only that aids in predictive modelling.

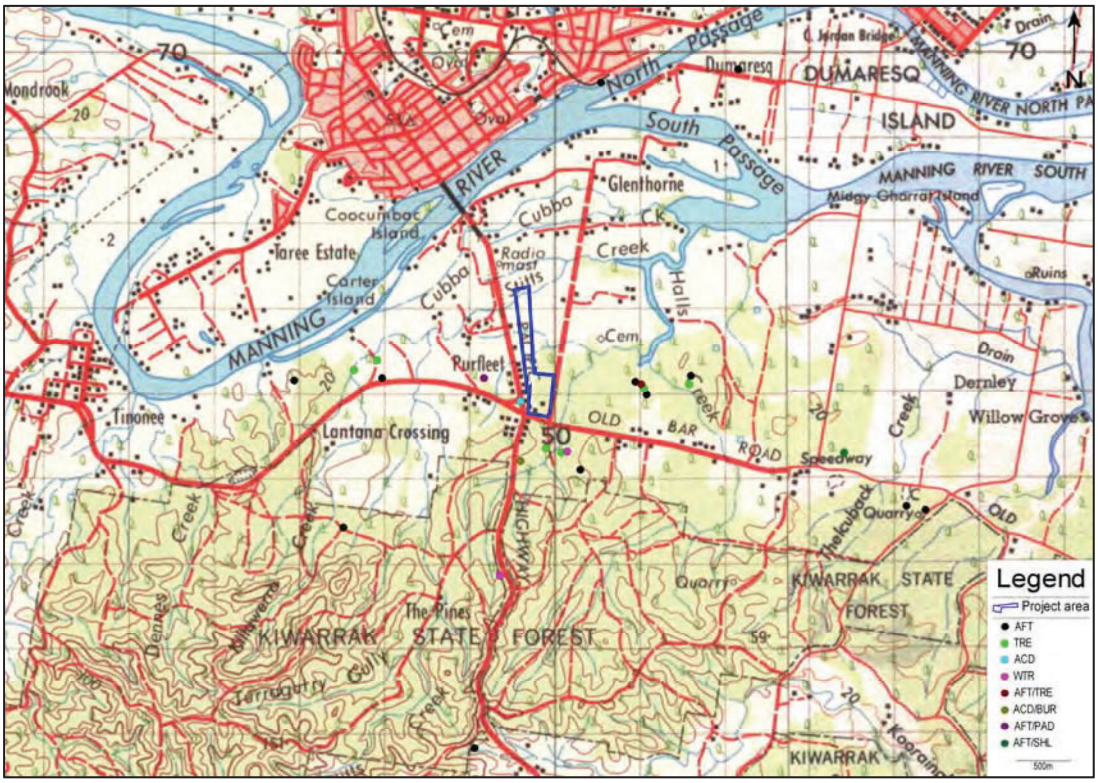
The new terminology for site names including (amongst many) an 'artefact' site encompasses stone, bone, shell, glass, ceramic and/or metal and combines both open camps and isolated finds into the one site name. Unfortunately, this greatly hinders in the predictive modelling as different sites types grouped under one name provided inaccurate data.

A search of the OEH AHIMS register has shown that 26 known Aboriginal sites are currently recorded within five kilometres of the project area. The AHIMs results are summarised in Table 5.1 (provided in full in Appendix B*)* and the location of sites is shown in Figure 5.1.

Table 5.1 Summary of AHIMS sites

Site type	Frequency	Percent
SHL/AFT	1	3.8%
TRE	7	26.9%
AFT/TRE	1	3.8%
AFT	12	46.2%
ACD	1	3.8%
ACD/BUR	1	3.8%
WTR	2	7.7%
AFT/PAD	1	3.8%
Subtotal	**26**	**100.0%**

Figure 5.1 Known sites



5.3 LOCAL ARCHAEOLOGICAL CONTEXT

The previous archaeological assessments pertaining to the local area have been undertaken in relation to environmental assessments for developments. The investigations indicate differing results and observations based on surface visibility and exposure, alterations to the landscape (including farming, residential development, roadworks and flooding), proximity to water sources and geomorphology. The reports available from OEH are discussed below.

Rich (1990a) undertook a management study of Aboriginal historic sites located in north east NSW. The resulting report clarified that the work was intended as an early step in coming to terms with the nature, scope and significance rather than being a definitive study of all sites. The study area, defined as being north east NSW, was divided into six smaller sub regions, being the Hunter Valley, the Tamworth – Quirindi region, the North West Slopes, the Northern Tablelands, the Mid North Coast and the Far North Coast. The work of identifying sites was undertaken via literature review, reference to the NPWS sites register, historic research of secondary sources and consultation with Aboriginal people. The focus was on historic Aboriginal sites, including such site types as contact, mission, massacre, reserve, station and cemetery. This research resulted in the identification of 311 potential historic Aboriginal sites in the study area. The potential sites that were identified included six first contact sites, nine food places, one quarry, three belief sites, 30 ceremonial sites, eight tribal battle sites, seven traditional style burials, 20 Aboriginal burial grounds, four Aboriginal burials in white cemeteries, four Aborigines killed sites, 38 Aborigines massacred sites, 26 whites killed sites, three whites massacred sites, five warfare structure sites, 14 contact and invasion period camp sites, 45 fringe and station camp sites, two house sites, three pre 1880 reserve and mission sites, 14 managed station sites, 66 pre 1950 reserve sites, 32 post 1950 reserve sites, 26 rural employment sites, three industrial employment sites, one courthouse, five homes/orphanages, two Native Police depot sites, one Police Tracker station, 15 schools and two other institution sites. Rich stated that the site labels used to categorise these locations was suggestive only. Rich noted that the number of potential site features added up to 389, but many of these features were grouped within a single location, making the total number of site locations 311. Rich noted that there had been no previous discussion on assessing the significance of historic Aboriginal sites and based discussion on factors including the significance to Aboriginal people, representativeness, potential for research, creative or technical accomplishment, landscape setting and public significance. Significance assessments varied across the types of sites, as did site registration since some locations had physical remains whereas others were locations of past events without tangible physical links. It was concluded that there were places where Aboriginal people had modified and altered their culture to adapt to white invasion, but that their culture continued to be distinct from White Australia with considerable scope for further research on Aboriginal culture, history and associated sites. Rich recommended that if new legislation were adopted that the definition of an Aboriginal site should be amended to include Aboriginal places of special significance, resource places, cultural heritage items reported in literature or by Aboriginal people and deposits, objects or material evidence relating to Aboriginal habitation. It was recommended that handicrafts made for sale that were more than 50 years old should be given protection along with resource places and sites without any apparent physical remains but which had been identified by literature references or by Aboriginal people. It was further recommended that appropriate indexing within the NPWS sites database, inclusion of sites in environmental impact studies and planning studies be undertaken.

Rich (1990b) undertook an archaeological survey of a proposed road alignment known as the Taree Traffic Relief Route. The road deviation was proposed to be undertaken off the existing Old Bar Road located to the north of Purfleet. The purpose of the road deviation was to allow traffic on the Pacific Highway to bypass Taree. The design had also been undertaken to increase safety by removing some of the sharp bends which were present in the existing section of the Pacific Highway. The study area comprised a section of road alignment located to the south-east of Taree on the mid-north coast of NSW, assessed to a width of 400 metres along its extent.

The topography of the study area included ranges, low hills and floodplain. It also included Dumaresq Island, situated within the Manning River. The underlying geology consisted of the Koorainghat Beds and the Belbora Beds, which included sandstone, shale, laminite, greywacke and tuff. The proposed route crossed over the Manning River and Ghinni Ghinni Creek. It was also located in proximity to Halls Creek (but did not cross its extent). Swamp land and unnamed tributaries were also present. Although vegetation had been cleared throughout the larger area, with logging a known past activity, there were a variety of species and extant mature vegetation present at the time of this assessment. These included stringybarks and casuarinas as well an understorey of geebung shrubs and grasses.

A search of the AHIMS register identified 36 sites from an area of approximately 110 square kilometres, stretching from Nabiac and Diamond Beach in the south to Diamond Head and South Brother in the north. The identified sites included modified trees, stone arrangements, burials and middens as well as ceremonial and mythological sites. No previously recorded sites were present within the bounds of the study area.

The survey identified 12 sites (Table 5.2) and two European historic sites were also noted (two timber getter tree stumps and the old Ghinni Ghinni post office). It was noted that vegetation cover had limited the ground surface visibility during the survey and that it was likely that other sites could occur within the study area.

Table 5.2 Summary of sites (Rich 1990b)

Site	Site type	Landform	Distance to water	Stream order	Artefacts /features	Disturbance	Subsurface potential
Site 1: Blue Hole	waterhole and washing area	spur slope	0 m	not provided	swimming/ washing hole	fire trail and quarrying	no
Site 2: Purfleet Cemetery	burials	flat	80 m	unnamed creek	cemetery	burials	no
Site 3	modified tree and water hole	not provided	40 m	unnamed tributary of Halls Creek	1 scar on bloodwood tree and water hole 10 m away	not provided	no
Site 4	modified tree	hillslope	100 m	unnamed tributary of Halls Creek	1 scar on grey gum	white ants	no
Site 5: Gillawarra Campsite and Corroboree Ground	ceremonial	Foot slope	5 m	Halls Creek estuary	ampsite and corroboree ground	not provided	no
Site 6	artefact scatter and modified tree	creek bank	immediately adjacent	Halls Creek	13 artefacts & 1 scar on bloodwood tree	vegetation clearance	yes
Site 7	modified trees	low lying swamp	0 m	swamp associated with Halls Creek	3 paperbark modified trees	not provided	no
Site 8	artefact scatter	spur	5-250 m	Halls Creek	18	track	yes
Site 9	artefact scatter	ridge	0-200 m	Halls Creek	25	vegetation clearance & track	yes
Site 10	modified tree	ridge	300 m	Halls Creek	2 scars	not provided	no
Isolated Find Kiwarrak Rest Area	isolated artefact	ridge	1.8 km	Koorainghat Creek	1 mudstone flake with use wear & retouch	roadway	no
Possible Canoe Tree	possible modified tree	not provided	250 m	Ghinni Ghinni Creek	1 x 3m long scar	vegetation clearance	not provided

Site 2 (Purfleet cemetery), Site 5 (Gillawarra historic campsite) and Site 9 (especially the section of it on the spur north of the survey line) were assessed as being of high significance. Site 1 (Blue Hole), Site 3 (modified tree with possible historical association), Site 6 (artefact scatter with modified tree) and Site 7 (modified trees) were defined as having moderate significance. Modified tree Sites 4 and 10 and artefact scatter Site 8 were defined as being of low significance.

Based on the findings Rich recommended that the Traffic Relief Route should be redesigned and repositioned to the west of Site 1 (Blue Hole), east of Site 2 (Purfleet cemetery), east of Site 3 (modified tree), and south of the slashed survey line from 40 metres to the south of Halls Creek to 900 metres north of Halls Creek in order to protect Sites 5, 6, 7 and the densest part of Site 9. It was recommended that if possible Sites 4 and 10 should be avoided. An application for a permit to destroy the remainder of sites was stated as required prior to works commencing, with such mitigation measures as monitoring and the surface collection of the isolated artefact site to be considered. It was further recommended that if any further sites were found during monitoring they should be salvaged.

Collins (1998) undertook an archaeological survey of a study area proposed for impacts associated with a realignment of the Pacific Highway. The realignment was proposed to bypass the village of Coopernook and create a new crossing of the Lansdowne River approximately 21 kilometres to the north of Taree on the NSW mid-north coast. A large quantity of fill was needed to form the planned dual carriageway embankments and it was proposed that these should come from the cut batters on the Taree Bypass to the south of Purfleet. The topography of the study area consisted of a moderate to steep ridge system with slopes, crests and a ridgeline which formed the watershed between creeks flowing northward into the Manning River and creeks flowing south into Khappinghat Creek. The underlying geology consisted of Carboniferous sedimentary rocks of the Koorainghat Beds which contained lithic sandstone, greywacke, laminite, tuff and shale. Vegetation in the study area included regenerated grassland and open dry sclerophyll forest dominated by grey gum, grey ironbark, forest oak, spotted gum, white mahogany, blady grass, bracken fern and introduced species like lantana and paspalum. A search of the AHIMS register identified 13 sites within a five-kilometre radius of the study area. These included artefact scatters, modified trees, an isolated artefact and post-contact sites. One unregistered isolated artefact was identified within the study area, but outside the proposed area of impact. It was predicted that sites likely to occur in the study area included quarries (due to the presence of raw material outcrops), artefact scatters and isolated artefacts. Although no quarries were identified the prediction about site likelihood being artefact based proved to be correct. One mudstone core was identified on an upper slope 250 metres form reliable water during the survey and was located outside the project area. As no sites were found within the study area, no site-specific recommendations were necessary. No further survey work or subsurface investigation were considered to be warranted, but it was noted that isolated artefacts could occur in areas where the topsoil was still present, particularly on crests and upper slope landforms. It was recommended that the proposed fill extraction proceed without heritage constraint, with all relevant contractors and employees to be advised of their legal obligations with regard to Aboriginal cultural materials. Stop work procedures were recommended to be instigated should unexpected finds be identified during works.

Leon, Maskin and Donovan (2004) were commissioned to undertake an archaeological investigation of a proposed water main replacement on Old Bar Road between Taree and Old Bar in the mid North Coast region of NSW. The topography of the study area included modified areas, such as existing road corridors, a recreational motor vehicle speedway, a cemetery and residential areas. Vegetation had been cleared in the study area, but examples of open forest system were present in the surrounding region. A search of the AHIMS register identified 22 sites within five kilometres of the study area and included artefact scatters and middens. It was predicted that site types such as artefact scatters, middens, modified trees and ceremonial areas could be present in the study area.

Two new sites were identified, conforming to aspects of the predictive model. The survey results are summarised below in Table 5.3.

Table 5.3 Summary of sites (Leon, Maskin and Donovan 2004)

Site	Site type	Landform	Distance to water	Stream order	Artefacts /features	Disturbance	Subsurface potential
WMR Old Bar 1	isolated artefact	slope	not provided	not provided	1	road & cemetery	no
WMR Old Bar 2	isolated artefact	slope	not provided	not provided	1	road & cemetery	no

It was recommended that the identified sites be protected, with permits required if any impacts to them were proposed to occur. Stop work procedures were recommended should any unexpected finds be identified during works.

Irish (2006) undertook an Aboriginal archaeological survey and heritage impact assessment for a study area totalling 11 hectares in size. This study area was proposed for the development of a highway service centre. The study area was located adjacent to the Pacific Highway Interchange approximately four kilometres to the south-southeast of Taree on the mid-north coast of NSW. The topography consisted of floodplain to the north and a broadly east-west tending ridge to the south. The study area was in the northern foothills of this ridge, on the western side of a low spur separating the course of two tributaries of Halls Creek, flowing north into the Manning River. The closest watercourse was the western tributary known as Wollards Creek, with Kooringhat Creek also in the vicinity. The underlying geology consisted of the Carboniferous Period sediments of the Kooringhat Beds which included lithic sandstone, greywacke, tuff, laminite and shale as well as Belbora Beds which included lithic sandstone, tuff, laminite and agglomerate. Vegetation had been cleared across the study area but was likely to have previously contained eucalypt species, blackbutt, tallowwood, ironbark, mahogany, spotted gum, stringybark, bloodwood, casuarina and acacia. A search of the AHIMS register identified 17 sites within a 10-kilometre radius of the study area. These comprised of eight artefact scatters, five modified trees, two waterholes/wells, one mythological site and one historical cemetery. One site, a post-contact well, was identified as occurring within the bounds of the study area. It was noted that the overall lack of archaeological data made it premature to make predictions about likely Aboriginal site distribution. It was stated that it was unlikely that the subject land was intensively used by Aboriginal people and predicted that only artefact scatter and isolated artefact sites were likely to occur. The survey identified high levels of disturbance across much of the study area from past vegetation clearance, track use, limited earthworks and the natural erosion of soil deposits. Erosion meant that in situ subsurface deposits were unlikely to be extant. One isolated artefact site was identified outside the study area and beyond the proposed area of impact. It was recommended that the previously recorded post-contact well site should be protected from impacts by the retention of a five-metre radius buffer zone. No other archaeological constraints were identified. Purfleet-Taree Local Aboriginal Land Council produced a separate cultural report which further called for avoidance and protection of the isolated artefact identified outside the study area. Stop work procedures and further consultative work were recommended to be undertaken should unexpected finds be identified during works.

5.4 LOCAL & REGIONAL CHARACTER OF ABORIGINAL LAND USE & ITS MATERIAL TRACES

The following is a summary and discussion of previous investigations detailed in Section 5.3. It must be remembered, however, that there are various factors which will have skewed the results as they are in a regional assessment. Therefore, the summary provides an indication of what may be expected in terms of site location and distribution.

- the majority of sites are located within 50 metres of a reliable water source and reduce with distance from water;
- artefact densities are highest within 50 metres of a water source and decrease with distance from water;
- the likelihood of finding sites of any size increases with proximity to water and the likelihood of finding large artefact scatters also increases markedly with proximity to water;
- the main site types are artefact scatters and isolated finds
- the data suggests that elevated landforms in close proximity to water sources were the preferred location for camping, followed by slopes. However, this does not account for vertical movement of artefacts or sites being moved from flooding, flowing creeks etc.
- mudstone, silcrete, chert and tuff are by far the most common raw material types represented at sites in the region. Quartz is the next most frequently in artefact assemblages followed by volcanic materials, porphyry and petrified wood. Siltstone, rhyolite and porcellanite are relatively rare.
- flakes, broken flakes and flaked pieces are the most common artefact types recorded
- the vast majority of artefactual material in the region was observed on exposures with good to excellent ground surface visibility. The likelihood of finding artefacts surrounding these exposures is reduced due to poor visibility. The site area is often given as the area of exposure. Hence, it is inappropriate to attempt to draw any conclusions regarding site extent based on current information; and
- the majority of sites have been impacted by past land uses, some with significant impacts to the archaeological record (i.e. excavation works), others minimal impact (tracks).

Based on information gained from previous studies within a five kilometre radius of the project area, it can be expected that:

- the likelihood of locating sites increases with proximity to water;
- the likelihood of finding large sites increases markedly with proximity to water;
- a variety of raw materials will be represented though the majority of sites will be predominated by mudstone and silcrete;
- a variety of artefact types will be located though the majority will be flakes, flaked pieces and debitage;
- grinding grooves will be located along or near water sources;
- the likelihood of finding scarred trees is dependent on the level of clearing in an area’ and
- the majority of sites will be subject to disturbances including human and natural.

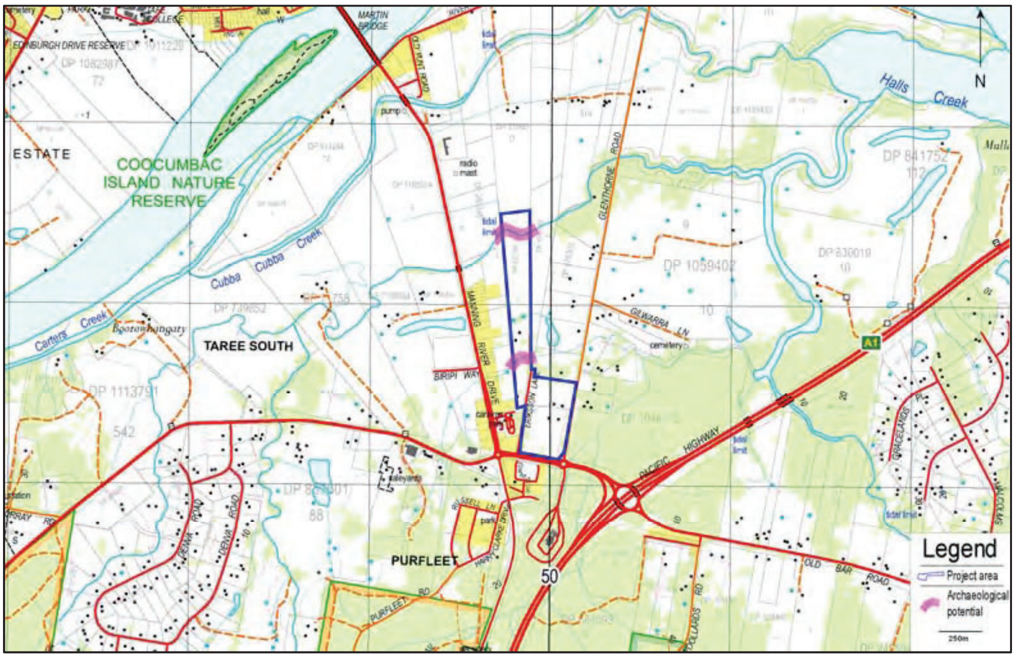
These findings are consistent with models developed for the area.

5.5 PREDICTIVE MODEL FOR THE PROJECT AREA

Due to issues surrounding ground surface visibility and the fact that the distribution of surface archaeological material does not necessarily reflect that of sub-surface deposits, it is essential to establish a predictive model.

Previous archaeological studies undertaken throughout the region, the OEH AHIMS register and the environmental context provide a good indication of site types and site patterning in the area. This research has shown that occupation sites (artefact scatters and isolated finds) are the most frequently recorded site type and are commonly located along or adjacent to watercourses, and on relatively flat to gently sloping topography in close proximity to reliable water. Sites with higher artefact densities are similarly concentrated within fifty metres of watercourses. Within the local area, previous assessments within a similar environmental context indicate that, within a well-watered context, there is high potential for archaeological material to be present on level, typically well-elevated landforms that provide ready access to low-lying waterlogged areas and the associated resources. Within the specific project area, the landscape would have provided some subsistence resources during times of heavy rain, which was likely suited to small scale camping by small groups of people over short periods of time as well as hunting and gathering and travel to the more reliable Manning River. It is possible that isolated finds and small density artefacts scatters maybe located along and within 50 metres of Stitts Creek and the 2nd order creek in the south of the project area (Refer to Figure 5.2). The refinement of this predictive model will be dependent upon an investigation of the range of landforms and the occurrence of modern disturbances within the project area.

Figure 5.2 Archaeological potential



5.6 ARCHAEOLOGICAL POTENTIAL IN THE PROJECT AREA

Based on archaeological sites registered in the region and the results of past archaeological studies, two sites types are likely to occur throughout the project area:

- **Artefact scatters**

Also described as open campsites, artefact scatters and open sites, these deposits have been defined at two or more stone artefacts within 50 metres of each other and will include archaeological remains such as stone artefacts and may be found in association with camping where other evidence may be present such as shell, hearths, stone lined fire places and/or heat treatment pits. These sites are usually identified as surface scatters of artefacts in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing, grazing) and access ways can also expose surface campsites. Artefact scatters may represent evidence of;

- Large camp sites, where everyday activities such as habitation, maintenance of stone or wooden tools, manufacturing of such tools, management of raw materials, preparation and consumption of food and storage of tools has occurred;
- Medium/small camp sites, where activities such as minimal tool manufacturing occurred;
- Hunting and/or gathering events;
- Other events spatially separated from a camp site, or
- Transitory movement through the landscape.

Artefact scatters are a common site type in the locality and the broader region. There is potential for artefact scatters to occur within the project area within 50 metres of Stitts Creek and the 2nd order creek in the southern half of the project area.

There is also the potential for such sites to be impacted on through past impacts including previous clearing and flooding.

- **Isolated finds**

Isolated artefacts are usually identified in areas where ground surface visibility is increased due to lack of vegetation. Erosion, agricultural activities (such as ploughing) and access ways can also expose surface artefacts. Isolated finds may represent evidence of;

- Hunting and/or gathering events; or
- Transitory movement through the landscape.

Isolated finds are a common site type in the locality and the broader region. There is potential for isolated artefacts to occur across the project area and across all landforms. There is also the potential for such sites to be impacted on through past impacts including previous clearing and flooding.

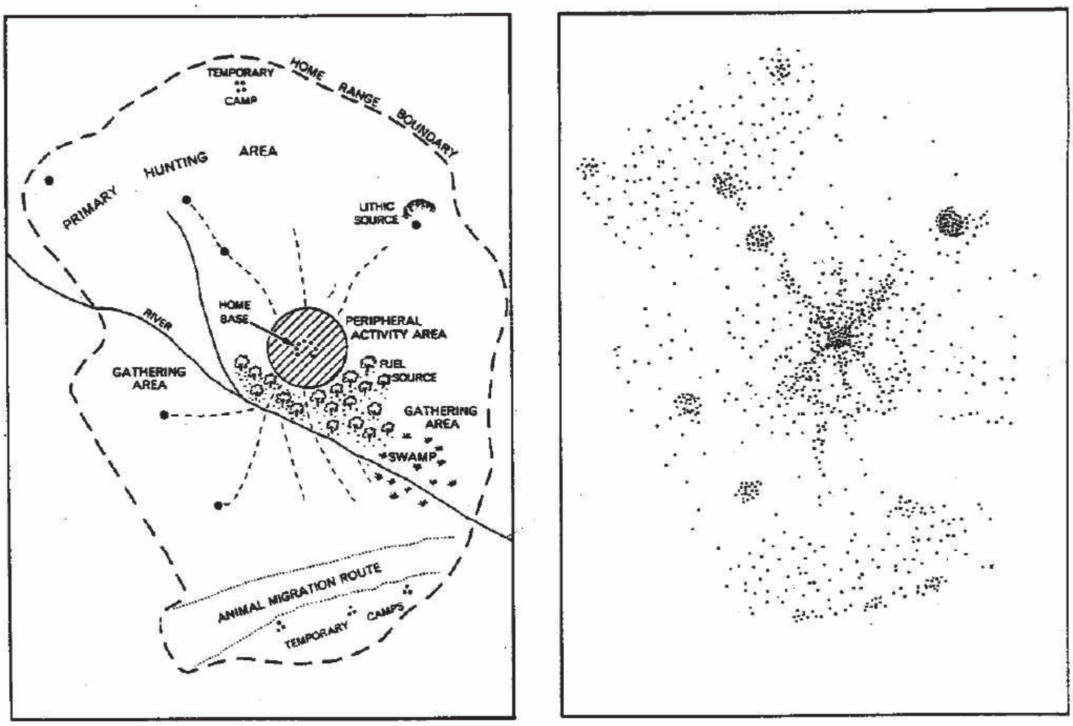
5.7 HERITAGE REGISTER LISTINGS

The State Heritage Register, the Australian Heritage Database (includes data from the World Heritage List UNESCO, National Heritage List, Commonwealth Heritage List, Register of the National Estate) and the MidCoast Local Environmental Plan have no sites listed. However, not all indigenous places are listed, and the Heritage Commission is consulting with Traditional Owners to gradually include indigenous information.

5.8 MODELS OF PAST ABORIGINAL LAND USE

The main aim of this project is to attempt to define both the nature and extent of occupation across the area. As a result, the nature of the analysis will focus on both the landform units and sites. The purpose of this strategy is to highlight any variations between sites and associated assemblages, landforms and resources across the area treating assemblages as a continuous scatter of cultural material across the landscape. In doing this, it is possible to identify variation across the landscape, landforms and assemblages that correspond with variation in the general patterns of landscape use and occupation. Thus, the nature of activities and occupation can be identified through the analysis of stone artefact distributions across a landscape. A general model of forager settlement patterning in the archaeological record has been established by Foley (1981). This model distinguishes the residential 'home base' site with peripheral 'activity locations'. Basically, the home base is the focus of attention and many activities and the activity locations are situated away from the home base and are the focus of specific activities (such as tool manufacturing). This pattern is illustrated in Figure 5.3. Home base sites generally occur in areas with good access to a wide range of resources (reliable water, raw materials etc). The degree of environmental reliability, such as reliable water and subsistence resources, may influence the rate of return to sites and hence the complexity of evidence. Home base sites generally show a greater diversity of artefacts and raw material types (which represent a greater array of activities performed at the site and immediate area). Activity locations occur within the foraging radius of a home base camp (approximately 10 km); (Renfrew and Bahn 1991). Based on the premise that these sites served as a focus of a specific activity, they will show a low diversity in artefacts and are not likely to contain features reflecting a base camp (such as hearths). However, it is also possible that the location of certain activities cannot be predicted or identified, adding to the increased dispersal of cultural material across the landscape. If people were opting to carry stone tools during hunting and gathering journeys throughout the area rather than manufacturing tools at task locations, an increased number of used tools should be recovered from low density and dispersed assemblages.

Figure 5.3 Foley's model (L) and its manifestation in the archaeological record (R), (Foley 1981).



6 RESULTS

6.1 METHODOLOGY

The survey areas were surveyed on foot by the in accordance with the proposed methodology provided to the stakeholders for review and approved. The survey included transects at approximately 2 metres apart walked in an east/west direction across the entire project area and focused on areas of high ground surface visibility and exposures (erosional features, creek banks, tracks, cleared areas).

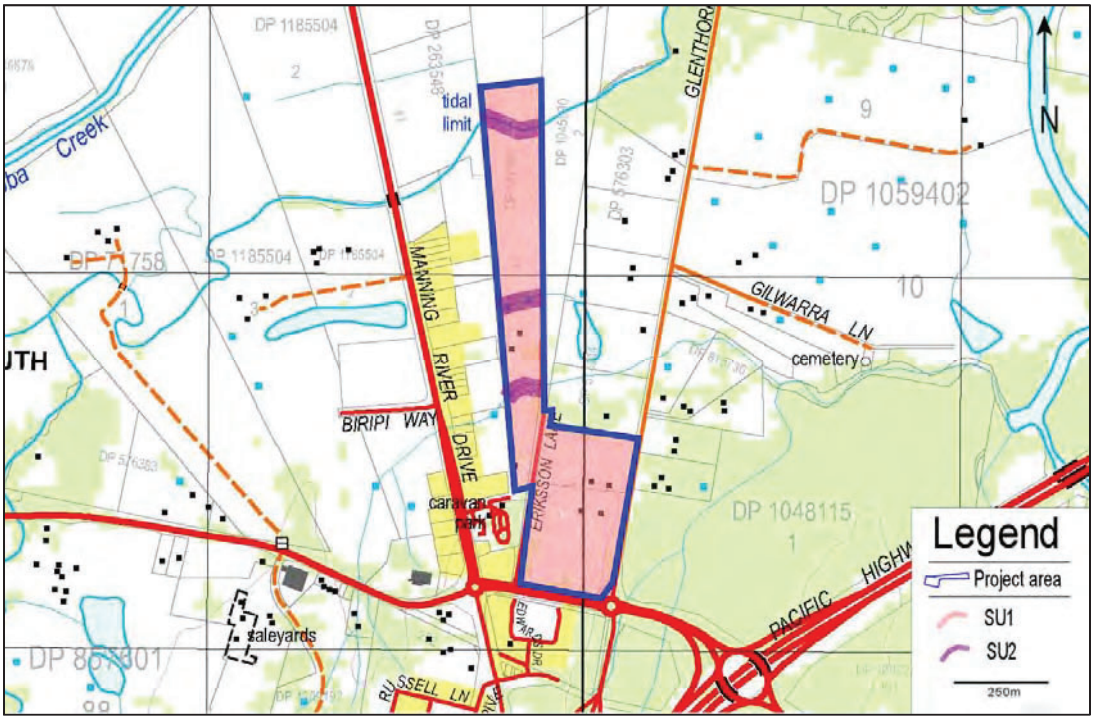
6.2 LANDFORMS

McDonald et al (1998) describes the categories of landform divisions. This is a two layered division involving treating the landscape as a series of 'mosaics'. The mosaics are described as two distinct sizes: the larger categories are referred to as landform patterns and the smaller being landform elements within these patterns. Landform patterns are large-scale landscape units, and landform elements are the individual features contained within these broader landscape patterns. There are forty landform pattern units and over seventy landform elements. However, of all the landform element units, ten are morphological types. For archaeological investigations they divide the landscape into standardised elements that can be used for comparative purposes and predictive modelling. As outlined in Section 3, the project area includes two landforms: gentle slopes and drainage lines.

6.3 SURVEY UNITS

For ease of management, the project area was divided into 2 Survey Units (SUs) that were based on landforms (Refer to Figure 6.1).

Figure 6.1 Survey Units



Survey Unit 1 Slopes

The slopes of the project area had been subject to previous large-scale clearing, grazing and agricultural practices as evident by deteriorated ridges and furrows. Currently used for grazing, there are residential houses, and associated infrastructure and utilities. A large dam is located roughly through the centre of the project area and additional disturbances include tracks and fencing. Vegetation is predominantly pasture grass with few trees in some areas which contributed to reduced ground surface visibility. Exposures were low to moderate and no raw materials usually transported into the area and utilised for stone tool manufacture were present or visible. Examples of this survey unit are provided in Figure 6.2.

Figure 6.2 Examples of vegetation and disturbances

Survey Unit 2 drainage lines

This drainage lines included up to 10 metres both sides of all drainage lines. The 1st order drainage line located roughly through the centre of the project area has been significantly impacted by the dam construction, clearing and grazing and the 2nd order located towards the south has been impacted by clearing, grazing, road and dam construction. The northern Stitts Creek appears to remain relatively undisturbed ad forms part of a flood plain. Examples of this survey unit are provided in Figure 6.2.

6.4 EFFECTIVE COVERAGE

Effective coverage is an estimate of the amount of ground observed taking into account local constraints on site discovery such as vegetation and soil cover. There are two components to determining the effective coverage: visibility and exposure.

Visibility is the amount of bare ground on the exposures which may reveal artefacts or other cultural materials, or visibility refers to 'what conceals'. Visibility is hampered by vegetation, plant or leaf litter, loose sand, stony ground or introduced materials (such as rubbish) On its own, visibility is not a reliable factor in determining the detectability of subsurface cultural materials (DECCW 2010/783:39).

The second component in establishing effective coverage is exposure. Exposure refers to 'what reveals'. It estimates the area with a likelihood of revealing subsurface cultural materials rather than just an observation of the amount of bare ground. Exposure is the percentage of land for which erosion and exposure is sufficient to reveal cultural materials on the surface (DECCW 2010/783:37). The effective coverage for the project area was determined for both visibility and exposure ratings and Table 6.1 details the visibility rating system used.

Table 6.1 Ground surface visibility rating

Description	**GSV rating %**
Very Poor – heavy vegetation, scrub foliage or debris cover, dense tree of scrub cover. Soil surface of the ground very difficult to see.	0-9%
Poor – moderate level of vegetation, scrub, and / or tree cover. Some small patches of soil surface visible in the form of animal tracks, erosion, scalds, blowouts etc, in isolated patches. Soil surface visible in random patches.	10-29%
Fair – moderate levels of vegetation, scrub and / or tree cover. Moderate sized patches of soil surface visible, possibly associated with animal, stock tracks, unsealed walking tracks, erosion, blow outs etc, soil surface visible as moderate to small patches, across a larger section of the project area.	30-49%
Good – moderate to low level of vegetation, tree or scrub cover. Greater amount of areas of soil surface visible in the form of erosion, scalds, blowouts, recent ploughing, grading or clearing.	50-59%
Very Good – low levels of vegetation / scrub cover. Higher incidence of soil surface visible due to recent or past land-use practices such as ploughing, mining etc.	60-79%
Excellent – very low to non-existent levels of vegetation/scrub cover. High incidence of soil surface visible due to past or recent land use practices, such as ploughing, grading, mining etc.	80-100%
Note: this process is purely subjective and can vary between field specialists, however, consistency is achieved by the same field specialist providing the assessment for the one project area/subject site.	

As indicated in *Table 6.2*, the effective coverage for project area illustrates that overall effective coverage was low at 13.39% with grass being the limiting factor and erosion across the project area is minimal. The disturbances included clearing, fences, grazing, past ploughing, residential and associated infrastructure and utilities, all of which have impacted upon the landscape and associated cultural materials.

Table 6.2 Effective coverage for the investigation area

SU	**Landform**	**Area (m2)**	**Vis. %**	**Exp. %**	**Exposure type**	**Previous disturbances**	**Present disturbances**	**Limiting visibility factors**	**Effective coverage (m2)**
1	slope	207,810	15%	90%	erosion, tracks	clearing, ploughing, residential, grazing	residential, grazing, dam	grass	28,054
2	drainage	4,390	10%	80%	erosion, tracks	clearing, dam, grazing	grazing, dam	grass	351
Totals		**212,200**							**28,406**
								Effective coverage %	**13.39%**

The level and nature of the effective survey coverage is considered satisfactory to provide an effective assessment of the Aboriginal sites identified and those potentially present within the investigation area. The coverage was comprehensive for obtrusive site types (e.g. grinding grooves and scarred trees) but somewhat limited for the less obtrusive surface stone artefact sites by surface visibility constraints that included vegetation cover and minimal exposures.

In view of the predictive modelling (Section 5) and the results obtained from the effective coverage, it is concluded that the survey provides a valid basis for determining the probable impacts of the proposal and formulating recommendations for the management of the identified sites and potential Aboriginal sites.

6.5 ARCHAEOLOGICAL SITES

Sites were labelled according to the project title, e.g. TS/1 where TS represents Taree South, and 1 indicates the site number allocated consecutively.

6.5.1 DEFINITION OF A SITE

A 'site' can be defined by various factors. For this study a 'site' was defined on the combination of the following inter-related factors:

- landform;
- exposure and visibility;
- visible boundaries of artefacts; and
- a feature identified by the Aboriginal community on the basis of their own cultural knowledge and significance.

The 'site area' was defined as the area in which artefacts were observed on a landform, though it must be remembered that this may not represent an accurate picture of site size. Visibility of artefacts is affected by differences in vegetation cover and hence ground surface visibility, as well as the degree of natural and human-induced disturbance.

6.5.2 DEFINITION OF SITE COMPLEX

Site complex refers to sites that occur in groups. For example, complexes may consist of burial grounds and carved trees, artefact scatters that represent different stages of procurement and manufacture or artefact scatters and shell middens. Complexes may also consist of artefact scatters that are connected across a landscape with the scatters being either specific activity centres (such as tool manufacturing sites) or larger base camp areas (with more artefacts and a variety of artefacts).

6.5.3 MAPPING IDENTIFIED SITES

MCH use topographic maps with MGA system 1994 (unless they are new maps produced after 1999 that have used the MG94 system) and our hand held Global Positioning System (GPS) units use MGA. It is important to note that the Global Positioning System is operated by the United States and is subject to changes that may affect the accuracy and performance of all GPS equipment. At present, the hand-held unit operated by MCH have an estimated error of approximately 5-10 metres though this is also dependant on the number of satellites available and detected and other factors such as tree coverage/interference.

6.5.4 SITES IDENTIFIED

No sites were identified during the survey.

6.6 POTENTIAL ARCHAEOLOGICAL DEPOSIT (PAD)

The terms 'Potential Archaeological Deposit (PAD)' and 'area(s) of archaeological sensitivity' are used to describe areas that are likely to contain sub-surface cultural deposits. These sensitive landforms or areas are identified based upon the results of fieldwork, the knowledge gained from previous studies in or around the subject area and the resultant predictive models. Any or all of these attributes may be used in combination to define a PAD.

The likelihood of a landscape having been used by past Aboriginal societies and hence containing archaeologically sensitive areas is primarily based on the availability of local natural resources for subsistence, artefact manufacture and ceremonial purposes. The likelihood of surface and subsurface cultural materials surviving in the landscape is primarily based on past land uses and preservation factors.

Given the known extent and content of sites typically situated on elevated land in close proximity to reliable water sources, the very gentle slope overlooking Stitts Creek and flood plain is likely to have been utilised for small to moderate groups of people for camping. One PAD has been identified and described below.

6.6.1 TS/PAD1

TS/PAD (Figure 6.3) is located in the eastern end of the project area and includes the very gentle slope on the western side of Stitts Creek. The eastern side consists of flood plains and would not have been suitable for camping. The PAD extends from the upper flood plain reaches and for approximately 50 metres. This PAD appears to have been subject to minimal disturbances and is an elevated landform overlooking the Creek (3rd order) and as such has potential to contain in situ cultural materials.

Figure 6.3 ST/PAD 1 location

6.7 DISCUSSION

As no sites have been identified, the results of the investigation are discussed below in terms of overall site integrity, local and regional contexts, and predictive modeling.

6.7.1 INTEGRITY

The integrity of the study area can be assessed only for surface integrity through the consideration of past and present land uses and their impacts. Subsurface integrity can only be assessed through controlled excavation that allows for the examination of both the horizontal and vertical distribution of cultural materials (caused by natural and/or human impacts) and by conjoining artefacts. Land uses and their impacts (clearing, ploughing, building construction, grazing), as well as natural impacts (bioturbation, erosion, flooding), within the project area are considered to range from moderate to high and due to such disturbances, the integrity of the deposits in the project area are disturbed and any sites that may have been present would have been disturbed.

6.8 INTERPRETATION & OCCUPATION MODEL

Given the fact that no sites identified, it is not possible to discuss site interpretation or occupation models.

6.9 REGIONAL & LOCAL CONTEXT

Given the fact that no sites identified, it is not possible to discuss the regional or local archaeological contexts.

6.10 REASSESSMENT OF THE PREDICTIVE MODEL

In view of the survey results, the predictive model of site location can be reassessed for the project area. The potential for artefacts to occur within the project area are is assessed as low or negligible due to the location from reliable water and associated subsistence resources and the impacts from the various land uses.

6.11 CONCLUSION

Sites provide valuable information about past occupation, use of the environment and its specific resources including diet, raw material transportation, stone tool manufacture, and movement of groups throughout the landscape. Previous research has shown that proximity to water was an important factor in past occupation of the area, with sites reducing in number significantly away from water. This research has also shown that occupation sites (artefact scatters and isolated finds) are the most frequently recorded site type and are commonly located along or adjacent to reliable watercourses, and on relatively flat to gently sloping topography in close proximity to reliable fresh water. Sites with higher artefact densities are similarly concentrated within fifty metres of watercourses and decrease with distance from the reliable water source. This is represented in the archaeological record through the lower density of sites and site contents with distance from the water source.

Given that Manning River being approximately 900 metres to the north, it is highly unlikely that the project area would have been favoured for large scale past Aboriginal occupation. Rather, the use of Stitts Creek and associated resources during time of heavy rain was likely to have been suitable for small scale camping en route to the Manning River and this is expressed in the archaeological record as low-density artefact scatters within 50mmetres of reliable water. Additionally, the area may have been utilised as hunting and gathering grounds as well as travel on the way to the Manning River and this type of land use is manifest in the archaeological record as a background scatter, which in this case would have been disturbed through past land uses. The identified PAD may reveal evidence of past Aboriginal land use along Stitts Creek.

7 SIGNIFICANCE ASSESSMENT

7.1 THE SIGNIFICANCE ASSESSMENT PROCESS

One of the key steps in the process of cultural heritage management is the assessment of significance. Not all sites are equally significant and not all are worthy of equal consideration and management (Sullivan and Bowdler 1984; Pearson and Sullivan 1995: 7). The assessment of significance of archaeological sites and resources is defined in most cases by what these entities can contribute to our understanding or knowledge of a place or site. In most cases, it is not possible to fully articulate or comprehend the extent of the archaeological resource at the outset, let alone its value. Therefore, the evaluation of the significance of archaeological material is based on the potential this resource has to contribute to our understanding of the past and the contribution that it can make to our understanding of a place or a cultural landscape.

7.2 BASIS FOR EVALUATION

The significance of archaeological sites or cultural places can be assessed on the criteria of the Burra Charter, the Australian Heritage Commission Criteria of the National Estate, and the OEH guidelines that are derived from the former two. There are two realms of significance assessment:

- Aboriginal cultural significance
- Archaeological (scientific) significance

The Aboriginal cultural significance of the sites or landscape is assessed by the RAPs and the archaeological significance by a qualified archaeologist.

7.3 ARCHAEOLOGICAL (SCIENTIFIC) SIGNIFICANCE

Scientific significance is assessed according to the contents of a site, state of preservation, integrity of deposits, representativeness/rarity of the site type, and potential to answer research questions on past human behaviour (NPWS 1997). For open campsites, evidence required to adequately assess significance includes information about the presence of sub-surface deposits, the integrity of these deposits, the nature of site's contents and extent of the site. A review of information pertaining to previously recorded sites within the local area and region enables the rarity and representativeness of a site to be assessed. High significance is usually attributed to sites that are so rare or unique that the loss of the site would affect our ability to understand an aspect of past Aboriginal use/occupation of an area. In some cases a site may be considered highly significant because its type is now rare due to destruction of the archaeological record through development. Medium significance can be attributed to sites that provide information on an established research question. Low significance is attributed to sites that cannot contribute new information about past Aboriginal use/occupation of an area. This may be due to site disturbance or the nature of the site's contents. In order to clarify the significance assessment, the criteria used are explained below.

7.3.1 RESEARCH POTENTIAL

Research potential refers to the potential for information gained from further investigations of the evidence to be used in answering research questions. Research questions can relate to any number of issues concerning past human material culture and associated behaviour (including cultural, social, spiritual etc) and/or use of the environment. Several inter-related factors to take into consideration include the intactness or integrity of the site, the connectedness of the site to other sites, and the potential for a site to provide a chronology extending back in the past. Several questions are posed for each site or area containing evidence of past occupation:

- Can the evidence contribute information not available from any other resource?
- Can the evidence contribute information not available from any other location or environmental setting?
- Is this information relevant to questions of past human occupation (including cultural, social and/or spiritual behaviour) and/or environments or other subjects?

Assessing research potential therefore relies on comparisons with other evidence both within the local and regional context. The criteria used for assessing research potential include:

- potential to address specific local research questions;
- potential to address specific regional questions;
- potential to address general methodological and theoretical questions;
- potential sub-surface deposits; and
- potential to address future research questions.

The particular questions asked of the available evidence should be able to contribute information that is not available from other resources or evidence and are relevant to questions about past human societies and their material culture. Levels for defining research potential are as follows:

High	Has the potential to provide new information not obtained from any other resource to answer current and/or future research questions.
Medium	Has the potential to contribute significant additional information to answer current and/or future research questions.
Low	Has no potential to contribute significant information to answer current or future research questions.

7.3.2 REPRESENTATIVENESS AND RARITY

Representativeness and rarity are assessed at a local, regional and national level (although assessing at a national level is difficult and commonly not possible due to a lack of national reports and available database). As the primary goal of cultural resource management is to afford the greatest protection to a representative sample of Aboriginal heritage throughout a region, this is an important criterion. The more unique or rare the evidence is, the greater its value as being representative within a regional context.

The main criteria used for assessing representativeness and rarity include:

- the extent to which the evidence occurs throughout the region;
- the extent to which this type of evidence is subject to existing and potential future impacts in the region;
- the integrity of the evidence compared to that at other locations within the region;
- whether the evidence represents a primary example of its type within the region; and

- whether the evidence has greater potential for educational purposes than at other similar locations within the region.

7.3.3 NATURE OF THE EVIDENCE

The nature of the evidence is related to representativeness and research potential. For example, the less common the type of evidence, the more likely it is to have representative value. The nature of the evidence is directly related to its potential to be used in addressing current and/or future research questions. Criteria used in assessing the nature of the evidence include:

- presence, range and frequency of artefacts and artefact types; and
- presence and types of other features.

7.3.4 INTEGRITY

The state of preservation and disturbances of the evidence (integrity) is also related to representativeness and research potential. The higher the integrity (well preserved and not disturbed) of the evidence, the greater the level of information that is likely to be obtained from further study. This translates to greater importance for the evidence within a local and regional context, as it may be a suitable example for preservation/ conservation. The criteria used in assessing integrity include:

- horizontal and vertical spatial distribution of artefacts;
- preservation of intact features such as hearths or knapping floors;
- preservation of site contents such as charcoal which may enable direct dating providing a reliable date of occupation of a given area;
- preservation of artefacts which may enable use-wear/residue analysis to determine tool use and possibly diet; and
- preservation of other cultural materials that may enable interpretation of the evidence in relation to cultural/social behaviour (e.g. burial types and associated mortuary practices may have been based on cultural, social, age, and/or gender distinctions).

Many of these criteria can only be obtained through controlled excavation. Generally high levels of ground disturbance (such as erosion, tracks, dams etc) limit the possibility that an area would unlikely contain intact spatial distributions, intact features, in situ charcoal et cetera.Definitions for defining levels of site integrity and condition have been derived from Witter (1992) and HLA (2002) and are as follows:

Excellent	Disturbance, erosion or development is minimal.
Good	Relatively undisturbed deposits or partially disturbed with an obvious in situ deposit.
Fair	Some disturbance but the degree of disturbance is difficult to assess.
Poor	Clearly mostly destroyed or disturbed by erosion or development.
Very Poor	Sites totally disturbed or clearly not in situ.
Destroyed	A known site that is clearly no longer there.

7.3.5 SCIENTIFIC EVALUATION

The following is an evaluation of the scientific significance of the individual archaeological sites identified within the project area. Table 7.1 presents the archaeological significance assessment for the sites identified.

Table 7.1 Significance assessment

Site	Site Type	Representativeness	Integrity	Res. Pot	Sci. Sig
ST/PAD	PAD	unknown	unknown	unknown	unknown

7.4 CULTURAL SIGNIFICANCE

While Aboriginal sites and places may have scientific significance, they also have cultural/social significance to the Aboriginal people from that area. Determining cultural/social significance can only be determined by the Aboriginal people from the area in which the sites and/or places were identified. Consultation with the Aboriginal community has been undertaken in order to document cultural/social significance and are discussed below.

7.4.1 AESTHETIC SIGNIFICANCE

Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use (Australia ICOMOS 1999:11). Table 7.2 provides information relating to the aesthetic value of the project area and PAD by the RAPs.

Table 7.2 RAPs: Aesthetic values

RAP	
Mick Leon	has not assigned any specific or general aesthetic significance to the project area or PAD
Lee Davison	has not assigned any specific or general aesthetic significance to the project area or PAD

7.4.2 HISTORIC SIGNIFICANCE

The historic value encompasses the history of aesthetics, science and society. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment (Australia ICOMOS 1999:11). Table 7.3 provides information relating to the historic value of the project area and PAD by the RAPs.

Table 7.3 RAPs: Historic values

RAP	
Mick Leon	has not assigned any specific or general historic significance to the project area or PAD
Lee Davison	has not assigned any specific or general historic significance to the project area or PAD

7.4.3 SCIENTIFIC SIGNIFICANCE

The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness, and on the degree to which the place may contribute further substantial information. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the settings are substantially intact, than where it has been changed or evidence does not survive. However, some events or associations may be so important that the place retains significance regardless of subsequent treatment (Australia ICOMOS 1999:11). Table 7.4 provides information relating to the scientific value of the project area and PAD by the RAPs.

Table 7.4 RAPs: Scientific values

RAP	
Mick Leon	has not assigned any specific or general scientific significance to the project area or PAD
Lee Davison	has not assigned any specific or general scientific significance to the project area or PAD

7.4.4 SOCIAL/SPIRITUAL SIGNIFICANCE

Social value embraces the qualities for which a place has become a focus of spiritual, political, national or other cultural sentiment to a majority or minority group (Australia ICOMOS 1999:11). Table 7.5 provides information relating to the social/spiritual value of the project area and PAD by the RAPs.

Table 7.5 RAPs: Social/spiritual values

RAP	
Mick Leon	has not assigned any specific or general social/spiritual significance to the project area or PAD
Lee Davison	has not assigned any specific or general social/spiritual significance to the project area or PAD

8 ASSESSMENT OF IMPACTS

The archaeological record is a non-renewable resource that is affected by many processes and activities. As outlined in Section 3 and 6, the various natural processes and human activities would have impacted on archaeological deposits through both site formation and taphonomic processes. Chapter 4 describes the impacts within the project area, showing how these processes and activities have disturbed the landscape and associated cultural materials in varying degrees.

8.1 IMPACTS

Detailed descriptions of the impacts are provided in Section 1.5 and the results of the survey in Section 6. The OEH Code of Practice for the Archaeological Investigation of Aboriginal Objects in New South Wales (2010:21) describes impacts to be rated as follows:

1) Type of harm: is either direct, indirect or none

2) Degree of harm is defined as either total, partial or none

3) Consequence of harm is defined as either total loss, partial loss, or no loss of value

Table 8.1 Impact summary

Site	**Site type**	**Type of harm**	**Degree of harm**	**Consequence of harm**	**Rep.**	**Integ.**	**Res. Pot**	**Sci. Sig**
PAD	PAD	direct	total	total	unknown	unknown	unknown	unknown

The results of the assessment indicate that the identified ST/PAD1 will be impacted on by any future development. As the nature of the PAD remains unknown at this time, the impacts from any future development on the archaeological record remain unknown.

8.2 CUMULATIVE IMPACTS

The cumulative impact to Aboriginal heritage in the area appears to be limited given that:

- the net development footprint (i.e. the area of direct impact) is small and does not affect a high proportion of any particular landform present within the region; and
- a comparable suite of landforms (simple slopes) that are expected to and do contain a similar archaeological resource occur in multiple contexts both within the local area and throughout the region.

However, the nature of the PAD remains unknown at this time and as such the cumulative impacts to the archaeological record remain unknown.

Mitigation measures to minimise these impacts are outlined in the following chapter.

9 MITIGATION AND MANAGEMENT STRATEGIES

Specific strategies, as outlined through the DECCW (2010b) Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales (DECCW 2010b), the Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW (OEH 2011), and the Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW (DECCW 2010c), are considered below for the management of the identified site within the project area.

One of the most important considerations in selecting the most suitable and appropriate strategy is the recognition that Aboriginal cultural heritage is very important to the local Aboriginal community. Decisions about the management of sites and potential archaeological deposits should be made in consultation with the appropriate local Aboriginal community.

9.1 CONSERVATION/PROTECTION

The OEH is responsible for the conservation/protection of Indigenous sites and they therefore require good reason for any impact on an indigenous site. Conservation is the first avenue and is suitable for all sites, especially those considered high archaeological significance and/or cultural significance. Conservation includes the processes of looking after an indigenous site or place so as to retain its cultural significance and are managed in a way that is consistent with the nature of peoples’ attachment to them.

There is an opportunity for the proposed development to protect the PAD identified if the development can be altered.

9.2 FURTHER INVESTIGATION

An Aboriginal Heritage Impact Permit (AHIP) is no longer required to undertake test excavations (providing the excavations are in accordance with the Code of Practice for Archaeological Investigations in NSW). Subsurface testing is appropriate when a Potential Archaeological Deposit (PAD) has been identified, and it can be demonstrated that sub-surface Aboriginal objects with potential conservation value have a high probability of being present, and that the area cannot be substantially avoided by the proposed activity. However, testing may only be undertaken as per the Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2011) and discussions/consultation with the local Aboriginal community.

If the identified PAD will be impacted upon, test excavations will be required for the PAD prior to any works.

9.3 AHIP

If harm will occur to an Aboriginal object or Place, then an AHIP is required form the OEH. If a systematic excavation of the known site could provide benefits and information for the Aboriginal community and/or archaeological study of past Aboriginal occupation, a salvage program may be an appropriate strategy to enable the salvage of cultural objects. The AHIP may also include surface collection of artefacts.

As no site shave been identified and AHIP is not required.

10 RECOMMENDATIONS

10.1 GENERAL

1) The persons responsible for the management of onsite works will ensure that all staff, contractors and others involved in construction and maintenance related activities are made aware of the statutory legislation protecting sites and places of significance. Of particular importance is the National Parks and Wildlife Amendment (Aboriginal Objects and Aboriginal Places) Regulation 2010, under the National Parks and Wildlife Act 1974;

2) Should any Aboriginal objects be uncovered during works, all work will cease in that location immediately and the Environmental Line contacted; and

10.2 ST/PAD1

3) If the identified PAD will be impacted upon by any future development an archaeological subsurface investigation will be required in accordance with the Code of Practice for Archaeological Investigations of Aboriginal Objects in NSW.

REFERENCES

Anonymous.2003 Catchment SIM GIS.http://www.uow.edu.au/~cjr03/ index.htm?Overview/VNAnalysis/VNAnalysisFrame.htm~mainFrame. Downloaded 24 February 2004.

Arnour-Chelu, M. and Andrews, P. 1994. Some Effects of Bioturbation by Earthworms (Oligochaeta) on Archaeological Sites. Journal of Archaeological Science 21:433-443.

Balek, C. 2002. Buried Artefacts in Stable Upland Sites and the Role of Bioturbation: A Review. Geoarchaeology: An International Journal 17(1):41-51.

Byrne, D., and Nugent, M. 2004. Mapping Attachment: A Spatial Approach to Aboriginal Post-Contact Heritage. Department of Environment and Conservation, NSW.

Cahen, D. and J. Moeyersons. 1977. Subsurface Movements of Stone Artefacts and Their Implications for the Prehistory of Central Africa. Nature 266:812-815.

Collins, J. 1998. Pacific Highway Proposed Fill Material Quarry on the Cut Batters of the Taree Bypass: Archaeological Survey for Aboriginal Sites. Report prepared for Connell Wagner Pty Ltd.

Department of Environment, Climate Change and Water (DECCW). 2010a. Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Environment, Climate Change and Water (DECCW). 2010b. Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales. Department of Environment, Climate Change and Water NSW, Sydney.

Department of Environment, Climate Change and Water (DECCW). 2010c. Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW. Department of Environment, Climate Change and Water NSW, Sydney.

Foley, R. 1981. A Model of Regional Archaeological Structure. Proceedings of the Prehistoric Society. 47: 1-17.

Fowler, K.D, H.J. Greenfield and L.O. van Schalkwyk. 2004. The Effects of Burrowing Activity on Archaeological Sites: Ndondondwane, South Africa. Geoarchaeology 19(5):441-470.

Hughes, P. J. and Sullivan, M. 1984. Environmental Approaches to the Assessment of Archaeological Significance. In S. Sullivan and S. Bowdler (eds) Site Surveys and Significance Assessments in Australian Archaeology. Pp: 34-47.

Irish, P. 2006. Aboriginal Heritage Impact Assessment Report Proposed Highway Service Centre, Pacific Highway, Taree, NSW. Report prepared for Ashtan Service Centres Pty Ltd.

Klaver, J and Heffernan, K. 1991. Greater Taree Aboriginal heritage study.

Koettig, M. 1986. Assessment of Archaeological Sites along the Proposed Singleton to Glennies Creek Water Pipeline Route and the Reservoir Site at Apex Lookout, Hunter Valley, New South Wales. Unpublished report for The Public Works Department.

Leon, M. J; Maslin, V., and Donovan, G. 2004. Purfleet-Taree Local Aboriginal Land Council Culture & Heritage Section - Aboriginal Sites Investigation on Wednesday S1h May, 2004 of Water Main Replacement, Old Bar Road. Report prepared for Geolyse Pty Ltd.

L'Oste-Brown, S., L. Godwin., and C. Porter., In Association with Bowen Basin Aboriginal steering Committee. 1998. Towards an Indigenous Social and Cultural Landscape of the Bowen Basin. Bowen Basin Aboriginal Cultural Heritage Project. Cultural Heritage Monograph Series Volume 2. Queensland Department of Environment and Heritage, Brisbane.

Manning River Times. 2011. Biripi's Native Tongue. Site accessed 23 June 2018. https://www.manningrivertimes.com.au/news/local/news/general/biripis-native-tongue/2210262 .aspx

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. 1998. Australian Soil and Land Survey Field Handbook, Second Edition. Inkata Press, Australia.

Mulvaney, J., and J. Kamminga. 1999. Prehistory of Australia. Allen and Unwin, Australia.

National Parks and Wildlife Service, Ed. 1997. Aboriginal Cultural Heritage Standards and Guidelines Kit. NPWS, Sydney.

Odell, G. and F. Cowan. 1987. Estimating Tillage Effects on Artifact Distributions. American Antiquity 52(3):456-484.

Office of Environment and Heritage (OEH), 2011. Guide to Investigating, Assessing and reporting on Aboriginal Cultural Heritage in NSW. Department of Environment, Climate Change and Water NSW, Sydney.

Peacock, E. and D. Fant. 2002. Biomantle Formation and Artefact Translocation in Upland Sandy Soils: An Example from the Holly Springs National Forest, North-Central Mississippi, U.S.A. In Geoarchaeology 17(1):91-114.

Pearson, M., and Sullivan, S. 1995. Looking after Heritage Places: The Basics of Heritage Planning for Managers, Landowners and Administrators. Melbourne University Press.

Rich, E. 1990a. Aboriginal Historic Sites in North East NSW: Management Study. Report to The National Parks and Wildlife Service of NSW (NPWS) and The Australian Heritage Commission.

Rich, E. 1990b. Pacific Highway S.H. No 10 - Taree Traffic Relief Route: Archaeological Survey for Aboriginal Sites. Report prepared for GHD Group.

Robinson, C. 2011. Totems of the Birpai. Site accessed 24 June 2018. http://mnclibrary.org.au/totems-of-the-biripi/

Roper, D. 1976. Lateral Displacement of Artifacts Due to Plowing. American Antiquity 41(3):372-375.

Simon, E, 1987. Through My Eyes. Collins Dove, Australia.

Sullivan S., and Bowdler, S. 1984. Site Survey and Significance Assessment in Australian Archaeology. Canberra: RSPacS, Australian National University.

Waters, M. 2000. Alluvial Stratigraphy and Geoarchaeology in the American Southwest. Geoarchaeology: An International Journal 15(6):537-557.

Waters, M. and D. Kuehn. 1996. The Geoarchaeology of Place: The Effect of Geological Processes on the Preservation and Interpretation of the Archaeological Record. American Antiquity 61(3):483-496.

Wheeling Jesuit University, 2002. Exploring the Environment: Water Quality. http://www.cotf.edu/ete/modules/waterq/wqphysmethods.html Downloaded 24 February 2004.

Villa, P. 1982. Conjoinable Pieces and Site Formation Processes. American Antiquity 47(2):276-290.

Yorston, R.M., Gaffney, V.L. and Reynolds, P.J. 1990. Simulation of Artefact Movement Due to Cultivation. Journal of Archaeological Science 17:67-83.

APPENDIX A

Aboriginal Stakeholder Consultation

APPENDIX B

AHIMS search results

AHIMS Web Services (AWS)

Search Result

Purchase Order/Reference : Taree

Client Service ID : 338363

Date: 11 April 2018

Penny Mccardle

Po Box 166
Adamstown New South Wales 2289

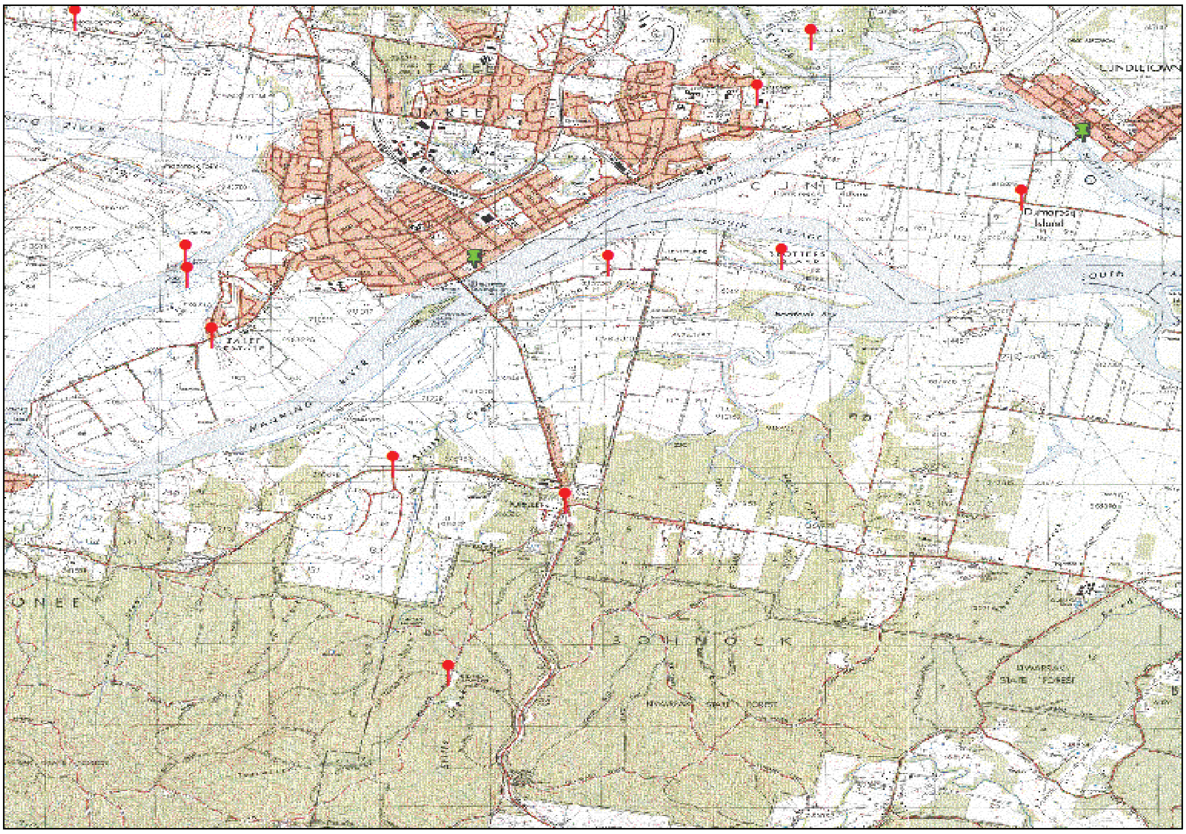
Attention: Penny Mccardle

Email: mcheritage@iprimus.com.au

Dear Sir or Madam:

AHIMS Web Service search for the following area at Datum :GDA, Zone : 56, Eastings : 445000 - 455000, Northings : 6462000 - 6472000 with a Buffer of 50 meters. Additional Info : Assessment, conducted by Penny Mccardle on 11 April 2018.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

26	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date .Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Taree

Client Service ID : 338363

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
30-5-0002	Purfleet Wunmurra Site	AGD	56	449700	6466100	Open site	Valid	Aboriginal Ceremony and Dreaming : -	Natural Mythological (Ritual)	
	Contact	**Recorders**	Harry Creamer,Barbara Clarke					**Permits**		
30-5-0015	TTRR1 / Blue hole;	AGD	56	449460	6464050	Open site	Valid	Water Hole : -	Water Hole/Well	
	Contact	**Recorders**	Elizabeth Rich,Alice Gorman					**Permits**		
30-5-0016	TTRR 3;	AGD	56	450000	6465550	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Elizabeth Rich,Alice Gorman					**Permits**		
30-5-0017	TTRR 4;	AGD	56	450180	6465500	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Elizabeth Rich,Mr.David Crew					**Permits**		
30-5-0018	TTRR 5;	AGD	56	451050	6466330	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Elizabeth Rich,Alice Gorman					**Permits**		
30-5-0019	TTRR 6;	AGD	56	451120	6466300	Open site	Valid	Artefact : -, Modified Tree (Carved or Scarred) : -	Open Camp Site,Scarred Tree	
	Contact	**Recorders**	Elizabeth Rich,Alice Gorman					**Permits**		
30-5-0020	TTRR 7;	AGD	56	451150	6466250	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Elizabeth Rich,Alice Gorman					**Permits**		
30-5-0021	TTRR 8;	AGD	56	451180	6466180	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Elizabeth Rich,Alice Gorman					**Permits**		
30-5-0022	TTRR 9;	AGD	56	451700	6466400	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Elizabeth Rich,Alice Gorman					**Permits**	612	
30-5-0023	TTRR 10;	AGD	56	451680	6466300	Open site	Valid	Modified Tree (Carved or Scarred) : -	Scarred Tree	
	Contact	**Recorders**	Elizabeth Rich,Mr.David Crew					**Permits**		
30-5-0043	TTRR 14;	AGD	56	452260	6470000	Open site	Valid	Artefact : -	Open Camp Site	
	Contact	**Recorders**	Ms.Jacqueline Collins					**Permits**	612	
30-6-0013	Farguhar Inlet;Farguhar Park;	AGD	56	453500	6465500	Open site	Valid	Shell : -, Artefact : -	Midden	
	Contact	**Recorders**	Australian Museum					**Permits**		

Report generated by AHIMS Web Service on 11/04/2018 for Penny Mccardle for the following area at Datum :GDA, Zone : 56, Eastings : 445000 - 455000, Northings : 6462000 - 6472000 with a Buffer of 50 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 26

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : Taree

Client Service ID : 338363

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
30-5-0010	Purfleet Mission Cemetery	AGD	56	449700	6465400	Open site	Valid	Aboriginal Ceremony and Dreaming : -, Burial : -		1746,1943
	Contact	**Recorders**	Glen Morris,Elizabeth Rich,Alice Gorman,John Saunders,Gillian Saunders,Ms.Adrier					**Permits**		
30-5-0051	CBQ1	AGD	56	449160	6462020	Open site	Valid	Artefact : 1		4349
	Contact	**Recorders**	Ms.Jacqueline Collins					**Permits**		
30-5-0067	Buckets Way South Taree-4	GDA	56	448015	6466582	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact Searle	**Recorders**	Vienna Maslin,Mr.Murray Wood					**Permits**		
30-5-0068	Buckets Way South Taree-1	AGD	56	447744	6466468	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact Searle	**Recorders**	Vienna Maslin,Mr.Murray Wood					**Permits**		
30-5-0069	Buckets Way South Taree-2	AGD	56	448075	6466373	Open site	Valid	Artefact : 1		
	Contact Searle	**Recorders**	Vienna Maslin,Mr.Murray Wood					**Permits**		
30-5-0066	Buckets Way South Taree-3	AGD	56	447043	6466345	Open site	Valid	Artefact : 0		
	Contact	**Recorders**	Vienna Maslin,Mr.Murray Wood					**Permits**		
30-5-0070	Buskets Way South Taree-1	AGD	56	447744	6466468	Open site	Valid	Modified Tree (Carved or Scarred) : 1		
	Contact Searle	**Recorders**	Vienna Maslin,Mr.Murray Wood					**Permits**		
30-5-0072	Railway Cutting Site	GDA	56	450644	6469846	Open site	Valid	Artefact : 1		
	Contact	**Recorders**	Doctor.Alan Williams					**Permits**		
30-6-0165	WMR 2 OldBar	AGD	56	454457	6464825	Open site	Valid	Artefact : 1		99024
	Contact Mick Leon	**Recorders**	Purfleet Taree Local Aboriginal Land Council					**Permits**	1987	
30-6-0166	WMR 1 OldBar	AGD	56	454235	6464872	Open site	Valid	Artefact : 1		
	Contact Mick Leon	**Recorders**	Vienna Maslin					**Permits**	1988	
30-5-0077	MC Taree Masters PAD1	GDA	56	449270	6466372	Open site	Valid	Artefact : 1, Potential Archaeological Deposit (PAD) : 1		
	Contact	**Recorders**	Myall Coast Archaeological Services					**Permits**		
30-5-0053	Kiwarrak State Forest	AGD	56	447620	6464619	Open site	Valid	Artefact : -		98226
	Contact	**Recorders**	Archaeological Risk Assessment Services (ARAS),Mr.Giles Hamm					**Permits**		
30-5-0064	PCW - 1	AGD	56	450248	6465510	Open site	Valid	Water Hole : 1		100072
	Contact T Russell	**Recorders**	Mr.Paul Irish					**Permits**		
30-5-0065	Wollards Creek IF 1	AGD	56	450402	6465297	Open site	Valid	Artefact : 1		

Report generated by AHIMS Web Service on 11/04/2018 for Penny Mccardle for the following area at Datum :GDA, Zone : 56, Eastings : 445000 - 455000, Northings : 6462000 - 6472000 with a Buffer of 50 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 26

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	Contact S Scanlon	**Recorders**	Mr.Paul Irish					**Permits**		

Report generated by AHIMS Web Service on 11/04/2018 for Penny Mccardle for the following area at Datum :GDA, Zone : 56, Eastings : 445000 - 455000, Northings : 6462000 - 6472000 with a Buffer of 50 meters. Additional Info : Assessment. Number of Aboriginal sites and Aboriginal objects found is 26

Appendix J - Council Letter of Support for Strategic Merit

From: Roger Busby

Sent: Tuesday, 12 December 2017 1:45 PM

To: pw@walshconsulting.com.au

Cc: Richard Pamplin

Subject: Potential Planning Proposal Glenthorne Rd

Dear Peter,

Thank you for your letter dated 1 December 2017 enquiring into Council's categorisation of a planning proposal for this site at Glenthorne and the associated fee. I advise as follows regarding proceeding with this proposed application:

Planning proposal categorisation:

Due to the size of land, need to justify the rezoning on economic grounds and potential agency consultation for this rezoning I have classified it as a Category 2 Application.

Application fee:

The lodgement fee (Stage 1 Council Fee) for a Category 2 application is $40,000 (GST is not applicable - rezoning fees are GST exempt). This fee includes any processing by Council staff up to and including 200 hours. If this is exceeded an additional Stage 2 Council Fee of $150/hr applies. Richard (see below) can organise an invoice for the $40,000 payment if you would prefer prior to payment.

Application Form and Fee Agreement:

I have attached the Application Form – you will need to complete as the Applicant and have the landowner/s sign it and whoever the invoices need to be made out to needs to sign the Fee Agreement attached to the application (Appendix 2).

I confirm (and you can use this email as confirmation) that I consider this rezoning to have Strategic Merit for the purposes of lodgement – see page 2 of the application form.

Processing:

Due to our current resources I advise that staff are not available to process this application. As per Council's policy on planning proposals you have the following options:

a. Wait until there is staff capacity to process this application (likely to be 5+ years);

b. Withdraw (or do not lodge the application in the first instance); or

c. Have the application processed by a consultant engaged by Council at the applicant's cost (this option is only available if there are staff resources available to manage a consultant).

At present I advise that there are staff resources available to commence management of a consultant to review and process this application. I wish to point out however that if all applications are active at the same time that resources will be allocated on the basis of their strategic priority to

Council. Additionally, as staff are close to capacity the opportunity to commence this application may close if any other applications are formally lodged prior to this one.

Our recently appointed Special Projects Coordinator, Richard Pamplin, will be undertaking the management of the consultant for this application. In this regard all further formal correspondence on this application should be forwarded to Richard Pamplin at our Taree Office (PO Box 482 Taree NSW 2430) quoting file number S1714. Richard can be contacted directly on 6592 5266 or richard.pamplin@midcoast.nsw.gov.au

Following lodgement of the Application (including the signed Fee Agreement) and payment of the Stage 1 Council Fee Richard will issue a Request for Quotation (RFQ) for a consultant to process this application on a 2 stage basis, involving separate engagement for each stage. Stage 1 will involve an initial assessment as to whether the application includes an Acceptable Planning Proposal in accordance with Council's Policy – Planning proposals and development control plan applications and if so then undertaking a comprehensive assessment of the planning proposal before it is finalised for reporting to Council for a decision on whether to seek a Gateway Determination from the Department of Planning and Environment. If a positive decision from Council and a subsequent positive Gateway Determine is obtained the application will then move onto Stage 2. You will need to pay the Stage 2 Consultant Fee (which will be re-evaluated based on the Gateway decision) prior to Council engaging the consultant and work on this component being undertaken. Applicants do not have any role in the selection of this consultant and must only deal directly with Council staff on this application.

Please note that to be considered as an Acceptable Planning Proposal the consultant engaged by Council will be ensuring that the planning proposal has been prepared by a Qualified Town Planner as per Council's policy, that it is consistent with section 55 of the Environmental Planning and Assessment Act 1979, that it has been prepared in accordance with the NSW Department of Planning and Environment's Planning Proposals: A guide to preparing planning proposals, that the main issue relevant to this application (economic justification) has been adequately assessed, that the planning proposal has been prepared using Council's template for planning proposals and that the consultant's/applicant's logos are not included in the planning proposal (they are however permitted to be on attachments to the planning proposal). Please also note that if deemed acceptable this does not mean that the planning proposal does not require further studies or that Council is in agreement with it, merely that it is acceptable to proceed to a comprehensive assessment by Council's consultant.

If not deemed to be acceptable all work will cease on this application until the applicant has addressed the deficiencies advised by Council.

I note that your planning proposal includes details on a proposed Highway Service Centre (HSC). As rezoning is sought for IN1 – General Industrial and a number of uses would be permitted on the site, information on the proposed HSC should be removed although reference can be made to desired uses in the text of the PP. I also suggest that you await the release of the Regional Economic Development Strategy that should provide some higher level strategic context for the planning proposal. I will let you know shortly when this document is timed for release.

Once the preferred consultant's cost to undertake the Stage 1 assessment is known Richard will invoice you for this amount prior to the consultant being engaged. Please note that while Council is seeking a fixed cost from the consultant, such a cost will be based on an assumption on the amount of work involved in assessing and processing an Acceptable Planning Proposal and that the comprehensive assessment of the planning proposal only finds minor aspects that need to be addressed. Should this not be the case the consultant's fee will be varied based on their hourly rates, with a nominated upfront amount from the applicant required to be paid to Council before further work is undertaken.

Richard can provide further information on Council's processes if required.

Please let me or Richard know if you'd like the invoice issued as mentioned above for the Stage 1 Council Fee.

Regards

Roger Busby

MCC Website

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